User Manual

ACM5000 Remote Site Managers

ACM5500 Management Gateways

ACM7000 Resilience Gateways

IM7200 & IM4200 Infrastructure Managers

CM7100 Console Servers

Revision 4.32 **2017-07-28**

User Manual

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Safety

Follow the safety precautions below when installing and operating the console server:

- do not remove the metal covers. There are no operator serviceable components inside. Opening or removing the cover may expose you to dangerous voltage which may cause fire or electric shock. Refer all service to Opengear-qualified personnel.
- to avoid electric shock the power cord protective grounding conductor must be connected through to ground.
- always pull on the plug, not the cable, when disconnecting the power cord from the socket.
- do not connect or disconnect the console server during an electrical storm.

It is recommended you use a surge suppressor or UPS to protect the equipment from transients.

Proper back-up systems and necessary safety devices should be utilized to protect against injury, death or property damage due to system failure. Such protection is the responsibility of the user.

This console server device is not approved for use as a life-support or medical system.

Any changes or modifications made to this console server device without the explicit approval and consent of Opengear will void Opengear of any liability or responsibility of injury or loss caused by any malfunction.

This equipment is for indoor use only. All the console's communication wirings are limited to use inside of a building.

FCC warning statement

This device complies with Part 15 of the FCC rules. Operation of this device is subject to the following conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference that may cause undesired operation.

Publishing history

date	ed	software	models	features
2010/01	3.8.4		SD4001	
2010/03	3.8.5		ACM5004-G	fixed Failover details & added DDNS.
2010/06	3.9	3.1	ACM5004-I	Shadow password, °F, SNMP, SMS gateway.
2010/08	3.9.1	3.2		OpenVPN, Zenoss, config commit, & Call Home.
2010/12	4.0	3.3		Firewall router, Web Terminal, & SNMP updates.
2011/06	4.1	3.4		GPS, SNMP monitoring & IPv6, 32-port models, & SMS over cellular.
2011/10	4.2	3.5		Auto-Response.
2011/11	4.3	3.5.2	IM4216-34	PPTP, GRE, Groups, FTP server, multiple dial-in, & pmshell.
2012/02	4.4	3.5.2u3	ACM5500	Kerberos, Cisco RJ in SD4000, & remove KCS.
2012/04	4.5	3.5.2u14		Cellular redial.
2012/07	4.6	3.5.3	SD4001 rev-01 & CM4001/4008 EoL.	SMS ARM, simple key, & Services page.
2012/12	4.7	3.6	ACM5504-5-G-W-I & IM4004-5 EoL.	Authenticated NTP.
2013/04	4.8	3.7		4G LTE support.
2013/09	4.9	3.8	IM7200	
2013/10	4.10		IM7208 & DDC models	
2014/01	4.11	3.9		Dual SIM, SNMP DIO, bulk provisioning, & WEEE.
2014/03	4.12	3.10		Connection Manager network management backend & Auto-Response extensions.
2014/07	4.13	3.11		New SNMP MIB, OpenLDAP, & LDAPS.
2014/09	4.14	3.12		Manage devices UI & brute force protection.
2014/10	4.15		CM7100	
2015/01	4.16	3.15		IP Passthrough
2015/02	4.17	3.15.1	CM4100 EoL.	ZTP
2015/06	4.18	3.16	ACM7000	
2015/11	4.19	3.16.2	SD4000 EoL.	Unauthenticated SSH & multicarrier cellular.
2016/03	4.20	3.16.4u2	ACM7004-5	
2016/04	4.21			Minor document cleanup.
2016/06	4.22		ACM7004-5 RSG	Link Layer Discovery Protocol (LLDP).
2016/07	4.23	3.16.5u1	IM7216-2-24U-DAC	disabling AAA accounting UI.
2016/09	4.24			ZTP configuration via DHCP & USB consoles
2016/11	4.3			Edits, Copy-edits and re-format throughout.
2017/01	4.31	3.16.6u1	CM7196A & ACM700x-2-M	More on ZTP configuration.

2017/07	4.32	4.0.0	IM7216-2-24E-DAC	Packet state matching in firewall rules and CLI session events in auto-responses.

This manual

The *Opengear User Manual* describes the features and capabilities of the following Opengear product lines, and provides instructions to best take advantage of them:

Remote Management Gateways
ACM5504-5-G/GV-W-I
ACM5504-5-G/GV-I
ACM5504-5-LA/LR/LV-I
ACM5508-2
ACM5508-2-M
ACM5008-2-P
ACM7005-4
ACM7004-2-M
ACM7008-2-M

Remote Site Managers
ACM5002-F-E
ACM5003-M-F-E
ACM5004-F-E
ACM5004-2-I
and -G, -GV, -GS, and -LR models with cellular support.

Infrastructure Managers
IM7248-2-DAC
IM7232-2-DAC
IM7216-2-DAC
IM7216-2-24E-DAC
and -LA, -LR, and -LV models with 4G LTE.
with 4G LTE options

Infrastructure Managers
IM4248-2-DAC
IM4248-2-DDC
IM4232-2-DAC
IM4232-2-DDC
IM4216-2-DAC
IM4216-2-DDC
IM4216-34-DAC
IM4216-34-DDC
IM4208-2-DAC
and -G and -GV models with cellular support.

Console Servers
CM7116-2-DAC
CM7132-2-DAC
CM7148-2-DAC
CM7196A-2-DAC-US

Each of these products is referred to generically in this manual as a *console server*.

Where appropriate, product groups may be referred to as *console servers*, gateways or by specific product line name or product group (for example the *IM4200 family* or the *ACM5500*).

Who should read this user manual?

You should read this manual if you are responsible for evaluating, installing, operating, or managing an Opengear appliance. This manual assumes you are familiar with the internal network of your organization, and are familiar with the Internet, IP networks, HTTP, FTP and basic security operations.

Manual organisation

The *Opengear User Manual* is structured as follows:

1. Introductory material	An overview of the *console server's* features and information regarding this manual.
2. Installation	Physical installation of the *console server* and the interconnecting of managed devices.
3. System configuration	Initial installation and configuration of the *console server* and the supported services.
4. Serial port, host, device & user configuration	Configuring serial ports and connected network hosts, and setting up users.
5. Firewall, failover, & OOB access	Set up the firewall and the high availability access features of the *console server*.
6. SSH tunnels & SDT connector	Secure remote access using SSH and configure for RDP, VNC, HTTP, HTTPS & access to network- and serially-connected devices.
7. Alerts, auto-response & logging	Set up local and remote event and data logs. Configure auto-responses to trigger events.
8. Power, environment, & digital I/O	Manage USB, serial and network attached power strips and UPS supplies. Also EMD environmental sensor configuration.
9. Authentication	Access to the *console server* requires authenitcated usernames and passwords.
10.Nagios integration	Set Nagios central management. Configure *console server* as a distributed Nagios server.
11.System management	Access to and configuration of services to be run on the *console server*.
12.Status reports	The dashboard summary and detailed status and logs of serial and network connected devices (ports, hosts, power and environment).
13.Management	Port controls and user-accessible reports.
14.Configuration from the command line	Command line installation and configuration using the *config* command.
15.Advanced configuration	Advanced command line configuration activities using Linux commands.
16.Appendices	Command definitions, specifications, certifications, terminology definitions, licenses, service and warranty details.

The most recent version of this manual is always at http://opengear.com/support/documentation/.

Types of users

The *console server* supports two classes of users:

1. First there are administrative users, who have unlimited configuration and management privileges over the console server; and all the connected devices.

   Administrative users are set up as members of the admin user group. Users in this class are referred to in this manual as Administrators. An Administrator can access and control the console server using the config utility, the Linux command line or the browser-based Management Console. By default, the Administrator has access to all services and ports to control all the serial connected devices and network connected devices (hosts).

2. The second class of users embraces those who have been set up by an Administrator with specific limits of their access and control authority. These users are set up as members of one of the pre-configured user groups (pptpd, dialin, ftp, pmshell or users) or another user groups an Administrator has added.

   They are only authorized to perform specified controls on specific connected devices and are referred to as Users. These Users (when authorized) can access serial or network connected devices; and control these devices using the specified services (eg Telnet, HHTPS, RDP, IPMI, Serial-over-LAN, Power Control).

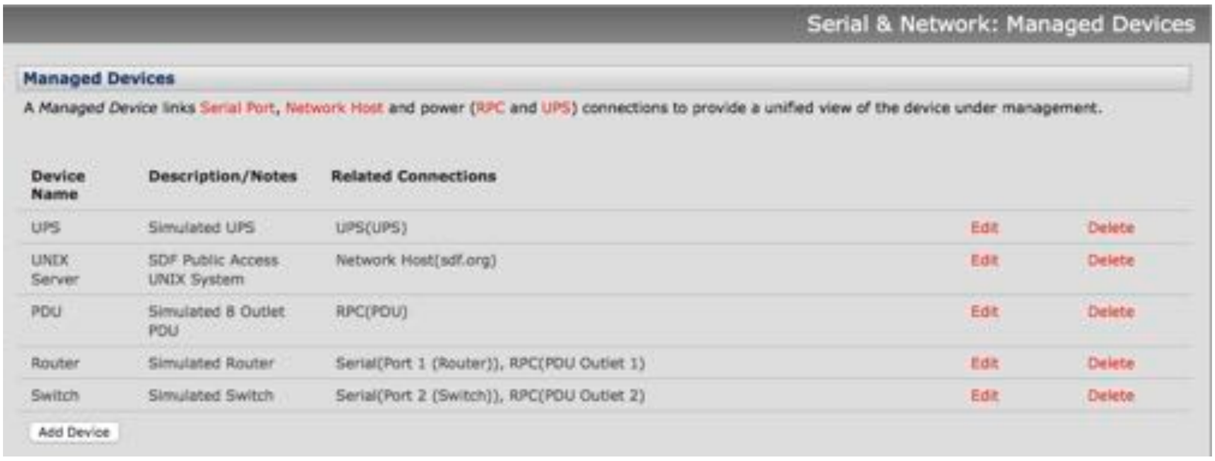
   An authorized User also has a limited view the Management Console and can only access authorized configured devices and review port logs.

In this manual, when the term user (lower case) is used, it is referring to both classes of users above. This document also uses the term *remote users* to describe users who are not on the same LAN segment as the *console server*.

These remote users may be users, who are on the road connecting to managed devices over the public Internet. They may be an Administrator in another office connecting to the *console server* itself over the enterprise VPN. Or the remote user may be in the same room or the same office but connected on a separate VLAN to the *console server*.

Management console

The features of your *console server* are configured and monitored using the Opengear Management Console. When you first browse to the Management Console, you can use the menu displayed on the left side to configure the console server. Once you have completed



Serial & Network: Managed Devices

Managed Devices

A *Managed Device* links Serial Port, Network Host and power (RPC and UPS) connections to provide a unified view of the device under management.

Device Name	Description/Notes	Related Connections		
UPS	Simulated UPS	UPS(UPS)	Edit	Delete
UNIX Server	SDF Public Access UNIX System	Network Host(sdf.org)	Edit	Delete
PDU	Simulated 8 Outlet PDU	RPC(PDU)	Edit	Delete
Router	Simulated Router	Serial(Port 1 (Router)), RPC(PDU Outlet 1)	Edit	Delete
Switch	Simulated Switch	Serial(Port 2 (Switch)), RPC(PDU Outlet 2)	Edit	Delete

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the initial configuration, you can continue to use the Management Console runs in a browser and provides a view of the console server and all the connected devices.

Administrators can use the Management Console, either locally or from a remote location, to configure and manage the console server, users, ports, hosts, power devices and associated logs and alerts.

Users can also use the Management Console, but have limited menu access to control select devices, review their logs, access them using the Web terminal, or control power to them.

The console server runs an embedded Linux operating system, and experienced Linux and UNIX users may prefer to undertake configuration at the command line.

You can gain command line access by cellular, dial-in, or by directly connecting to the *console server's* serial console port (aka the *console server's* modem port). The shell can also be accessed via ssh or Telnet over a LAN or by connecting with PPTP, IPsec or OpenVPN.

Manual conventions

The *Opengear User Manual* uses typeface 'colour' to distinguish between different software elements.

- Procedure steps are denoted with bullet-points like this.
- Bullet-pointed text is also, on occasion, used to present related items in a list.

Bold text in a procedure indicates a user interface element you click on or navigate to.

Italic text in a procedure indicates a user interface element that references a variable you can change or set.

Italics are also used in the standard typographic fashion to indicate a formal name (the book title in the first paragraph of this section, for example). The phrase 'console server' — when referring to any of Opengear's hardware products — is also italicised throughout.

Links, both to external resources and to other places in the manual are set in blue.

```
Mono-spaced type indicates a file-name or shell-based interface
element, such as a script or application that runs from the bash
shell or the Windows command-line. If you might enter the string at
a shell-prompt or in a text-editor, it will be set thus.
```

Note: Not a user-interface element. Indented text set in italics and prefixed with the word 'Note:' is text to pay specific attention to. The **Opengear User Manual** *equivalent to the rare but now famous phrase 'hic sunt dracones' (here be dragons).*

Where to find additional information

1. The *Quick Start Guide* that came with your *console server*.

   This provides instructions for the installation and configuration of Opengear hardware.

2. The Opengear Knowledge Base at https://opengear.zendesk.com/.

   This online resource includes technical how-to articles, tips, FAQs and important notifications.

1. Installation

1.1. Models

This chapter describes how to install the *console server* hardware, and connect it to controlled devices.

There are multiple families and models, each with a different number of network/serial/USB ports or power supply and wireless configurations.

model	serial		usb			network		flash	console	v.92 modem	wireless	sensors	rj pinout*	power
	232	232/422/485	1	2	3	100	1000	GB						
ACM5002-F-E	2			1		1		4	n/a	n/a	n/a	temp/probes	02	ext ac/dc
ACM5004-F-E	4			1		2		4	n/a	n/a	n/a	temp/probes	02	ext ac/dc
ACM5003-M-F-E	3			1		1		4	n/a	internal	n/a	temp/probes	02	ext ac/dc
ACM5004-G(S/V)-E		4		1		1		0	n/a	n/a	3g	temp/probes	02	ext ac/dc
ACM5004-G(S/V)-I		4		1		1		0	n/a	n/a	3g	temp & D I/O	02	ext ac/dc
ACM5004-2-I		4		2		2		0	n/a	n/a	n/a	temp & D I/O	02	ext ac/dc
ACM5504-5-G(V)-I		4		2		5		4	n/a	n/a	3g	temp & D I/O	02	ext ac/dc
ACM5504-5-G-W-I		4		2		5		4	n/a	n/a	wap, 3g	temp & D I/O	02	ext ac/dc
ACM5504-5-Lx-I		4		2		5		4	n/a	n/a	4g	temp & D I/O	02	ext ac/dc
ACM5508-2	8			2		2		4	n/a	n/a	n/a	temp & D I/O	02	ext ac/dc
ACM5508-2-I		8		2		2		4	n/a	n/a	n/a	temp & D I/O	02	ext ac/dc
ACM5508-2-M	8			2		2		4	n/a	internal	n/a	n/a	02	ext ac/dc
ACM5508-2-L-I	8			2		2		4	n/a	n/a	4g	temp & D I/O	02	ext ac/dc
ACM7004	4			4		2		4	n/a	internal	4g	external	02	ext ac/dc
ACM7004-5	4			4		5		4	n/a	internal	4g	external	02	ext ac/dc
ACM7008-2	8			4		2		4	n/a	internal	4g	external	02	ext ac/dc
ACM7004-2-M	4			4			2	4	n/a	internal	n/a	temp & D I/O	02	ext ac/dc
ACM7008-2-M	8			4			2	4	n/a	internal	n/a	external	02	ext ac/dc
IM4248-2-DAC/DC	48		1	2		2		16	1	internal	3g opt	external	00/01/02	dual ac/dc
IM4232-2-DAC/DC	32		1	2		2		16	1	internal	3g opt	external	00/01/02	dual ac/dc
IM4216-2-DAC/DC	16		1	2		2		16	1	internal	3g opt	external	00/01/02	dual ac/dc
IM4208-2-DAC/DC	8		1	2		2		16	1	internal	3g opt	external	00/01/02	dual ac/dc
IM4216-34-DAC/DC	16		1	2		34		16	1	internal	n/a	external	02	dual ac/dc
IM7208-2-DAC	8			2			2	16	1	internal	wap, 4g opt	external	01/02	dual ac/dc
IM7216-2-DAC	16			2			2	16	1	internal	wap, 4g opt	external	01/02	dual ac/dc

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model	serial		usb			network		flash	console	v.92 modem	wireless	sensors	rj pinout*	power
	232	232/422/485	1	2	3	100	1000	GB						
IM7232-2-DAC	32			2			2	16	1	internal	wap, 4g opt	external	01/02	dual ac/dc
IM7248-2-DAC	48			2			2	16	1	internal	wap, 4g opt	external	01/02	dual ac/dc
IM7216-2-24U-DAC	16			24	2		2	16	1	internal	wap, 3g, 4g	external	01/02	dual ac/dc
IM7216-2-24E-DAC	16				2		24	16	1	internal	wap, 4g opt	external	01/02	dual ac/dc
CM7148-2-SAC	48			2			2	4	1	n/a	n/a	external	02	single ac
CM7116-2-SAC	16			2			2	4	1	n/a	n/a	external	02	single ac
CM7148-2-DAC	48			2			2	4	1	n/a	n/a	external	02	dual ac
CM7132-2-DAC	32			2			2	4	1	n/a	n/a	external	02	dual ac
CM7116-2-DAC	16			2			2	4	1	n/a	n/a	external	02	dual ac
CM7196A-2-DAC-US	96			2			2	64	1	n/a	n/a	external	02	dual-ac

IM7200-series models have dual 10/100/1000 LAN ports with two RJ45 ports and two SFP fiber module slots.

CM7100-series models have dual 10/100/1000 RJ45 LAN ports.

The CM7196A-2-DAC-US has dual 10/100/1000 LAN ports with two RJ45 ports and two SFP fiber module slots.

*The RJ pinout values in the model table translate as follows:

00	Opengear Classic.
01	Cisco Rolled.
02	Cisco Straight.

The varuous product families support different software features.

model	dhcp	ddns	mgt lan	cell or wi-fi	oob	auto-response	flash (ftp & tftp)	fips	ipsec, pptp & openvpn
ACM5000	yes	yes	yes[1]	yes[2]	yes	yes	yes[3]	yes	yes
ACM5500	yes	yes	yes[1]	yes[2]	yes	yes	yes	yes	yes
ACM7000	yes	yes	yes	yes[2]	yes	yes	yes	yes	yes
IM4200	yes	yes	yes	yes[2]	yes	yes	yes	yes	yes
IM7200	yes	yes	yes	yes[2]	yes	yes	yes	yes	yes
CM7100	yes	yes	yes	no	yes	yes	yes	yes	yes

1. ACM500x-2, ACM550x-2, ACM5504-5 models only.
2. Selected models have 3G/4G cellular, Wi-Fi Wireless Access Points (WAP) or both.
3. ACM5002-F-E, ACM5003-M-F-E and ACM5004-F-E models only.

Note: To avoid physical and electrical hazard please read appendix 3 on Safety

The sections below show the components shipped with each of these models.

1.1.1. ACM5000 kit components

component	part #s
ACM5002-F-E, ACM5003-M-F-E, ACM5004-F-E & ACM5004-2-I Remote Site Manager (plus –SDC options and -G/GV/GS models with cellular support)	
2 x Cable UTP Cat5 blue	440016
Cisco Connector DB9F-RJ45 straight and DB9F-RJ45 cross-over	319014 319015
Power Supply 12VDC 1.0A Wall mount	4500XX
Quick Start Guide	539000

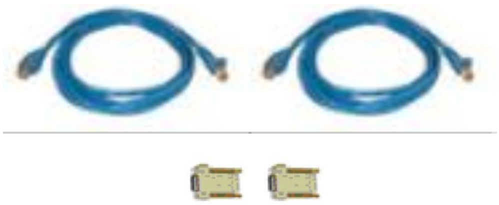
Unpack the ACM5000 kit and verify you have all the parts shown above, and that they all appear in good working order. The ACM5004-G has an external 3G aerial to be attached.

Connect the ACM5000 to the network, the serial ports of the controlled servers and AC power as shown below.

1.1.2. ACM5500 kit components

component	part #s
ACM5504-5-G/GV-W-I, ACM5504-5-G/GV-I, ACM5504-5-LA/LR/LV-I, ACM5508-2 ACM5508-2-L-I, ACM5508-2-M and ACM5008-2-P Remote Management Gateway	
2 x Cable UTP Cat5 blue	440016

Cisco Connector DB9F-RJ45 straight and DB9F-RJ45 cross-over	3190014 3190015
Power Supply 12VDC 1.0A Wall mount	4500XX
Quick Start Guide	539000



Unpack the ACM5500 kit and verify you have all the parts shown above, and that they all appear in good working order.

The ACM5004-5-G(V)-I and ACM5504-5-LA/LR/LV-I models come with an external cellular aerial to be attached. The ACM5004-5-G(V)-W-I also has an external 802.11 wireless aerial to be attached.

Connect the ACM5500 to the network, serial and USB ports of the controlled devices, environmental monitors and AC power as shown below.

1.1.3. ACM7004-2, ACM7004-5, ACM7008-2 kit components

component	part #s
ACM7004-2-LA, ACM7004-2-LR, ACM7004-2-LV, ACM7004-2-LMA, ACM7004-2-LMV, ACM7004-2-LMCR, ACM7004-2-LMCT, ACM7004-2-M, ACM7008-2-LMA, ACM7008-2-LMV, ACM7008-2-LMR, ACM7008-2-LMCR, ACM7008-2-LMCT, ACM7008-2-M, ACM7004-5-LMA, ACM7004-5-LMV, ACM7004-5-LMCR, ACM7004-5-LMCT	
2 x 4G LTE blade antennas	569028
DB9F-to-RJ45 crossover serial adapter	319015
12V switching DC power supply	450031
Rack kit (1 tab, 1 ear, 2 rack screws, 2 nuts, 4 screws)	590003
Quick Start Guide	520085

1.1.4. ACM7005-4 Remote Site Gateway kit components

component	part #s
ACM7004-5 Remote Site Gateway	
DB9F-to-RJ45 crossover serial adapter	319015
12V switching DC power supply	450031
Rack kit (1 tab, 1 ear, 2 rack screws, 2 nuts, 4 screws)	590003
Quick Start Guide	520085

1.1.5. IM4208-2, IM4216-2, IM4232-2, IM4248-2, & IM4216-34 kit components

component	part #s
IM4216-2 Infrastructure Manager	509006
IM4248-2 Infrastructure Manager	509007
IM4208-2 Infrastructure Manager	509008
IM4216-34 Management Gateway	509009
2 x Cable UTP Cat5 blue	440016
DB9F-RJ45S straight adapter and DB9F-RJ45S cross-over adapter	319000 319001
Dual IEC AC power cord (DAC models only)	440001
Quick Start Guide	539001

Unpack the IM4200 (IM4208-2, IM4216-2, IM4232-2, IM4248-2 Infrastructure Manager or IM4216-34 Management Gateway) kit and verify you have all the parts shown above, and that they all appear in good working order.

If you are installing the IM4200 in a rack you will need to attach the rack mounting brackets supplied with the unit, and install the unit in the rack. Take care to heed the safety precautions listed in appendix 3.

Connect the IM4200 to the network, to the serial ports of the controlled devices, and to power as outlined below.

1.1.6. IM7208-2, IM7216-2-24U, IM7216-2-24E, IM7232-2, & IM7248-2 kit components

component	part #s
IM7248-2-DAC, IM7232-2-DAC, IM7216-2-24U-DAC, IM7216-2-DAC, IM7216-2-24E, and IM7208-2-DAC Infrastructure Managers (and -LA/LR/LV models with 4G LTE)	
2 x Cable UTP Cat5 blue	440016
Cisco Straight and Rolled Connectors DB9M/F -RJ45	319014 319015 319016 319017 319018 319019
Dual IEC AC power cord (DAC models only)	440001
Quick Start Guide	539001

Unpack the IM7200 kit and verify you have all the parts shown above, and that they all appear in good working order.

If you are installing the IM7200 in a rack you will need to attach the rack mounting brackets supplied with the unit, and install the unit in the rack. Take care to heed the safety precautions listed in appendix 3.

Connect the IM7200 to the network, to the serial ports of the controlled devices, and to power as outlined below.

Note: The IM7208-2-DDC, IM7216-2-DDC, IM7232-2-DDC and IM7248-2-DDC products are DC powered and the kits do not include an IEC AC power cord.

1.1.7. CM7116-2, CM7132-2, CM7148-2, and CM7196A-2-DAC-US kit components

component	part #s
CM7116-2, CM7132-2, CM7148-2, and CM7196A-2-DAC-US Console Server	
2 x Cable UTP Cat5 blue	440016
Cisco Connector DB9F-RJ45 straight and DB9F-RJ45 cross-over	319014 319015
Dual IEC AC power cord	440001
Quick Start Guide	539001

Unpack the CM7116-2 (or CM7132-2, CM7148-2, or CM7196A-2-DAC-US) kit and verify you have all the parts shown above, and that they all appear in good working order.

If you are installing the CM7116-2 (or CM7132-2, CM7148-2, or CM7196A-2-DAC-US) in a rack you will need to attach the rack mounting brackets supplied with the unit, and install the unit in the rack. Take care to heed the safety precautions listed in appendix 3.

Connect the CM7116-2 (or CM7132-2, CM7148-2, or CM7196A-2-DAC-US) to the network, to the serial ports of the controlled devices, and to power as outlined below.

1.2. Power connection

1.2.1. All IM7200, IM4200, & CM7100 –DAC models

These standard IM7200, IM4200 and CM7100 console servers all have dual universal AC power supplies with auto failover built in. These power supplies each accept AC input voltage between 100 and 240 VAC with a frequency of 50 or 60 Hz and the total power consumption per console server is less than 30W.

Two IEC AC power sockets are located at the rear of the metal case, and these IEC power inlets use conventional IEC AC power cords. Power cords for various regions are available, although the North American power cord is provided by default. There is a warning notice printed on the back of each unit.

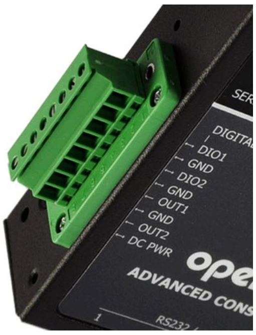
Note: To avoid electrical shock the power cord grounding conductor must be connected to ground.

1.2.2. All ACM5000 & ACM7000 models

All ACM5000 models are supplied with an external AC-12V DC wall-mount power supply. This comes with a selection of wall socket adapters for each geographic region (North

American, Europe, UK, Japan or Australia). The 12V DC connector from the power supply unit plugs into the 12V DC (PWR) power jack on the side of the console server casing.

- Plug in the power supply AC power cable and the DC power cable.
- Turn on the AC power and confirm the console server Power LED (PWR) is lit.



The ACM5000 models can also be powered from an external +9V DC to +30V DC power source by connecting the DC power lines to a power plug that plugs into the 12VDC (PWR) jack.

The industrial ACM5004-2-I model can also be powered externally by connecting a +9 to +30V DC power source to the DC PWR and GND connectors on the green screw terminal block on the side of the unit.

Note: All ACM5000 models can also be ordered with the -SDC option. These units are supplied with an external DC-DC power converter. This converter has an integrated power cable/connector that plugs into the 12VDC (PWR) connector on the ACM5000. The input voltage for the DC-DC converter is plus or minus 36V DC to 72V DC

1.2.3. All ACM5500 models

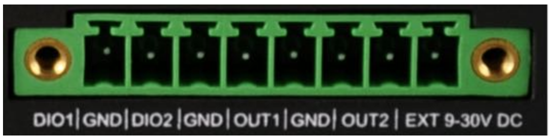
All the ACM5500 models are supplied with an external AC-12VDC wall mount power supply. This comes with a selection of wall socket adapters for each geographic region (North American, Europe, UK, Japan or Australia). The 12V DC connector from the power supply unit plugs into the 12VDC (PWR) power jack on the side of the console server casing.

- Plug in the power supply AC power cable and the DC power cable.
- Turn on the AC power and confirm the console server Power LED (PWR) is lit.

The ACM5500 models can also be powered via an external +9V DC to +30V DC power source. Connect the DC power lines to a power plug that plugs into the 12VDC (PWR) jack.

The ACM5500 can also be powered via an external 9V AC to 24V AC power source to this jack.

The industrial ACM5508-2-I and ACM5504-5-G-I models also can be powered externally by connecting a +9 to +30V DC power source to the EXT 9-30V DC and GND connectors on the green screw terminal block on the side of the unit.



Note: An external DC-DC power converter can be ordered as an accessory with any ACM5500 remote management gateway. This converter has an integrated power cable/connector that plugs into the 12VDC (PWR) connector on the ACM5500. The input voltage for the DC-DC converter is plus or minus 36V DC to 72V DC.

1.2.4. IM7200-DDC & IM4200-DDC

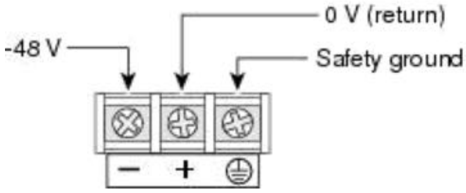
The -DDC model *console servers* all have dual DC power supplies with auto failover built in. To connect to the DC input supply:

- Strip the DC wire insulation to expose approximately 10 mm (0.4″) of conductor.
- Connect the safety ground wire to the 'E' safety ground terminal on the terminal block first. The DDC is floating (with regards to Earth), however the safety terminal on the three way screw terminal block connects to Earth or Chassis Ground.
- Connect the power wires to the appropriate terminals of the terminal block.

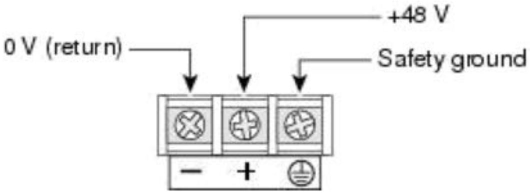
  The **+** terminal on the four way screw terminal block should always be connected to the more positive voltage (from 0V to +48 V).

  The **-** terminal on the four way screw terminal block should connect to the more negative voltage (from -48V to 0V).

  So the connections for -48 Volt DC input power are:



  The connections for +48 Volt DC input power are:



- Tighten the terminal screw to a torque of 0.93 ± 0.05 N·m (8.0 ± 0.5 in·lb$_f$).
- Repeat the connection steps above for the second power supply.
- Turn on the DC power.

Note: The safety covers are an integral part of the DDC product. Do not operate the unit without the safety cover installed.

Note: Any exposed wire lead from a DC-input power source can conduct harmful levels of electricity. So ensure that no exposed portion of the DC-input power source wire extends from the terminal block plug and safety cover.

1.3. Network connection

All Opengear console servers ship with Ethernet ports.

These ports are located on the front panel of the rack-mount IM4200 units; the rear panel of the rack-mount CM7100 units (except the CM7196A-2-DAC-US, which has them on the front panel); and on the side of the smaller ACM7000, ACM5500 and ACM5000 units. All physical connections are made using either industry standard Cat5 cabling and connectors or Small form-factor pluggable transceivers (SFPs).

Ensure you only connect the LAN port to an Ethernet network that supports 10/100, or 10/100/1000 (IM7200, CM7100, ACM7000 only).

The IM7200 has four physical input ports which are logically presented as two ports (NET1 & NET2). Each logical port consists of a copper 10/100/1000 port and a fiber-optic small form-factor pluggable (SFP) module slot.

The ACM7004-5 has six physical input ports: an SFP port and an RJ45 port on the front of the device which are logically paired and marked as NET1; and four RJ45 ports on the back of the device which constitute an independent Ethernet switch and which are marked as NET2. The ACM7008-2-M has four physical input ports: two RJ45 ports and two SFP ports, all on the front of the device.

On all devices with logically-paired SFP and RJ45 ports, you can use only one of the two physical ports at a time: either the SFP module port or the 10/100/1000 port.

As well, and again on all console servers with logically-paired SFP and RJ45 ports, the fiber-optic medium (ie, the SFP module) has priority over the copper medium (ie the RJ45 port). Only if the SFP module is not plugged in, does the RJ45 copper link becomes active. This applies regardless of the connection order. If the SFP module is plugged in after the copper medium has established a link, the copper link is disconnected and the fiber-optic medium becomes active.

For the initial configuration of the console server you must connect a computer to the *console server's* principal network port. This port's label varies from model to model but always includes a numeric one (1). Specific labels include *NET1*, *NETWORK1*, *LAN1*, and *LAN USB1*.

1.4. Serial port connection

Console servers all come with one to forty eight serial ports, marked SERIAL or SERIAL PORTS. These ports connect to serially Managed Devices. Each console server also has either a dedicated Local Console (or modem) port marked LOCAL or CONSOLE, or one or its SERIAL ports can be software configured in Local Console mode. This Local Console port can be used for local command line access (or external serial modem out of band connection).

All *console server* models except the ACM5000, ACM5500 and ACM7000 have a dedicated local RS232 Console port. This is a DB9 connector located on the front of the IM4200 models, and a RJ45 connector (Cisco Straight) located on the front of the IM7200 and CM7100 models.

ACM5000, ACM5500 and ACM7000 models have two, three, four, or eight serial ports presented as RJ45 ports 1–x. By default, port 1 on all these models is configured in Local Console mode.

Conventional Cat5 cabling with RJ45 jacks is generally used for serial connections. Opengear supplies a range of cables and adapters that may be required to connect to the more popular servers and network appliances.

These are also overviewed in appendix 4. More detailed information is available online at https://opengear.zendesk.com/forums/21087337-cabling.

Before connecting the console port of an external device to the console server serial port, confirm that the device does support the standard RS-232C (EIA-232).

The *console servers* come with one to forty eight serial connectors for the RS232 serial ports:

The RJ45 serial ports are located on the front face of the ACM5000 and ACM5500; on the rear of the ACM7000; on the front panel of the rack mount IM4200; and on the rear panel of the rack mount IM7200.

The ACM5000, ACM5500, ACM7000, CM7100 and IM4216-34 models have Cisco Straight serial pinouts on the RJ45 connectors (see chapter 1.4.3 below).

All serial ports on the IM7200 are RJ45 and are software selectable for Cisco Straight or Cisco Rolled pinout.

The IM4200 family is available with a selection of alternate RJ45 pinouts e.g. the IM4208-2, IM4216-2 and IM4248-2 console servers have three RJ45 pinout configurations available: Opengear Classic, Cisco Straight or Cyclades/Cisco Rolled (see chapter 1.4.1).

These alternate pinouts need to be specified in the part number at the time of order e.g. to order an IM4248-2 dual power supply AC USA model, specify:

> IM4248-2-DAC-X2-US for a unit equipped with Cisco Straight RJ pinouts (straight through cable).
>
> IM4248-2-DAC-X1-US for a unit equipped with Cyclades/Cisco Rolled RJ pinouts (rolled cable connection).
>
> IM4248-2-DAC-X0-US for a unit equipped with Opengear Classic RJ pinouts.

Some console server models support RS-422 and RS-485 as well as RS-232.

The four RJ45 serial ports on the ACM5004-2-I and ACM5504-5-G-I are each RS-232/422/485 software selectable as are the eight RJ45 serial ports on the ACM5508-2-I.

See appendix 4 for RS422/485 pinout and connection details.

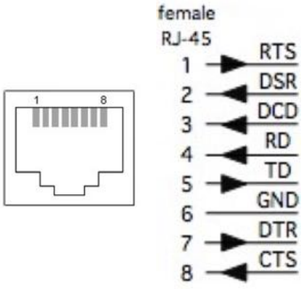
In summary:

model			**serial ports**			**console port**
	#	**connector**	**pinout**	**rs232**	**rs422/485**	
ACM500x	2,3,4	RJ	X2 Cisco	yes	no	no[1]
ACM5004-I	4	RJ	X2 Cisco	yes	yes	no[1]
ACM550x	4,8	RJ	X2 Cisco	yes	no	no[1]
ACM700x	4,8	RJ	X2 Cisco	yes	yes	no[1]
IM72xx-2	4,8	RJ	X2 Cisco	yes	no	no[1]
IM42xx-2	16,32,48	RJ	X2 Cisco or X1 Cisco Rolled (SW config)	yes	no	yes
IM42xx-2	8,16,32,48	RJ	X2 Cisco or X1 Cisco Rolled (SW config)	yes	no	yes
IM4216-34	16	RJ	X2 Cisco	yes	no	yes
CM71xx	16,32,48,96	RJ	X2 Cisco	yes	no	yes

1. The first serial port can be reassigned to be a console port.

1.4.1. Opengear Classic RJ45

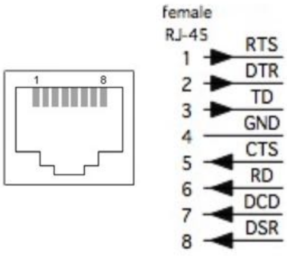
The IM4200 console servers are also available with this RJ45 pinout as an option:



pin	signal	definition	direction
1	RTS	request to send	output
2	DSR	data set ready	input
3	DCD	data carrier detect	input
4	RXD	receive data	input
5	TXD	transmit data	output
6	GND	signal ground	n/a
7	DTR	data terminal ready	output
8	CTS	clear to send	input

1.4.2. Cisco Rolled (Cyclades) RJ45 pinout (option -X1)

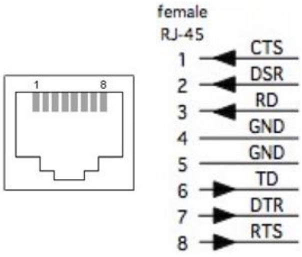
The IM4200 console servers are available with this RJ45 pinout option. The IM7200 console servers can select this pinout. This makes it easy to replace Avocent Cyclades products, and is convenient for use with rolled RJ45 cable:



pin	signal	definition	direction
1	RTS	request to send	output
2	DTR	data terminal ready	output
3	TXD	transmit data	output
4	GND	signal ground	n/a
5	CTS	clear to send	input
6	RXD	receive data	input
7	DCD	data carrier detect	input
8	DSR	data set ready	input

1.4.3. Cisco RJ45 pinout

The ACM5000, ACM5500, ACM7000, CM7100 and IM4216-34 models have Cisco serial pinouts on its RJ45 connectors. The IM4200 console servers are also available with this RJ45 pinout. The IM7200 console servers can select this pinout (it is the default). This provides straight through RJ45 cable to equipment such as Cisco, Juniper, Sun, and many more:



pin	signal	definition	direction
1	CTS	clear to send	input
2	DSR	data set ready	input
3	RXD	receive data	input
4	GND	signal ground	n/a
5	GND	signal ground	n/a
6	TXD	transmit data	output
7	DTR	data terminal ready	output

8	RTS	request to send	output

1.5. USB port connection

Most *console servers* have external USB ports. IM7200s have USB 3.0 ports. On other models these ports are mostly USB 2.0. They can be used for:

connecting to UPS or PDU managed devices (for managing UPS supplies, for example).

connecting an external USB memory stick

connecting to USB Consoles. NB: IM4200/ACM5xx/550x support 2 Cisco Consoles only.

Some *console server* models also have a USB1.1 port and this is best reserved for use with an external USB memory stick dedicated to recovery firmware boot images, extended log file storage or both.

All the IM4200-X models with internal cellular have one USB1.1 port on the front face and one USB 2.0 port at the rear face. This USB2.0 port uses a micro-AB USB connector so an adapter cable is also included. These models also have 16GB flash installed internally via a USB 2.0 flash drive for improved logging

All the other models in the IM4200-X family (IM42xx-2-DxC-Xx models such as IM4208-2-DAC-X0, IM4248-2-DDC-X2 and IM4216-34-DAC-X2) have one USB1.1 port on the front face and two additional USB 2.0 ports at the rear face (adjacent to modem jack). These IM4200-X models also have an internal 16GB flash drive

The IM7216-2-24U, like all other IM7200-series models, has two front-facing USB 3.0 ports. The IM7216-2-24U also has 24 rear-facing USB 2.0 ports. These rear-facing USB ports are presented as serial ports 17–40 and support USB console connections to devices from a wide range of vendors, including Cisco, HP, Dell and Brocade. Moreover, and aside from their utility as USB connections, all IM7216-2-24U USB ports can function as plain RS-232 serial ports when a USB-to-serial adapter is connected.

The IM7216-2-24U’s two front-facing USB ports are presented as Front, Upper USB and Front, Lower USB respectively. And, although these two ports can also be used as serial ports with a USB-to-serial adapter, in most instances it is expected the front-facing ports will be used on the IM7216-2-24U as they are used on other IM7200-series models: to connect to USB consoles on UPS supplies or Cisco devices; and for in-situ flash drive attachment to load updated firmware or saved configuration files.

Some *console server* models also come with internal USB connections to cellular modem and/ or flash memory.

The ACM5500 models all have an internal 4GB USB flash drive as well as two unallocated external USB2.0 ports.

The ACM7000 models all have an internal 4GB USB flash drive as well as four unallocated external USB2.0 ports. These four unallocated USB ports are labelled 1 – 4 on the device itself and in the Web interface. Note: a handful of ACM-7004-5s were manufactured with physical labels A – D on the four USB ports. If you have such an ACM-7004-5, be aware the Web interface still denotes them as USB ports 1 – 4, as it does with other 7000-series devices.

The ACM5000 models have two USB2.0 ports. However one or both of these may be pre-allocated internally. For example, the ACM5004-G has one internal USB committed for the cellular modem adapter, so there is only one external USB port free. Similarly with ACM5004-F-E model an internal USB flash is fitted, using up one of the two USB2.0 ports.

1.6. Fitting Cellular SIM and Antennas

The ACM5504-5-G-W-I, ACM5504-5-G-I, ACM5004-G-E and ACM5004-G-I models each have an internal 3G cellular modem that requires at least one (or more) SIM cards to be installed and at least one external cellular antenna to be attached. The ACM5000-GV/GS and ACM5500-GV/GS models also have an internal cellular modem requiring external antenna connection. However the Verizon and Sprint 3G networks do not require a SIM card.

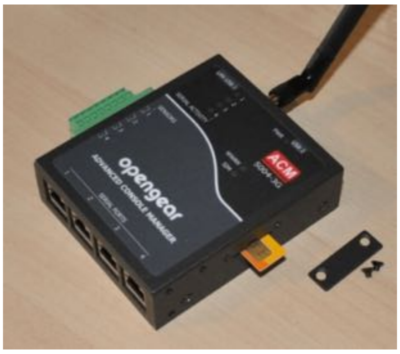
Similarly the IM4200-2-DAC-X2-G and IM4216-34-DAC-X2-G models have an internal 3G cellular modem that requires a SIM card and external antenna. The IM4200-2-DAC-X2-GV/GS and IM4216-34-DAC-X2-GV/GS models also have an internal cellular modem requiring external antenna connection however they do not require a SIM card.

The ACM5504-5-LA/LR/LV-I, ACM7004-2-LA/LR/LV, ACM5004-LR, ACM5004-LR-I and IM7200-LA/LR/LV/LM-I models all have an internal 4G LTE cellular modem that requires at least one SIM card to be installed and two external cellular antennas to be attached.

The ACM5504-5-G-W-I and all IM7200 models also have an internal 802.11 wireless modem that requires at least one external WiFi antenna to be attached.

1.6.1. ACM5004 -G & -L models

The ACM5000 -GV/-GS/-G work with Verizon USA, Sprint USA and global GSM carriers including AT&T USA, respectively. The ACM5000 -LR models work with global GSM carriers (outside the USA). Your carrier will provide you with a SIM card for activating you data plan (-G models only).



Note: you must install the SIM card before powering on the device.

Unscrew the cover plate on the side of the insert the SIM into the SIM garage then screw the cover plate back on.

Note: insert with contacts facing upwards as shown.

Screw the provided antenna on to the MAIN SMA antenna connector on the rear of the unit. Then place the unit and/or aerial in a location that will ensure the best signal.

These models come with dual SMA antenna connectors. The AUX connector can be used for receive diversity. This requires an external antenna (accessory Part# 569006) and cable (Part# 449041).

With -I models, the AUX connector can also be used for GPS. An external GPS passive antenna with magnetic base, SMA connector and 2 meter cable is available (Part # 569008).

These models have two cellular status LEDs. The SIM LED on top of unit should go on solid when powered and a SIM card has been inserted and detected.

The WWAN LED on top of the unit should go on at a fast blink once a radio connection has been established with your cellular carrier (that is, after an APN has been properly configured).

WWAN LED Status:

Off:	in reset mode or not powered.
Slow blink:	searching for service.
Solid Green:	active service; no traffic detected.
Fast Blink:	active service; traffic (blink proportional to traffic detected).

1.6.2. ACM5500 -G models

The ACM5500 -GV/-GS/-G work with Verizon USA, Sprint USA and global GSM carriers including AT&T USA, respectively. Your carrier will provide you with a SIM card for activating you data plan (-G models only).

Note: you must install the SIM card before powering on the device.

-G-I models can hold two SIM cards from alternate carriers, however only requires one SIM to operate. Unscrew the SIM card access panel and insert the first carrier SIM card in the bottom SIM slot. A second carrier SIM can also be installed in the slot above the first. Screw the cover plate back on.

Note: Take care to insert the SIM cards with contacts facing downward and the notch to the right-hand side.

Screw the provided cellular antenna on to the main Cell (M) connector on the rear of the ACM5504-G-I.

Then place the unit and/or aerial in a location that will ensure the best signal. The ACM5504-5-G-I has a second SMA antenna connector. This Cell (A) connector can be used for receive diversity. This requires an external antenna (accessory Part# 569006) and cable (Part# 449041).

The ACM5504-5-G-I has a second SMA antenna connector. This Cell (A) connector can be used for receive diversity. This requires an external antenna (accessory Part# 569006) and cable (Part# 449041).

Alternately, the Cell (A) connector can be used for GPS. An external GPS passive antenna with magnetic base, SMA connector and 2 meter cable is available (Part # 569008).

The ACM5504-5-G(V)-W-I models have an internal 802.11 WiFi adapter and come with an external WiFi antenna. Screw wireless antenna on to the main WIFI (M) connector.

The ACM5504-5-G(V)-W-I has a second WiFi antenna connector. This WIFI (A) connector can be used for diversity and requires an external antenna (part # 569011).

1.6.3. ACM5500 -L models

The ACM5500 -LA/-LV/-LR models work with AT&T USA, Verizon USA, or global 4G LTE carriers respectively. Your carrier will provide you with a SIM card for activating you data plan. -LR models can hold two SIM cards from alternate carriers, however only one SIM is required.

Note:you must install the SIM card before powering on the device.

Unscrew the SIM card access panel and insert the first carrier SIM card in the bottom SIM slot. A second carrier SIM can also be installed in the slot above the first.

Note: double check you inserted the SIM card in the bottom SIM slot with contacts facing downward and the notch to the right-hand side. Then replace the SIM card access panel.

ACM5500-L models are supplied with two external 7-band cellular antennas. Screw the provided antennas on to the main *Cell (M)* and diversity *Cell (A)* SMA connectors on the rear panel.

An external GPS passive antenna with magnetic base, SMA connector and 2 meter cable is available (Part #569008). It is screwed on to the GPS SMA connector on the rear panel.

1.6.4. ACM7000 -L models

'-L' model ACM7000s come with internal 4G LTE modems and either single (ACM7004-2-LA and ACM7004-2-LR) or dual (all other '-L' ACM7000-series models) mini-SIM card slots.

The -LA and -LMA models work with AT&T USA. The -LV and -LMV models work with Verizon USA. And the -LR and -LMR models work with global 4G LTE carriers. NB: -LM models are also multi-carrier. The ACM7004-5-LMA, for example, works with AT&T USA by default but can be re-set to work with Verizon USA. Likewise with a model like the ACM7008-2-LMV: it works with Verizon USA by default but can be re-set to work with AT&T USA.

Whichever carrier you choose, their SIM card activates the data plan and must be installed before powering on the device.

On single-SIM models, simply slide the carrier's SIM card into the slot on the front of the device, making sure the contacts are facing upwards and the notch is pointing outwards as the card slides into place.

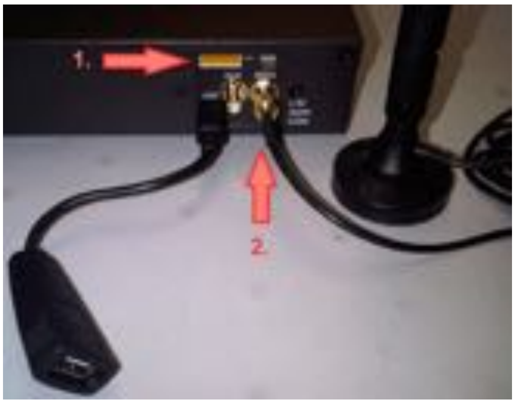
Dual-SIM models use a SIM cradle. The cradle holds the SIM card or cards and slides into the dual-SIM-card slot on the front of the device. The bottom slot is the default slot. If you have a dual-SIM ACM7000 and only one SIM card, insert the card into the bottom slot of the SIM cradle. No matter the specific configuration, SIM cards go into the cradle with the contacts upwards and the notch inward and adjacent to the longer cradle arm.

ACM7000 -L models also come with two external 7-band celluar antennas. Screw the provided antennas on to the main Cell (M) and diversity Cell (A) SMA connectors on the rear panel. An external GPS passive antenna with magnetic base, SMA connector and 2 meter cable is available (Part #569008). Screw it on to the GPS SMA connector on the rear panel.

1.6.5. IM4200 -G models

The IM4200-2-DAC-X2/X0-G and IM4216-34-DAC-X2-G models have an internal 3G-GSM HSUPA/UMTS cellular modem (and an internal 16GB flash memory and an additional USB port at the rear). They are also supplied with an external antenna with extension cable, and a USB adapter cable. They work with global GSM carriers.

Before powering on the console server:



- Your carrier will provide you with a SIM card. Insert the SIM card **(1)**. It will lock into place.

Note: Take care to insert SIM with contacts facing downward.

- Screw the external antenna coax cable onto the MAIN screw mount SMA connector on the rear of the *console server* **(2)**.
- The *AUX* connector can be used either for receive diversity (requires external antenna Part# 569006 and cable Part# 449041) or for GPS (requires external GPS passive antenna with cable Part# 569008).

The IM4200-2-DAC-X2/X0-GV/GS and IM4216-34-DAC-X2-GV/GS models also have an internal cellular modem (and an internal 16GB flash memory and an additional USB port at the rear). They do not require a SIM card, but the supplied external antenna is installed as above. These models work with Verizon USA and Sprint USA respectively.

1.6.6. All IM7200 models

All the IM7200 models have an internal 802.11 WiFi adapter and come with an external WiFi antenna.

Before powering on the IM7200:

- Screw wireless antenna on to the WIFI (MAIN) SMA connector.

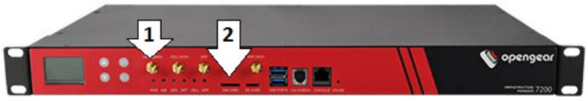
The IM7200 has a second WiFi antenna connector. This WIFI (AUX) connector can be used for diversity and requires an external antenna (part #569022).

1.6.7. IM7200 -L models

The IM7200- LA, LV, LR, LMA, and LMV models have a SIM card slot and three SMA cellular antenna connectors (for cellular with receive diversity and GPS).

LA models work with AT&T USA. LV models work with Verizon USA. LR models work with global 4G LTE carriers. LMA models default to AT&T but are multicarrier in the United States and also work with Verizon. LMV models default to Verizon but are multicarrier in the United States and also work with AT&T.

Included in the kit are two cellular antennas (with one 10 foot coaxial cable and magnetic antenna screw mount base for mounting outside the rack). If cellular signal strength is an issue, higher gain and directional antennas can be sourced.



Before powering on the IM7200 -LA/-LV/-LR:

- Screw one antenna (or antenna cable) onto the *CELL (MAIN)* screw mount **(1)** and the diversity antenna, onto the *CELL (AUX)* connector.

Note: if you have purchased a GPS antenna, screw it on to **GPS**.

- Your carrier will provide you with a SIM card. Insert the card into the SIM CARD slot and it will lock into place **(2)**.

Note: Take care to insert SIM card with contacts facing downwards.

1.7. Digital I/O & environmental sensors

ACM5000 or ACM5500 models with an -I in the model number or ACM5000 models with the -E option ship with an external green connector block for attaching environmental sensors and digital I/O devices.

Plug in this block and screw in any external devices.

On the ACM5508-2-I, ACM5504-5-G-I, ACM5504-5-LA/LR/LV-I, ACM5004-2-I, ACM5004-G/LR-I models this block can also be used for connecting the external DC power source.

ACM7000 models ship with an in-built, black, spring cage I/O connector block for attaching environmental sensors and digital I/O devices.

See chapter 7 for further details.

2. System configuration

This chapter provides step-by-step instructions for the initial configuration of your console server, and connecting it to the Management or Operational LAN. This involves the *Administrator*:

- activating the Management Console.
- changing the Administrator password.
- setting the IP address console server's principal LAN port.
- selecting the services to be enabled and access privileges.

This chapter also discusses the communications software tools that the *Administrator* may use in accessing the console server, and the configuration of the additional LAN ports.

Note: for guidance on configuring large numbers of Opengear appliances and/or automating provisioning, consult sections 3.1.12. Configuration over DHCP (ZTP) and 14.15 Bulk Provisioning.

2.1. Management console connection

Your console server comes configured with the following default IP address and subnet mask:

- IP address: 192.168.0.1.
- Subnet mask: 255.255.255.0.

For initial configuration it is recommended the *console server* be connected directly to a single computer.

If you choose to connect the console server and computer to a LAN before completing the initial setup steps the following conditions must be met:

- there must be no other devices on the LAN at IP address 192.168.0.1.
- the console server and the computer must be on the same LAN segment, with no interposed router appliances.

2.1.1. Connected computer setup

To configure the *console server* with a browser, the connected PC/workstation should have an IP address in the same range as the *console server* (for example, 192.168.0.100):

To configure the IP address of a computer running Linux, macOS, or Unix:

- run `ifconfig`.

To configure the IP address of a computer running Windows:

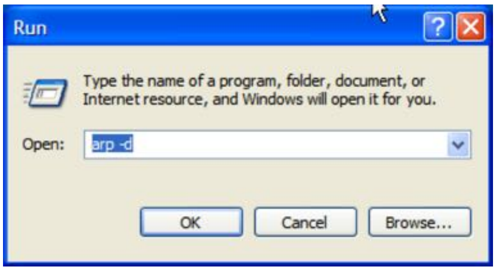
- Click **Start -> (Settings ->) Control Panel** and double click **Network Connections** (for Windows 95/98/Me, double-click **Network**).
- Right-click on **Local Area Connection** and select **Properties**.
- Select **Internet Protocol (TCP/IP)** and click **Properties**.
- Select **Use the following IP address** and enter the following details:

IP address:	*192.168.0.100*
Subnet mask:	*255.255.255.0*

- If you want to retain your existing IP settings for this network connection, click **Advanced** and add the above details as a secondary IP connection.

If it is not convenient to change your computer's network address, you can use the `ARP-Ping` command to reset the *console server's* IP address. To do this from a computer running Windows:

- Click **Start -> Run** (or select **All Programs > Accessories > Run**).
- Type `cmd` and click **OK** to bring up the `cmd.exe` shell prompt .
- Type `arp —d` to flush the ARP cache.



Type the name of a program, folder, document, or Internet resource, and Windows will open it for you.

Open: arp -d

- Type `arp —a` to view the current ARP cache (this should be empty).

Now add a static entry to the ARP table and `ping` the console server to assign the IP address to the *console server*.

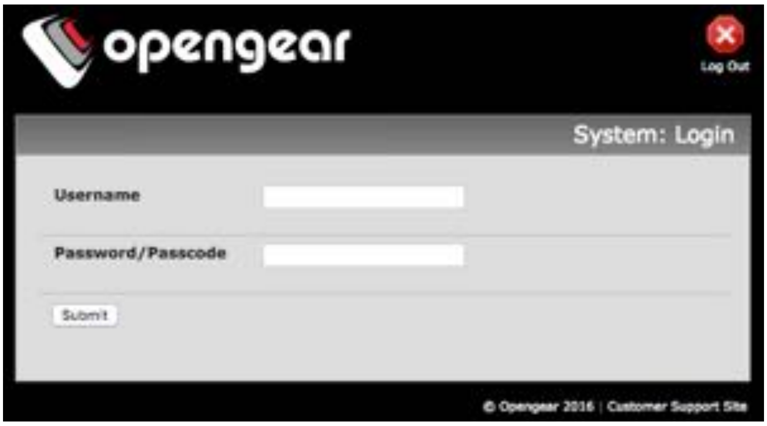
In the example below, a *console server* has the MAC Address 00:13:C6:00:02:0F (designated on the label on the bottom of the unit) and its IP address is set to 192.168.100.23.

Note: the computer issuing the `arp` *command must be on the same network segment as the* **console server** *(that is, have an IP address of 192.168.100.xxx).*

- On Windows: type `arp -s 192.168.100.23 00-13-C6-00-02-0F`
- On Linux, macOS or Unix: type `arp -s 192.168.100.23 00:13:C6:00:02:0F`
- Type `ping -t 192.18.100.23` to start a continuous ping to the new IP Address.
- Turn on the *console server* and wait for it to configure itself with the new IP address. It will start replying to the ping at this point.
- Type `arp —d` to flush the ARP cache again.

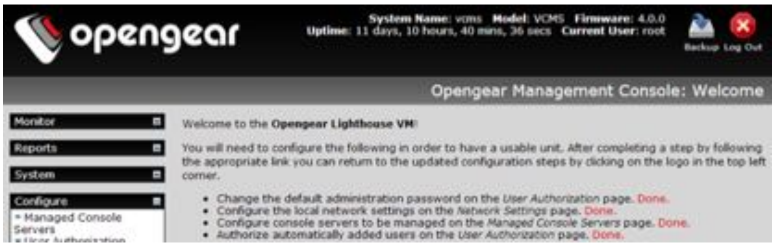
2.1.2. Browser connection

Launch or switch to your preferred browser on the connected computer and enter `https://192.168.0.1`.



Note: **Console servers** *ship with a self-signed SSL certificate and are factory configured with HTTPS access enabled and HTTP access disabled.*

The Management Console supports all current versions of the popular browsers: Internet Explorer, Firefox, Chrome, Safari and more.



System Name: vcms Model: VCMS Firmware: 4.0.0
Uptime: 11 days, 10 hours, 40 mins, 36 secs Current User: root

Welcome to the **Opengear Lighthouse VM**!

You will need to configure the following in order to have a usable unit. After completing a step by following the appropriate link you can return to the updated configuration steps by clicking on the logo in the top left corner.

- Change the default administration password on the *User Authorization* page. Done.
- Configure the local network settings on the *Network Settings* page. Done.
- Configure console servers to be managed on the *Managed Console Servers* page. Done.
- Authorize automatically added users on the *User Authorization* page. Done.

You will be prompted to log in.

- Enter the default administration username and administration password:

Username: *root*
Password: *default*

A **Welcome** page, which lists initial configuration steps, will display.

These steps are:

- Change default administration password (Users page. See chapter 2.2.)
- Configure the local network settings (System/IP page. See chapter 2.3.)
- Configure serial ports settings (Serial & Network/Serial Port page. See chapter 3.)
- Configure user port access (Serial & Network/Users page. See chapter 3.)

If your system has a cellular modem steps to configure the cellular router features will also present:

- Configure the cellular modem connection (System/Dial page. See chapter 4.)
- Allow forwarding to the cellular destination network (System/Firewall page. See chapter 4.)
- Enable IP masquerading for cellular connection (System/Firewall page. See chapter 4.)

After completing each of the above steps, return to the configuration list by clicking the Opengear logo in the top left corner of the page.

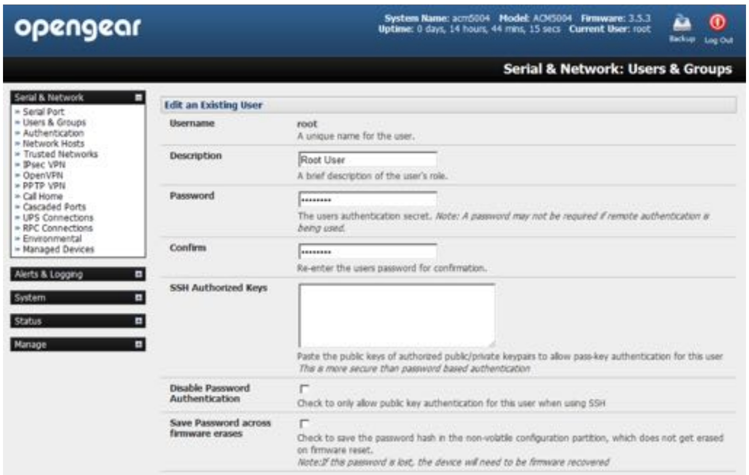
Note: if you are not able to connect to the Management Console at 192.168.0.1 or if the default Username and Password were not accepted, reset your **console server** *(See chapter 10).*

2.2. Administrator set-up

2.2.1. Change default root system password

For security reasons, only the administrative user named *root* can initially log into a *console server*. So only those people who know the root password can access and reconfigure the *console server* itself.

The corollary is that anyone who correctly guesses the root password can gain access and control of a *console server*. And the initial root password is **default**. It is essential, therefore to



System Name: acm5004 **Model:** ACM5004 **Firmware:** 3.5.3
Uptime: 0 days, 14 hours, 44 mins, 15 secs **Current User:** root

Serial & Network: Users & Groups

Edit an Existing User

Username root
A unique name for the user.

Description Root User
A brief description of the user's role.

Password ••••••••
The users authentication secret. *Note: A password may not be required if remote authentication is being used.*

Confirm ••••••••
Re-enter the users password for confirmation.

SSH Authorized Keys
Paste the public keys of authorized public/private keypairs to allow pass-key authentication for this user
This is more secure than password based authentication

Disable Password Authentication □
Check to only allow public key authentication for this user when using SSH

Save Password across firmware erases □
Check to save the password hash in the non-volatile configuration partition, which does not get erased on firmware reset.
Note:If the password is lost, the device will need to be firmware recovered

enter and confirm a new password before giving the console server any access to, or control of, other computers and network appliances.

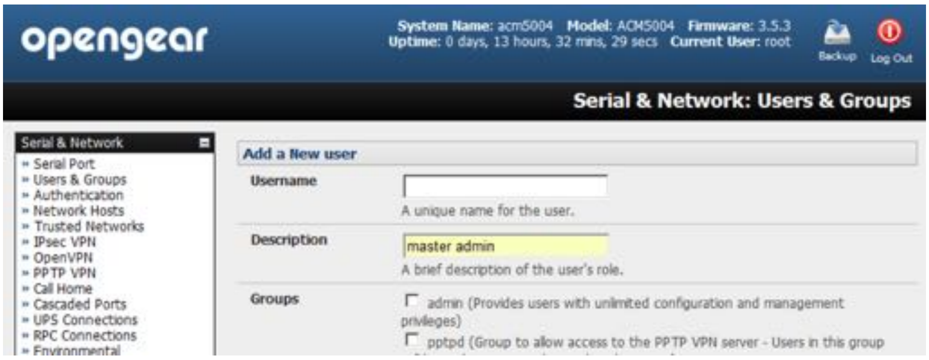
- Select **Change default administration password** from the **Welcome** page.
- The **Serial & Network > Users & Groups** page loads. From here a new, confirmed password for the root user can be set.

Note: There are no character restrictions in a **console server** *user's password. And passwords can be up to 254 characters long.*

- If the *console server* has flash memory (such as the IM7200) you will be given the option to *Save Password across firmware erases*.

  Checking this will save the password hash in the non-volatile configuration partition, which does not get erased on firmware reset. Take care as if this password is lost, however. In such an event, the affected *console server* will need to be firmware recovered.

- Click **Apply**.



System Name: acm5004 **Model:** ACM5004 **Firmware:** 3.5.3
Uptime: 0 days, 13 hours, 32 mins, 29 secs **Current User:** root

Serial & Network: Users & Groups

Add a New user

Username
A unique name for the user.

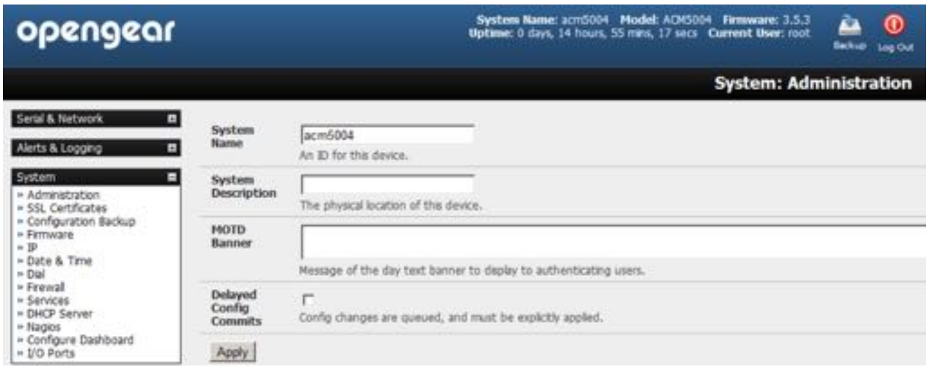
Description master admin
A brief description of the user's role.

Groups
□ admin (Provides users with unlimited configuration and management privileges)
□ pptpd (Group to allow access to the PPTP VPN server - Users in this group

Since the root password has changed a new log-in prompt will present. This time use the new password.

2.2.2. Setup a new administrator

A new *Administrator* user should be setup and this new user should be used for ongoing *console server* administration, rather than relying on the *root* user.



System Name: acm5004 **Model:** ACM5004 **Firmware:** 3.5.3
Uptime: 0 days, 14 hours, 55 mins, 17 secs **Current User:** root

System: Administration

System Name acm5004
An ID for this device.

System Description
The physical location of this device.

MOTD Banner
Message of the day text banner to deploy to authenticating users.

Delayed Config Commits □
Config changes are queued, and must be explicitly applied.

This new user can be configured in the admin group with full access privileges by selecting **Serial & Network > Users & Groups >Add a New User** (see chapter 2.2 for details).

2.2.3. Name the system

- Select **System > Administration**.
- Enter a *System Name* and *System Description* for the *console server* to give it a unique ID and make it simple to identify.

Note: The System Name can contain from 1 to 64 alphanumeric characters as well as the following special characters **.** **–** **_**. *There are no restrictions on the characters that can be used in the System Description, which can contain up to 254 characters.*

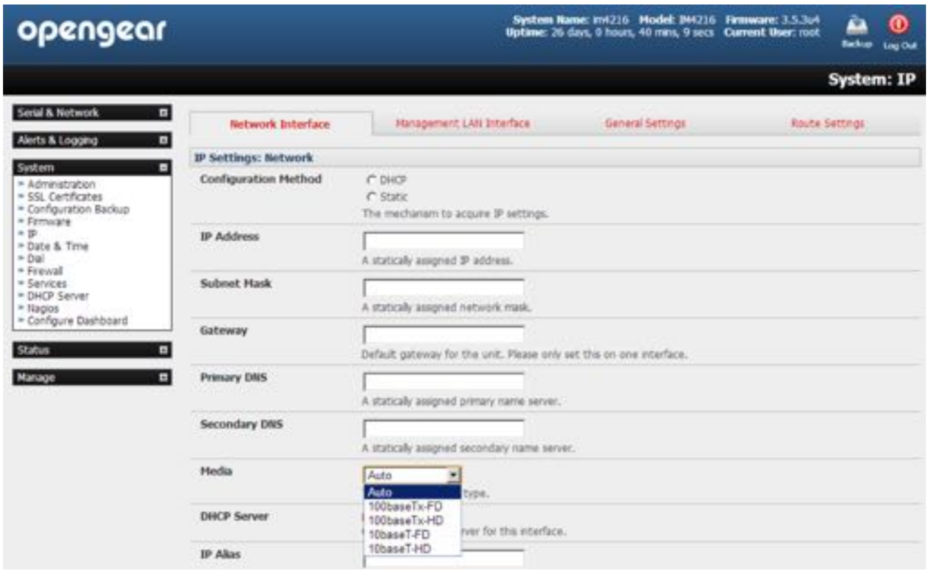
- Optional: text entered in the *MOTD Banner* field is displayed to users when the log-in to the *console server*.
- Click **Apply**.

Note: If you are not confident your console server has been supplied with the current release of firmware, you can upgrade it. (See chapter 10 for details.)

2.3. Network configuration

The next step is to enter an IP address for the principal Ethernet (*LAN/Network/Network1*) port on the *console server*; or enable its DHCP client so that it automatically obtains an IP address from a DHCP server on the network it is to be connected to.

- On the **System > IP** menu select the **Network Interface** page then check *DHCP* or *Static* for the *Configuration Method*.
- If you selected *Static* you must manually enter the new *IP Address*, *Subnet Mask*, *Gateway* and *DNS server* details. This selection automatically disables the DHCP client.



System Name: im4216 Model: IM4216 Firmware: 3.5.3u4
Uptime: 26 days, 0 hours, 40 mins, 9 secs Current User: root

System: IP

IP Settings: Network

Configuration Method ○ DHCP ○ Static
The mechanism to acquire IP settings.

IP Address
A statically assigned IP address.

Subnet Mask
A statically assigned network mask.

Gateway
Default gateway for the unit. Please only set this on one interface.

Primary DNS
A statically assigned primary name server.

Secondary DNS
A statically assigned secondary name server.

Media: Auto
type.

DHCP Server
ver for this interface.

IP Alias

- By default the *console server* LAN port auto detects the Ethernet connection speed. To lock the Ethernet port to 10 Mb/s or 100Mb/s and to Full Duplex (FD) or Half Duplex (HD) select a speed and duplex setting from the *Media* pop-up menu.

  If you encounter packet loss or poor network performance with the default auto-negotiation setting, try manually setting the *Media* settings on both the *console server* and the device it is connected to. In most cases, select 100baseTx-FD (100 megabits, full duplex). Make sure both sides are set identically.

- If you selected DHCP the *console server* will look for configuration details from a DHCP server. This selection automatically disables any static address. The *console server's* MAC address can be found on a label on the base plate.

  In its factory default state (with no *Configuration Method* selected) the *console server* has its DHCP client enabled, so it automatically accepts any network IP address assigned by a DHCP server on your network. In this initial state, the console server will then respond to both its Static address (192.168.0.1) and its newly assigned DHCP address.

  You may also enter a secondary address or comma-separated list of addresses in CIDR notation as an IP Alias. For example: 192.168.1.1/24.

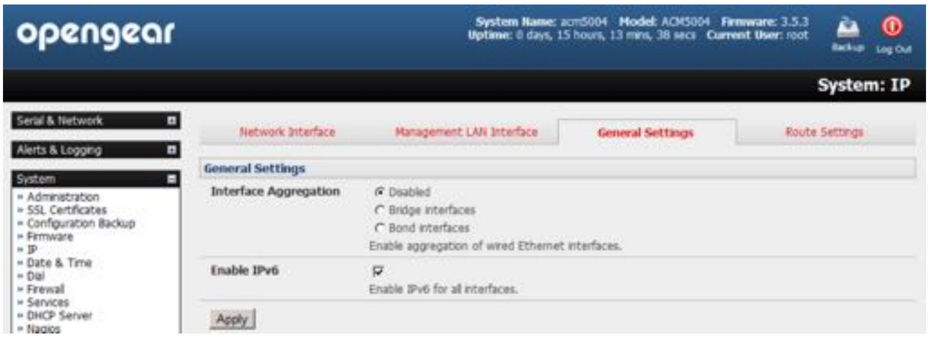
Note: If you changed the **console server's** *IP address, you may need to reconfigure your computer so it has an IP address that is in the same network range as this new address (as detailed earlier in this chapter).*

- Click **Apply**.
- Reconnect the browser on the computer that is connected to the console server by entering `https://new-ip-address-here/`.

2.3.1. IPv6 configuration

By default, the *console server* Ethernet interfaces support IPv4. They can also be configured for IPv6 operation, however.

- Select **System > IP**.
- Click the *General Settings* tab.
- Check the *Enable IPv6* check box.

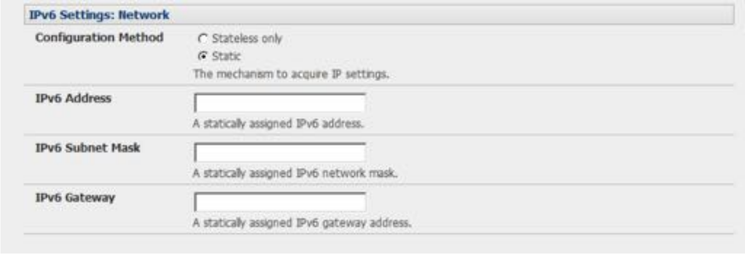


General Settings

Interface Aggregation: ● Disabled ○ Bridge interfaces ○ Bond interfaces
Enable aggregation of wired Ethernet interfaces.

Enable IPv6: ☑
Enable IPv6 for all interfaces.

- Click the *Network Interface* to access the *IPv6 settings* section.



IPv6 Settings: Network

Configuration Method: ○ Stateless only ● Static
The mechanism to acquire IP settings.

IPv6 Address:
A statically assigned IPv6 address.

IPv6 Subnet Mask:
A statically assigned IPv6 network mask.

IPv6 Gateway:
A statically assigned IPv6 gateway address.

- Configure the *IPv6 settings*.

2.3.2. Dynamic DNS (DDNS) configuration

With Dynamic DNS (DDNS) a *console server* which IP address is dynamically assigned (and that may change from time to time) can be located using a fixed host or domain name.

- The first step in enabling DDNS is to create an account with the supported DDNS service provider of your choice. Supported DDNS providers include:

provider	url	notes
DyNS	http://dyns.cx/	
Dyn	https://dyn.com/	formerly DynDNS.
GNUDip	http://freecode.com/projects/gnudip	An open-source DDNS tool for use by ISPs. Check if your ISP supports GNUDip.
Pubyun	http://pubyun.com/	Chinese DDNS provider. Formerly operated as 3322.org.

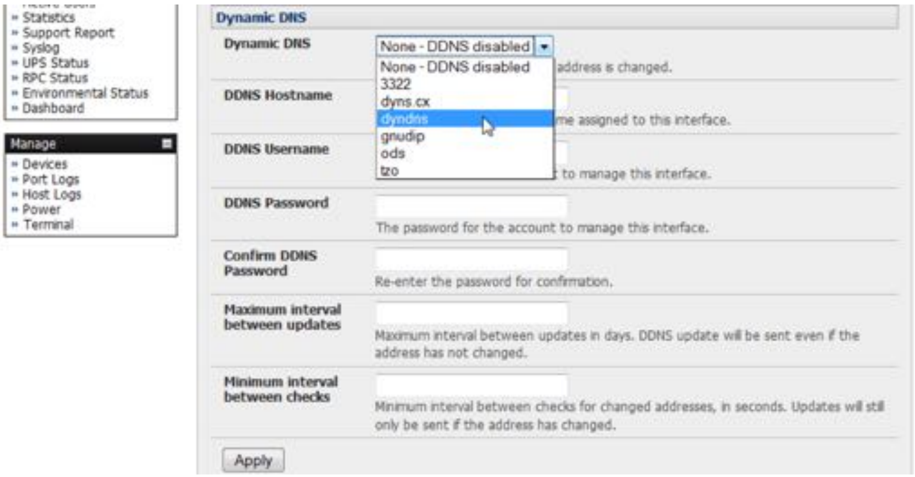
Note: *Two previously supported DDNS providers are ODS, which is no longer operating, and TZO, which was bought by Dyn and is no longer operating independently.*

Upon registering with the DDNS service provider, select a username and password, as well as a hostname that you will use as the DNS name (to allow external access to your machine using a URL).

Dynamic DNS service providers allow the user to choose a hostname URL and set an initial IP address to correspond to that hostname URL. Many Dynamic DNS providers offer a selection of URL hostnames available for free use with their service. However, with a paid plan, any URL hostname (including your own registered domain name) can be used.

You can now enable and configure DDNS on any of the Ethernet or cellular network connections on the console server (by default DDNS is disabled on all ports):

- Select the DDNS service provider from the drop down Dynamic DNS list on the **System > IP** or **System > Dial menu**.



Dynamic DNS

Dynamic DNS: None - DDNS disabled
address is changed.

DDNS Hostname
me assigned to this interface.

DDNS Username
to manage this interface.

DDNS Password
The password for the account to manage this interface.

Confirm DDNS Password
Re-enter the password for confirmation.

Maximum interval between updates
Maximum interval between updates in days. DDNS update will be sent even if the address has not changed.

Minimum interval between checks
Minimum interval between checks for changed addresses, in seconds. Updates will still only be sent if the address has changed.

- In *DDNS Hostname* enter the fully qualified DNS hostname for your *console server* (for example, `your-hostname.dyndns.org`.

- Enter the *DDNS Username* and *DDNS Password* for the DDNS service provider account.
- Specify the *Maximum interval between updates* in days. A DDNS update will be sent even if the address has not changed.
- Specify the *Minimum interval between checks* for changed addresses in seconds. Updates will still only be sent if the address has changed.
- Specify the *Maximum attempts per update* (that is, the number of times to attempt an update before giving up). By default this is set to 3.

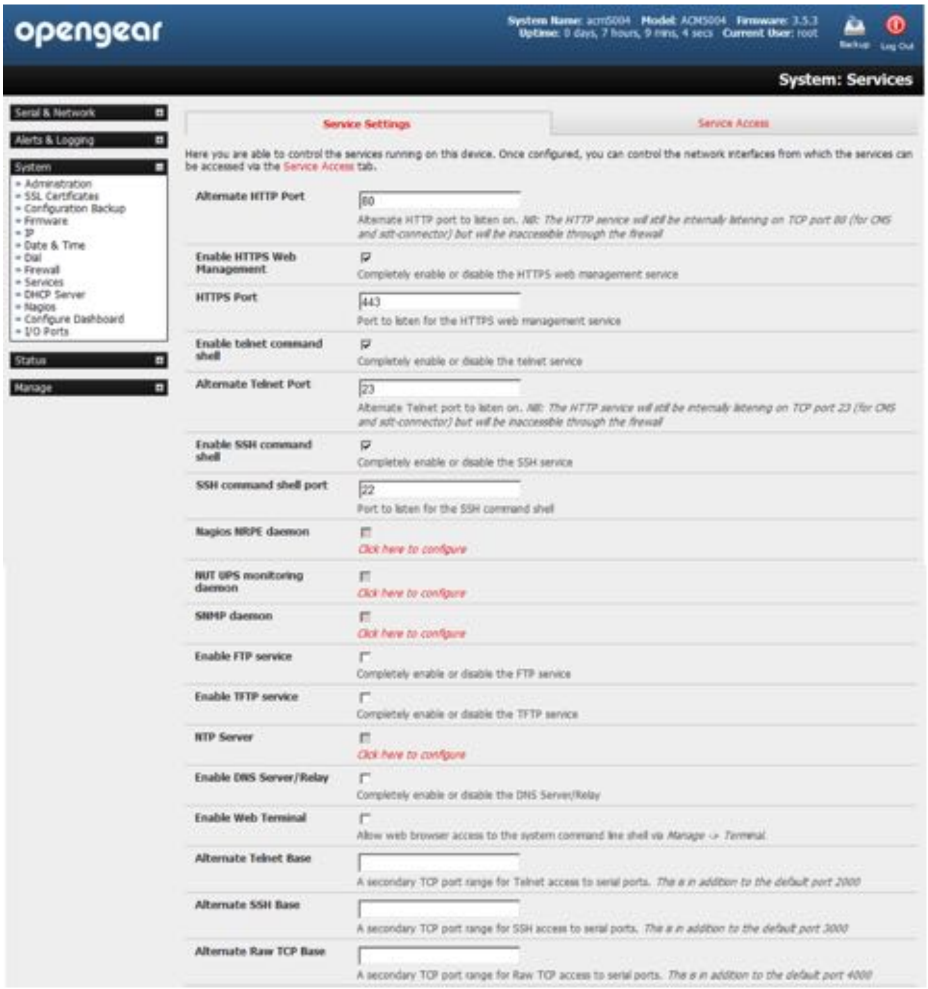
2.4. Services and service access

The *Administrator* can access the *console server*, connected serial ports, and managed devices using a range of access protocols and services. For each such access:

- the particular service must first be configured and enabled to run on the console server.
- then access through the firewall must be enabled for each network connection.

To enable and configure a service:

- Navigate to **System > Services**.
- Select the **Service Settings** tab.



System Name: acm5004 **Model:** ACM5004 **Firmware:** 3.5.3
Uptime: 0 days, 7 hours, 9 mins, 4 secs **Current User:** root

System: Services

Here you are able to control the services running on this device. Once configured, you can control the network interfaces from which the services can be accessed via the Service Access tab.

Alternate HTTP Port 80
Alternate HTTP port to listen on. *NB: The HTTP service will still be internally listening on TCP port 80 (for CMS and sdt-connector) but will be inaccessible through the firewall*

Enable HTTPS Web Management ☑
Completely enable or disable the HTTPS web management service

HTTPS Port 443
Port to listen for the HTTPS web management service

Enable telnet command shell ☑
Completely enable or disable the telnet service

Alternate Telnet Port 23
Alternate Telnet port to listen on.. *NB: The HTTP service will still be internally listening on TCP port 23 (for CMS and sdt-connector) but will be inaccessible through the firewall*

Enable SSH command shell ☑
Completely enable or disable the SSH service

SSH command shell port 22
Port to listen for the SSH command shell

Nagios NRPE daemon □
Click here to configure

NUT UPS monitoring daemon □
Click here to configure

SNMP daemon □
Click here to configure

Enable FTP service □
Completely enable or disable the FTP service

Enable TFTP service □
Completely enable or disable the TFTP service

NTP Server □
Click here to configure

Enable DNS Server/Relay □
Completely enable or disable the DNS Server/Relay

Enable Web Terminal □
Allow web browser access to the system command line shell via *Manage -> Terminal*

Alternate Telnet Base
A secondary TCP port range for Telnet access to serial ports. *This is in addition to the default port 2000*

Alternate SSH Base
A secondary TCP port range for SSH access to serial ports. *This is in addition to the default port 3000*

Alternate Raw TCP Base
A secondary TCP port range for Raw TCP access to serial ports. *This is in addition to the default port 4000*

Note: With firmware releases prior to version 3.5.3, services are enabled and configured using the **Service Access** *tab on the* **System > Firewall** *page.*

- Enable and configure basic services.
- **HTTP**

  By default the HTTP service is running and it cannot be fully disabled. However by default HTTP access is disabled on all interfaces and it is recommended this access remains disabled, if the console server is to be remotely accessed over the Internet.

  Alternate HTTP also enables you to configure an alternate HTTP port to listen on. However the HTTP service will continue internally listening on TCP port 80 (for CMS and sdt-connector communications) but will be inaccessible through the firewall.

- **HTTPS**

  By default the HTTPS service is running and this service is enabled on all network interfaces. It is recommended that only HTTPS access be used if the console server is to be managed over any public network (e.g. the Internet). This ensures the Administrator has secure browser access to all the menus on the console server. It also allows appropriately configured Users secure browser access to selected Manage menus. For information on certificate and user client software configuration see chapter 8, Authentication.

  The HTTPS service can be completely disabled (or re-enabled) by checking HTTPS Web Management and an alternate port specified (default port is 443).

- **Telnet**

  By default the Telnet service is running. However by default the service is disabled on all network interfaces.

  Telnet can be used to give the Administrator access to the system command line shell. While this may be suitable for a local direct connection over a management LAN, it is recommended this service be disabled if the console server is to be remotely administered. This service may also be useful for local Administrator and the User access to selected serial consoles.

  The Enable telnet command shell checkbox will completely enable or disable the telnet service. An alternate telnet port to listen on can be specified in Alternate Telnet Port (default port is 23).

- **SSH**

  This service provides secure SSH access to the console server and attached devices – and by default the SSH service is running and enabled on all interfaces. It is recommended you choose SSH as the protocol where the Administrator connects to the console server over the Internet or any other public network. This will provide authenticated communications between the SSH client program on the remote computer and the SSH sever in the console server. For more information on SSH configuration see chapter 8, Authentication.

  The Enable SSH command shell checkbox will completely enable or disable this service. An alternate SSH port to listen on can be specified in SSH command shell port (default port is 22).

- Enable and configure other services.

- **TFTP/FTP**

  If a USB flash card or internal flash is detected on a *console server* (for example, an ACM5000, ACM5500, ACM7000, CM7100, IM7200 or IM4200) then checking *Enable TFTP (FTP) service* will enable this service and set up default tftp and ftp server on the USB flash.

  These servers are used to store config files, maintain access and transaction logs etc. Files transferred using `tftp` and `ftp` will be stored under `/var/mnt/storage.usb/tftpboot/` (or `/var/mnt/storage.nvlog/tftpboot/` on ACM7000-series devices).

  Unchecking *Enable TFTP (FTP) service* will completely disable the TFTP (FTP) service.

- **DNS Relay**

  Checking *Enable DNS Server/Relay* will enable the DNS relay feature so clients can be configured with the *console server's* IP for their DNS server setting, and the console server will forward the DNS queries to the real DNS server.

- **Web Terminal**

  Checking *Enable Web Terminal* will allow web browser access to the system command line shell via **Manage > Terminal**.

- Specify alternate port numbers for Raw TCP, direct Telnet/SSH and unauthenticated Telnet/SSH services.

  The *console server* uses specific default ranges for the TCP/IP ports for the various access services that *Users* and *Administrators* can use to access devices attached to serial ports (see chapter 3, 'Serial port, host, device & user configuration'). The *Administrator* can also set alternate ranges for these services, and these secondary ports will then be used in addition to the defaults.

  The default TCP/IP base port address for `telnet` access is 2000, and the range for `telnet` is IP Address: Port (2000 + serial port #), thais is ports 2001 – 2048.

  For example, if the *Administrator* sets 8000 as a secondary base for `telnet` then serial port #2 on the *console server* can be accessed via `telnet` at IP Address:2002 and at IP Address:8002.

  The default base for SSH is 3000; for Raw TCP the default base is 4000; and for RFC2217 it is 5000.

A number of other services can be enabled and configured indirectly from this menu by selecting *Click here to configure*:

- **Nagios**

  Access to the Nagios NRPE monitoring daemons (see chapter 9).

- **NUT**

  Access to the NUT UPS monitoring daemon (see chapter 10).

- **SNMP**

  This will enable `netsnmp` in the *console server*. SNMP is disabled by default (see chapter 6 and chapter 14.5).

- **NTP**

  See chapter 10.

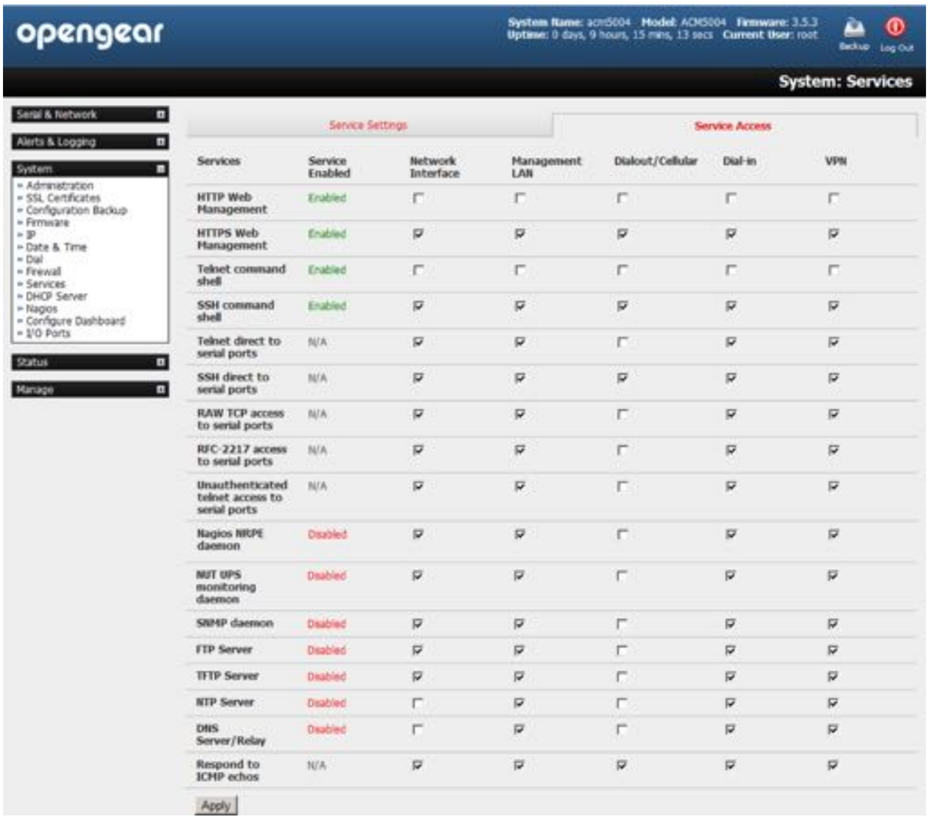
- Click **Apply**.

  As you apply your services selections, the screen will be updated with a confirmation message: *Message Changes to configuration succeeded*.

The **Services Access** settings can now be set to allow or block access.

This specifies which (enabled) services the *Administrator* can use over each network interface to connect to the *console server* and, through the *console server*, to attached serial and network connected devices.

- Navigate to **System > Services**.
- Select the **Service Access** tab.



Services	Service Enabled	Network Interface	Management LAN	Dialout/Cellular	Dial-in	VPN
HTTP Web Management	Enabled	□	□	□	□	□
HTTPS Web Management	Enabled	☑	☑	☑	☑	☑
Telnet command shell	Enabled	□	□	□	□	□
SSH command shell	Enabled	☑	☑	☑	☑	☑
Telnet direct to serial ports	N/A	☑	☑	□	☑	☑
SSH direct to serial ports	N/A	☑	☑	☑	☑	☑
RAW TCP access to serial ports	N/A	☑	☑	□	☑	☑
RFC-2217 access to serial ports	N/A	☑	☑	□	☑	☑
Unauthenticated telnet access to serial ports	N/A	☑	☑	□	☑	☑
Nagios NRPE daemon	Disabled	☑	☑	□	☑	☑
NUT UPS monitoring daemon	Disabled	☑	☑	□	☑	☑
SNMP daemon	Disabled	☑	☑	□	☑	☑
FTP Server	Disabled	☑	☑	□	☑	☑
TFTP Server	Disabled	☑	☑	□	☑	☑
NTP Server	Disabled	□	☑	□	☑	☑
DNS Server/Relay	Disabled	□	☑	□	☑	☑
Respond to ICMP echos	N/A	☑	☑	☑	☑	☑

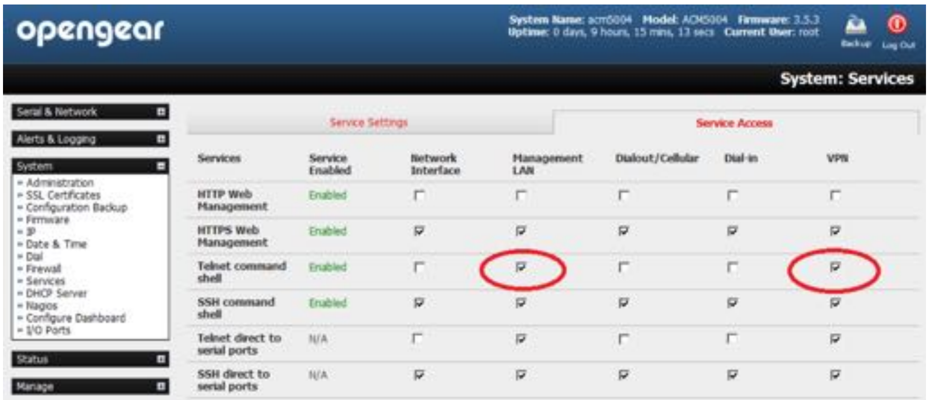
Note: With firmware releases pre 3.5.3 the **Service Access** *tab is found at* **System > Firewall**.

The services currently enabled for the *console server's* network interfaces present. Depending on the particular console server model the interfaces displayed may include :

Network interface	for the principal Ethernet connection).
Management LAN/OOB Failover	second Ethernet connections).
Dialout/Cellular	V90 and 3G modem.
Dial-in	internal or external V90 modem.
Wi-Fi	802.11 wireless.
VPN	IPsec or Open VPN connection over any network interface.

- Check or uncheck for each network to which service access is to be enabled or disabled.

In the example shown below, local administrators on the local *Management LAN* have `telnet` access direct to the *console server* (and attached serial ports) while remote administrators using Dial-In or Cellular have no `telnet` access (unless they set up a VPN).



Services	Service Enabled	Network Interface	Management LAN	Dialout/Cellular	Dial-in	VPN
HTTP Web Management	Enabled	□	□	□	□	□
HTTPS Web Management	Enabled	☑	☑	☑	☑	☑
Telnet command shell	Enabled	□	☑	□	□	☑
SSH command shell	Enabled	☑	☑	☑	☑	☑
Telnet direct to serial ports	N/A	□	☑	□	□	☑
SSH direct to serial ports	N/A	☑	☑	☑	☑	☑

- The *Respond to ICMP echos* (that is `ping`) service access options can be configured at this stage.

  This allows the console server to respond to incoming ICMP echo requests. `ping` is enabled by default. For security reasons, however, this service should generally be disabled post initial configuration.

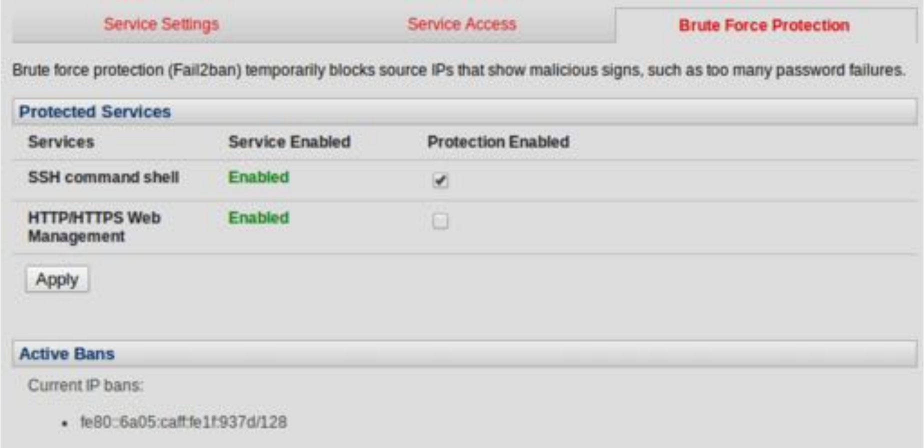
- You can also configure to allow serial port devices to be accessed from nominated network interfaces using Raw TCP, direct Telnet/SSH, unauthenticated Telnet/SSH services, etc.

- Click **Apply** to apply your services access selections.

2.4.1. Brute force protection

Brute force protection (Micro Fail2ban) temporarily blocks source IPs that show malicious signs, such as too many password failures.

This may help mitigate scenarios where the Opengear device's network services are exposed to an untrusted network such as the public WAN, and scripted attacks or software worms are attempting to guess (brute force) user credentials and gain unauthorized access.



Brute force protection (Fail2ban) temporarily blocks source IPs that show malicious signs, such as too many password failures.

Protected Services

Services	Service Enabled	Protection Enabled
SSH command shell	Enabled	☑
HTTP/HTTPS Web Management	Enabled	□

Active Bans

Current IP bans:

- fe80::6a05:caff:fe1f:937d/128

Brute force protection may be enabled for the listed services.

Once protection is enabled, 3 or more failed connection attempts within 60 seconds from a specific source IP trigger it to be banned from connecting for the next 60 seconds. Active Bans are also listed and may be refreshed by reloading the page.

Note: When an Opengear device is running on an untrusted network, it is recommended that a variety of strategies are used to lock down remote access. This includes strong passwords (or even better, SSH public key authentication), VPN, and using Firewall Rules to whitelist remote access from trusted source networks only. Please refer to the Knowledge Base for details.

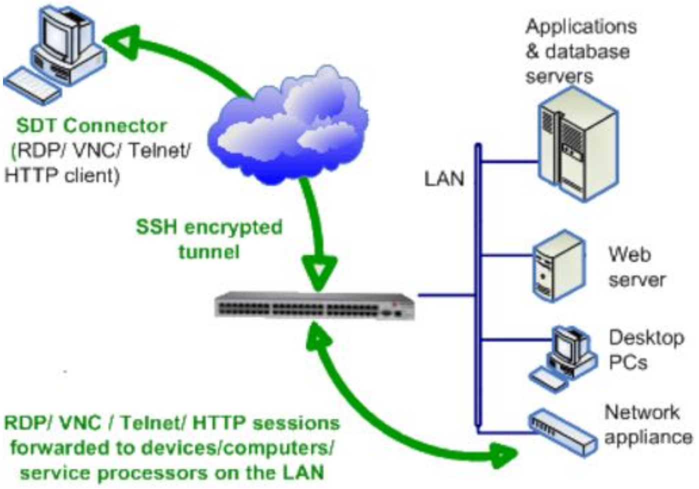
2.5. Communications software

You have configured access protocols for the *Administrator* client to use when connecting to the *console server*. *User* clients (which may be set up later) will also use these protocols when accessing console server serial attached devices and network attached hosts.

So you will need to have appropriate communications software tools set up on the *Administrator* (and *User*) client's computer. Opengear provides the *SDT Connector* as the recommended client software tool. Other generic tools such as PuTTY and SSHTerm may be used, however, and these are all described below.

2.5.1. SDT connector

SDT Connector is a lightweight tool that enables *Users* and *Administrators* to securely access the Console server, and the various computers, network devices and appliances that may be serially or network connected to the console server.


SDT Connector
(RDP/ VNC/ Telnet/ HTTP client)
SSH encrypted tunnel
RDP/ VNC / Telnet/ HTTP sessions forwarded to devices/computers/ service processors on the LAN
LAN
Applications & database servers
Web server
Desktop PCs
Network appliance

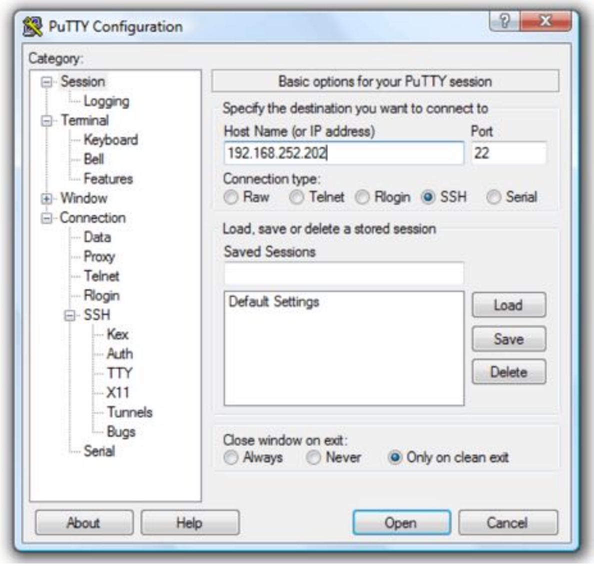
SDT Connector is a Java client program that couples the trusted SSH tunneling protocol with popular access tools such as Telnet, SSH, HTTP, HTTPS, VNC, and RDP to provide point-and-click secure remote management access to all the managed systems and devices.

Information on using *SDT Connector* for browser access to the *console server's* Management Console, Telnet/SSH access to the console server command line, and TCP/UDP connecting to hosts that are network connected to the console server can be found in chapter 5, SSH tunnels & SDT connector.

SDT Connector can be installed on computers running Windows or macOS and on most Linux, UNIX and Solaris systems.

2.5.2. PuTTY

Communications packages like *PuTTY* can be also used to connect to the Console server command line (and to connect serially attached devices as covered in chapter 3). *PuTTY* is a freeware implementation of Telnet and SSH for Win32 and UNIX platforms. It runs as an executable application without needing to be installed onto your system. *PuTTY* (the Telnet and SSH client itself) can be downloaded from http://putty.org/.



Specify the destination you want to connect to
Host Name (or IP address): 192.168.252.202
Port: 22
Connection type: ○ Raw ○ Telnet ○ Rlogin ● SSH ○ Serial
Load, save or delete a stored session
Saved Sessions
Default Settings
Close window on exit: ○ Always ○ Never ● Only on clean exit

To use *PuTTY* for an SSH terminal session from a Windows client, you enter the console server's IP address as the 'Host Name (or IP address)'.

To access the *console server* command line you select 'SSH' as the protocol, and use the default IP Port 22.

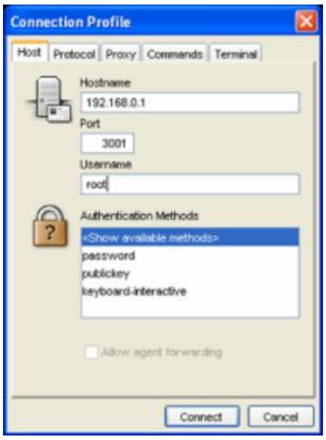
Click 'Open' and you will be presented with the *console server* login prompt. (You may also receive a 'Security Alert' that the host's key is not cached, you will need to choose 'yes' to continue.)

Using the Telnet protocol is similarly simple, except you use the default telnet port: port 23.

2.5.3. SSHTerm

Another communications package that may be useful is *SSHTerm*, an open source package that can be downloaded from http://sourceforge.net/projects/sshtools.

- To use SSHTerm for an SSH terminal session from a Windows client, Select **File > New Connection**.



Hostname: 192.168.0.1
Port: 3001
Username: root
Authentication Methods
<Show available methods>
password
publickey
keyboard-interactive
□ Allow agent forwarding

• A dialog box appears for your *Connection Profile*.

• Enter the host name or IP address for the *console server* you are connecting to and the TCP port that the SSH session will use (port 22).

•

• Enter your username, choose password authentication, and click **Connect**.

• If you receive a message about the host key fingerprint, select **Yes** or **Always** to continue.

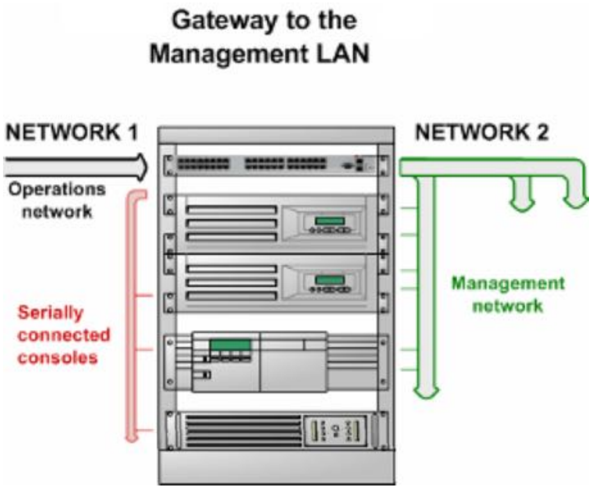
• The remote system will prompt you for a username and password. Enter these to login to the *console server*.

2.6. Management network configuration

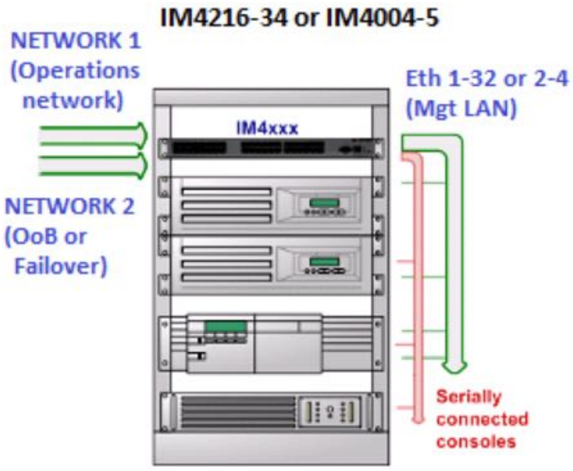
The IM4200, IM7200, CM7100, ACM5500, ACM7000 and ACM5004-2 *console servers* have additional network ports that can be configured to provide management LAN access and/or failover or out-of-band access.

2.6.1. Enable the management LAN

The IM4200, IM7200, CM7100, ACM7000, ACM5508-2-I/M and ACM5004-2 console servers can be configured so the second Ethernet port provides a management LAN gateway. The gateway has firewall, router and DHCP server features. However you need to connect an external LAN switch to Network/LAN 2 to attach hosts to this management LAN:



Note: The second ethernet port (Network/LAN2) on the IM4200, IM7200, CM7100, ACM7000, ACM5508-2-I/M and ACM5004-2 can be configured as either a Management LAN gateway port or it can be configured as an OOB/Failover port. It cannot be both. Do not allocate **Network/LAN 2** *as the* **Failover Interface** *when you configured the principal Network connection on the* **System > IP** *menu.*


IM4216-34 or IM4004-5
NETWORK 1 (Operations network)
NETWORK 2 (OoB or Failover)
IM4xxx
Eth 1-32 or 2-4 (Mgt LAN)
Serially connected consoles

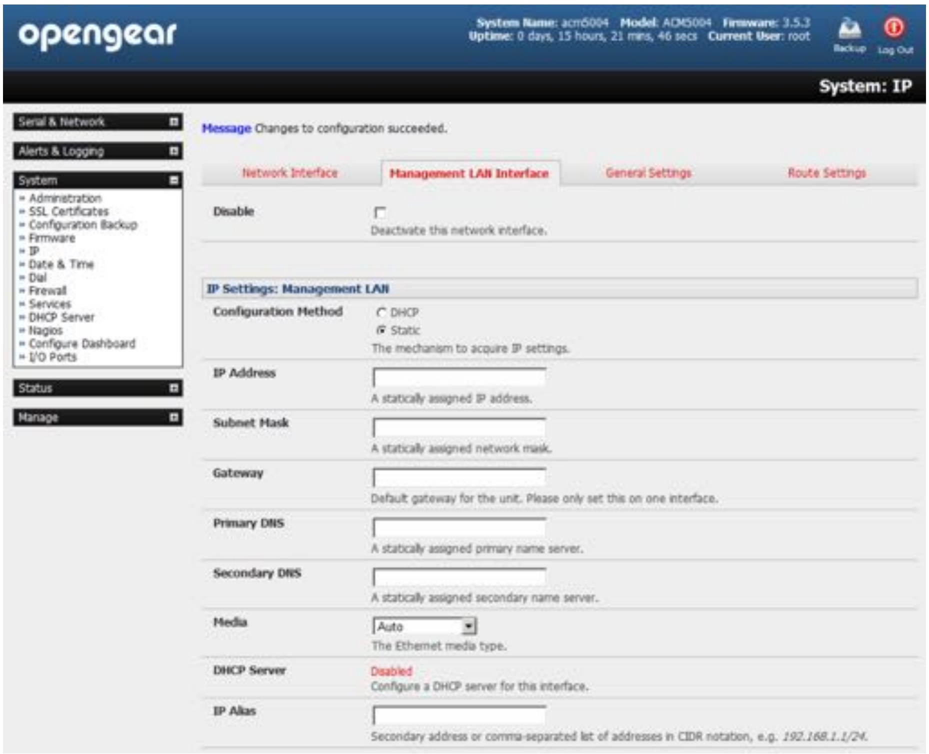
The ACM5504-5-G-I, ACM5504-5-LA/LR/LV-I, ACM5504-5-G-W-I and IM4216-34 console server models have integrated four or thirty-two port management LAN switches (with firewall, router, DHCP server and switch functions).

The IM4216-34 is normally configured with an active 32-port Management LAN (Ethernet 1-32) switch and Network 2 configured for OOB or Failover.

The ACM5504-5-G-W-I and ACM5504-5-G-I is normally configured with an active Management LAN. This can be a 4 port (ETH1-4) Management LAN switch, or a 3 port (ETH2-4) switch with ETH 1 configured for OOB/Failover.

Management LAN features are disabled by default. To configure a Management LAN gateway:

- Navigate to **System > IP**.
- Select the **Management LAN Interface** tab.
- Uncheck *Disable*.
- Set the *IP Address* and *Subnet Mask* for the Management LAN. Leave the DNS fields blank.



System Name: acm5004 **Model:** ACM5004 **Firmware:** 3.5.3
Uptime: 0 days, 15 hours, 21 mins, 46 secs **Current User:** root

Message Changes to configuration succeeded.

Disable □
Deactivate this network interface.

IP Settings: Management LAN

Configuration Method ○ DHCP ● Static
The mechanism to acquire IP settings.

IP Address
A statically assigned IP address.

Subnet Mask
A statically assigned network mask.

Gateway
Default gateway for the unit. Please only set this on one interface.

Primary DNS
A statically assigned primary name server.

Secondary DNS
A statically assigned secondary name server.

Media Auto
The Ethernet media type.

DHCP Server Disabled
Configure a DHCP server for this interface.

IP Alias
Secondary address or comma-separated list of addresses in CIDR notation, e.g. *192.168.1.1/24*.

- Click **Apply**.

The management gateway function is now enabled with default firewall and router rules. By default these rules are configured so the Management LAN can only be accessible by SSH port forwarding. This ensures the remote and local connections to Managed Devices on the Management LAN are secure.

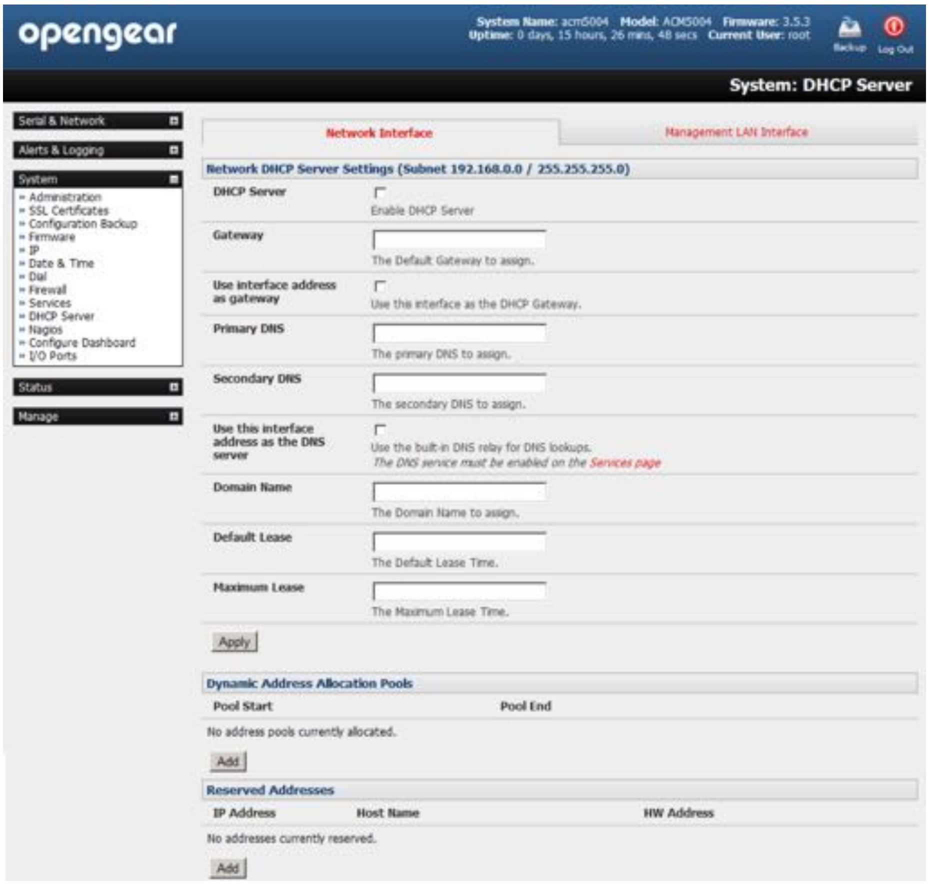
The LAN ports can also be configured in bridged or bonded mode (as described later in this chapter) or they can be manually configured from the command line.

2.6.2. Configure the DHCP server

All IM and ACM family devices host a DHCP server. It is, however, disabled by default. The DHCP server enables the automatic distribution of IP addresses to devices on the Management LAN that are running DHCP clients. To enable the DHCP server:

- Navigate to **System > IP**.
- Select the **Management LAN Interface** tab.
- Check the *Enable DHCP Server* checkbox.
- Enter the *Gateway* address to be issued to DHCP clients.

  If left blank, the *console server's* IP address is used.
- Enter the *Primary DNS* and *Secondary DNS* address to be issued to DHCP clients. Again if this field is left blank, the *console server's* IP address is used. For automatic DNS server assignment, leave this field blank.
- Enter a *Domain Name* suffix to issue DHCP clients. This is an optional value and step.



System Name: acm5004 **Model:** ACM5004 **Firmware:** 3.5.3
Uptime: 0 days, 15 hours, 26 mins, 48 secs **Current User:** root

System: DHCP Server

Network DHCP Server Settings (Subnet 192.168.0.0 / 255.255.255.0)

DHCP Server	□ Enable DHCP Server
Gateway	The Default Gateway to assign.
Use interface address as gateway	□ Use this interface as the DHCP Gateway.
Primary DNS	The primary DNS to assign.
Secondary DNS	The secondary DNS to assign.
Use this interface address as the DNS server	□ Use the built-in DNS relay for DNS lookups. *The DNS service must be enabled on the Services page*
Domain Name	The Domain Name to assign.
Default Lease	The Default Lease Time.
Maximum Lease	The Maximum Lease Time.

Dynamic Address Allocation Pools

Pool Start	Pool End

No address pools currently allocated.

Reserved Addresses

IP Address	Host Name	HW Address

No addresses currently reserved.

- Enter the *Default Lease* time and *Maximum Lease* time in seconds. The lease time is the time that a dynamically assigned IP address is valid before the client must request it again.
- Click **Apply**.

The DHCP server sequentially issues IP addresses from the specified address pool or pools:

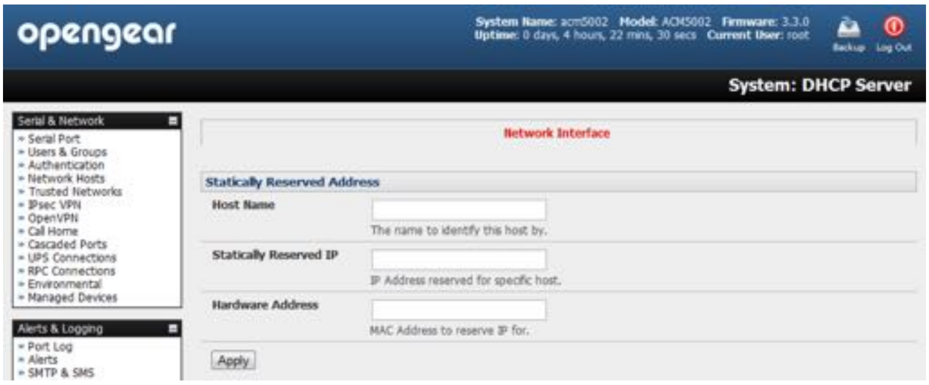
- Click **Add** in the *Dynamic Address Allocation Pools* field.
- Enter the *DHCP Pool Start Address* and *End Address*.
- Click **Apply**.

The DHCP server also supports pre-assigning IP addresses to be allocated only to specific MAC addresses and reserving IP addresses to be used by connected hosts with fixed IP addresses. To reserve an IP addresses for a particular host:

- Click **Add** in the *Reserved Addresses* field.
- Enter the *Hostname*, the *Hardware Address* (MAC) and the *Statically Reserved IP* address for the DHCP client.
- Click **Apply**.

When DHCP has initially allocated hosts addresses it is recommended to copy these into the pre-assigned list so the same IP address will be reallocated in the event of a reboot.

2.6.3. Select failover or broadband OOP



System Name: acm5002 Model: ACM5002 Firmware: 3.3.0
Uptime: 0 days, 4 hours, 22 mins, 30 secs Current User: root

System: DHCP Server

Network Interface

Statically Reserved Address

Host Name
The name to identify this host by.

Statically Reserved IP
IP Address reserved for specific host.

Hardware Address
MAC Address to reserve IP for.

The IM4200, IM7200, CM7100, ACM7000, ACM5508-2-I/M, ACM5504-5-G-W-I, ACM5504-5-G-I, ACM5504-5-LA/LR/LV-I, and ACM5004-2 console servers provide a failover option so in the event of a problem using the main LAN connection for accessing the console server; an alternate access path is used.

By default the failover is not enabled. To enable:

- Navigate to **System > IP**.
- Select the **Network** tab.
- Select the *Failover Interface* to be used in the event of a main network outage. This can be:

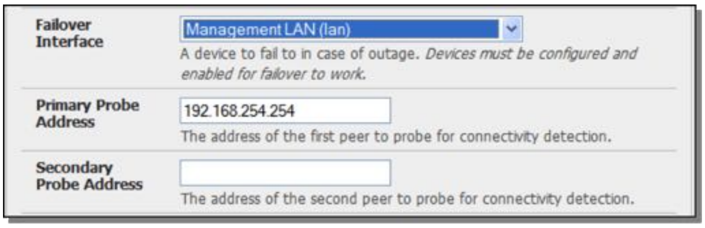
  an alternate broadband Ethernet connection (for example, the Network/LAN2 port on most models) or

  the IM4200 or IM7200 family internal modem or

  an external serial modem device connected to the IM4200 or IM7200 Console port (for out-dialing to an ISP or the remote management office).

- Click **Apply**.

Note: The failover method is not active until the external sites to be probed to trigger failover are specified and the failover ports themselves are set-up. This is covered in Chapter 4.

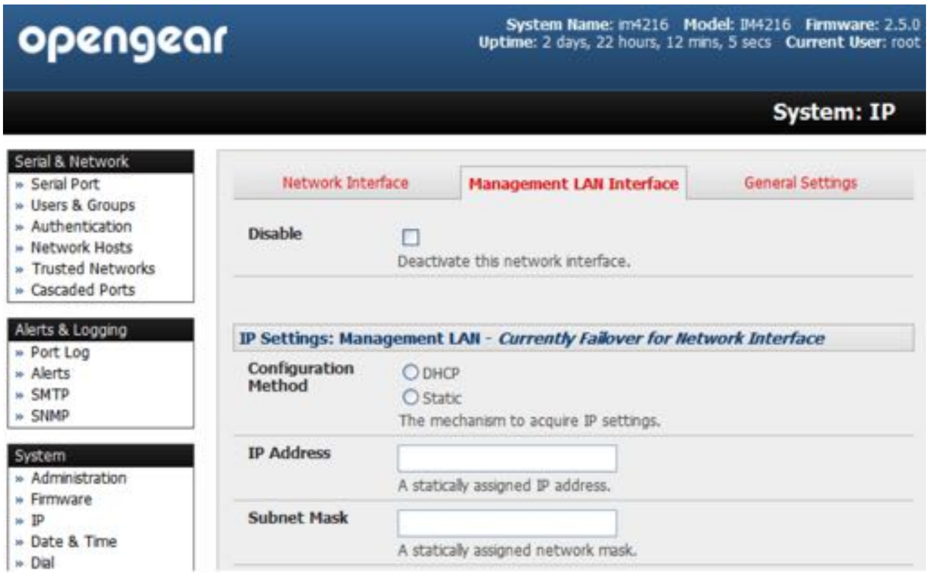


Failover Interface: Management LAN (lan)
A device to fail to in case of outage. *Devices must be configured and enabled for failover to work.*

Primary Probe Address: 192.168.254.254
The address of the first peer to probe for connectivity detection.

Secondary Probe Address:
The address of the second peer to probe for connectivity detection.

Note: The ACM5504-5-G(-W)-I and IM4216-34 can be configured with an active Management LAN/gateway and with one of the switched Ethernet ports configured for OOB/Failover (ETH 1 on the ACM5504-5-G(-W)-I or NETWORK 2 on the IM4216-34). On the other IM4200, IM7200, CM7100, ACM7000, ACM5508-2 and ACM5004-2 models, the second Ethernet port can be configured as either a gateway port or as an OOB/Failover port, but not both.



System Name: im4216 Model: IM4216 Firmware: 2.5.0
Uptime: 2 days, 22 hours, 12 mins, 5 secs Current User: root

System: IP

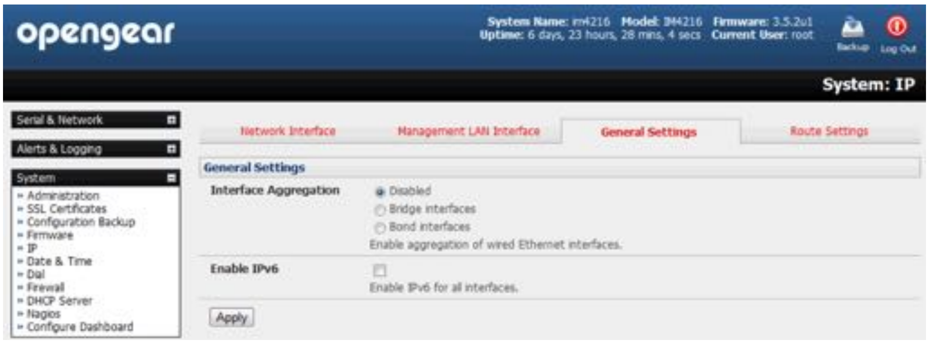
Disable ☐
Deactivate this network interface.

IP Settings: Management LAN - *Currently Failover for Network Interface*

Configuration Method ○ DHCP ○ Static
The mechanism to acquire IP settings.

IP Address
A statically assigned IP address.

Subnet Mask
A statically assigned network mask.



System Name: im4216 Model: IM4216 Firmware: 3.5.2u1
Uptime: 6 days, 23 hours, 28 mins, 4 secs Current User: root

System: IP

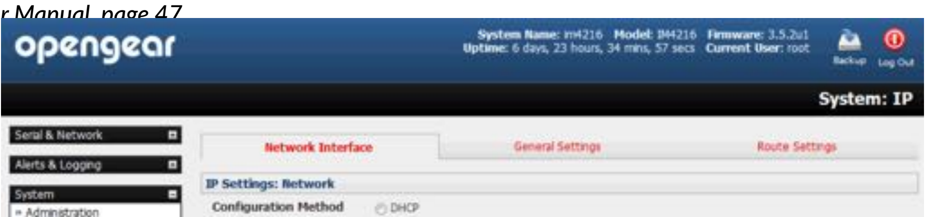
General Settings

Interface Aggregation ● Disabled ○ Bridge interfaces ○ Bond interfaces
Enable aggregation of wired Ethernet interfaces.

Enable IPv6 ☐
Enable IPv6 for all interfaces.

2.6.4. Aggregating the network ports

By default the *console server's* Management LAN network ports can only be accessed using SSH tunneling/port forwarding or by establishing an IPsec VPN tunnel to the *console server*.

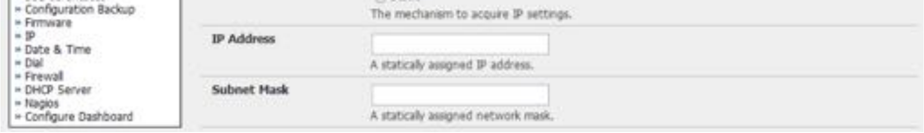


System Name: im4216 Model: IM4216 Firmware: 3.5.2u1
Uptime: 6 days, 23 hours, 34 mins, 57 secs Current User: root

System: IP

IP Settings: Network

Configuration Method ○ DHCP



The mechanism to acquire IP settings.

IP Address

A statically assigned IP address.

Subnet Mask

A statically assigned network mask.

However all the wired network ports on the *console servers* can be aggregated by being bridged or bonded.

- Navigate to **System > IP**.
- Click the **General Settings** tab.
- Click the *Bridge Interfaces* or *Bond Interfaces* radio button to enable wired Ethernet interface aggregation.

When bridging is enabled, network traffic is forwarded across all Ethernet ports with no firewall restrictions. All Ethernet ports are transparently connected at the data link layer (layer 2) so they do retain their unique MAC addresses, however.

With bonding, the network traffic is carried between the ports but they present with one MAC address.

Both modes remove all the Management LAN Interface and Out-of-Band/Failover Interface functions and disable the DHCP Server.

Note: In aggregation mode all the Ethernet ports are configured collectively via the **System > IP > Network Interface** *tab.*

2.6.5. Wi-Fi wireless LAN

All IM7200 models and the ACM5504-5-G-W-I have an internal 802.11 Wi-Fi adapter and come with an external Wi-Fi antenna. The Wi-Fi can be configured as a Wi-Fi Wireless Access Point (WAP) or as a Wi-Fi client.

The inbuilt Wi-Fi is inactive by default. If you wish to use the Wi-Fi facility you will need to attach the Wi-Fi antenna (and any auxiliary Wi-Fi antenna you may have ordered). To activate and configure the Wireless Access Point functionality:

- Navigate to **System > IP**.
- Click the **Wireless Network Interface** tab.
- Uncheck the *Disable* check-box.
- Select the device's operating mode: *Wireless Client* or *Wireless AP* (for Access Point).

If *Wireless AP* is checked the **Wireless AP Settings** section becomes visible.

- Set the *IP Address*, and the *netmask* in the *IP Settings* for the Wireless Network.

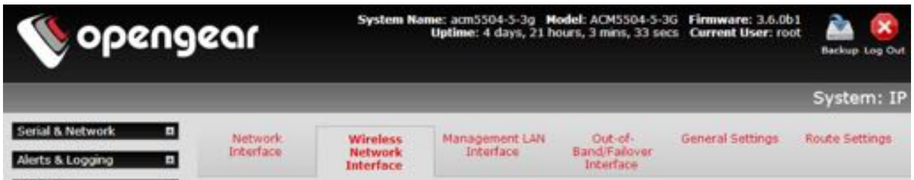
  Generally, if the device is being used as a Wireless AP, a static address is set here. In the example below, 192.168.10.1 is used.

  As well, in the example below, the *netmask* is set to 255.255.255.0 to give 254 unique network addresses in the subnet.

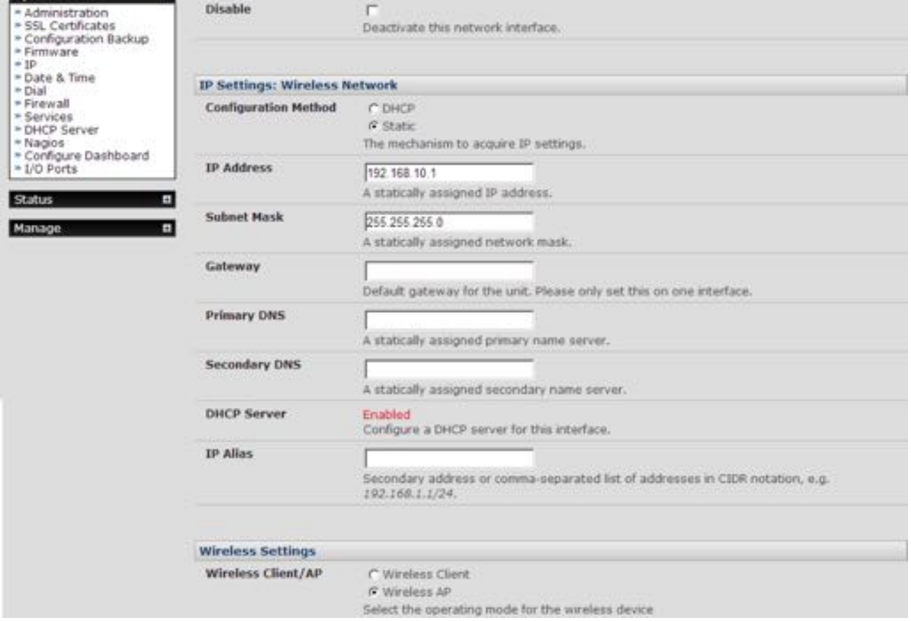
- Do not fill in the *Gateway*, *Primary DNS* and *Secondary DNS* values.

  These settings are used if the interface is to be the primary network link to the outside world, or if it will be used for failover.

- Select the correct country from the *Country* list.



System Name: acm5504-5-3g Model: ACM5504-5-3G Firmware: 3.6.0b1
Uptime: 4 days, 21 hours, 3 mins, 33 secs Current User: root



Disable	□ Deactivate this network interface.

IP Settings: Wireless Network

Configuration Method	○ DHCP ● Static The mechanism to acquire IP settings.
IP Address	192.168.10.1 A statically assigned IP address.
Subnet Mask	255.255.255.0 A statically assigned network mask.
Gateway	Default gateway for the unit. Please only set this on one interface.
Primary DNS	A statically assigned primary name server.
Secondary DNS	A statically assigned secondary name server.
DHCP Server	Enabled Configure a DHCP server for this interface.
IP Alias	Secondary address or comma-separated list of addresses in CIDR notation, e.g. *192.168.1.1/24*.

Wireless Settings

Wireless Client/AP	○ Wireless Client ● Wireless AP Select the operating mode for the wireless device

If the correct country is not listed, select the *World Regulatory Domain*.

- Select an *SSID* for the network.

  This should be unique.

- Check the *Broadcast SSID* check box.

  This should, in general, be done. Not broadcasting a wireless network's SSID is **not** a meaningful security measure.

- Select the *Network Channel*.

  The most commonly used channel is 6.

Note: if the unit is being deployed in an environment containing multiple Wireless APs (eg a multi-floor office building), a site survey, to establish what channels are locally unused is recommended.

- Select the unit's *Hardware Mode*.

  The unit supports 802.11b, 802.11g, and single band 802.11n. In most cases, selecting 802.11b/g/n will provide for the best interoperability with other hardware.

- Select the *Supported Authentication Methods*.

WPA/WPA2 with AES encryption is recommended. WEP and WPA with TKIP have been proven vulnerable to cryptanalysis attack. Only select these latter authentication methods if you must support client equipment that does not support WPA/WPA2 with AES.

If WPA/WPA2 is the selected *Supported Authentication Method*.

- Select one or both of TKIP and AES in *WPA/WPA2 Encryption Methods*.

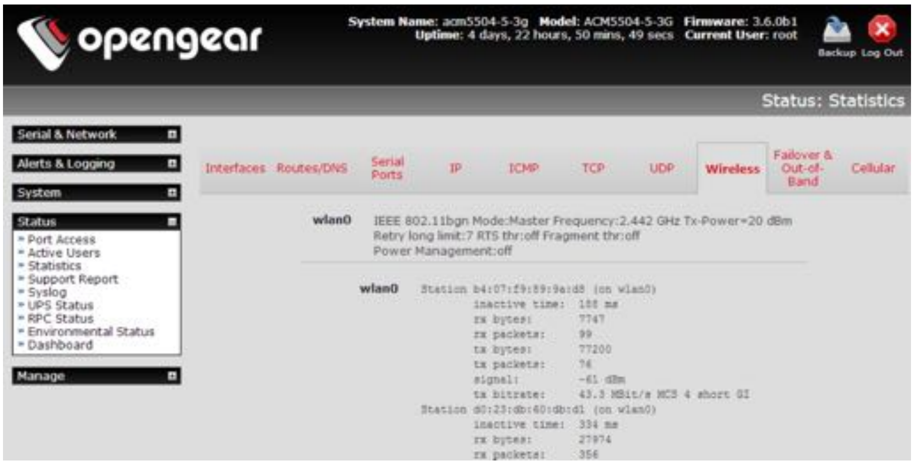
  As noted above, AES is more secure. It is also required for a Wireless AP to advertise itself as 802.11n if that is the selected *Hardware Mode*.

If WEP is the selected *Supported Authentication Method*.

- Select either *Open System* or *Shared System* in the *WEP Mode*.

Note: while Open System is more secure than Shared System (due to the way encryption keys are used), known vulnerabilities mean **WEP cannot be considered secure in any sense.**

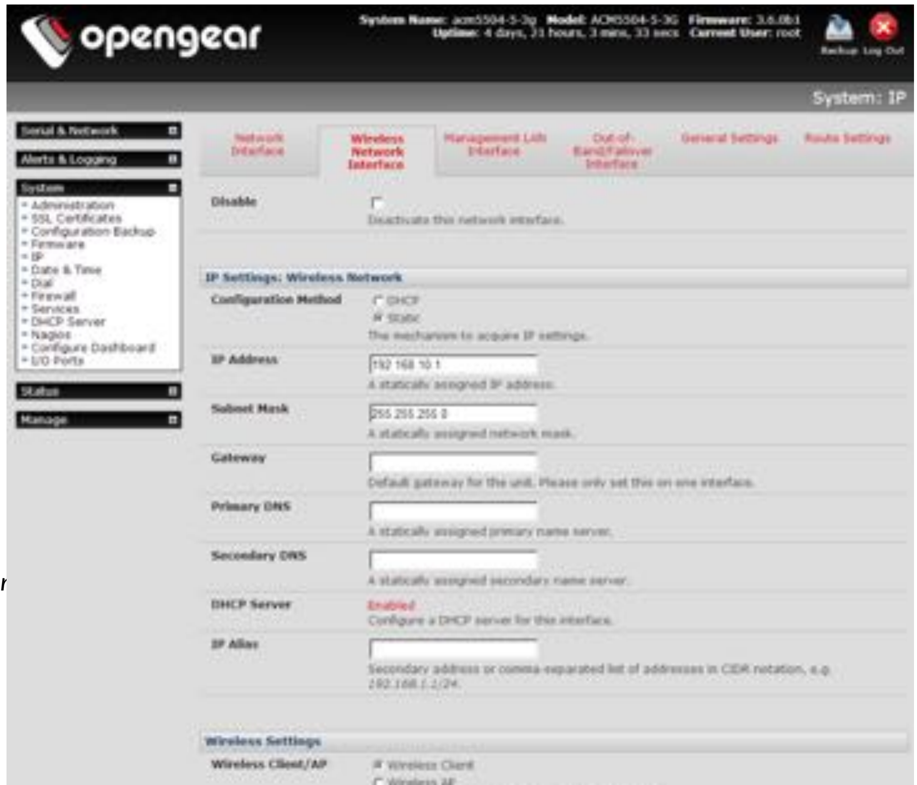
- click **Apply** and wait for the page to refresh.



System Name: acm5504-5-3g **Model:** ACM5504-5-3G **Firmware:** 3.6.0b1
Uptime: 4 days, 22 hours, 50 mins, 49 secs **Current User:** root

```
wlan0   IEEE 802.11bgn Mode:Master Frequency:2.442 GHz Tx-Power=20 dBm
        Retry long limit:7 RTS thr:off Fragment thr:off
        Power Management:off

wlan0   Station b4:07:f9:89:9a:d8 (on wlan0)
                inactive time:  188 ms
                rx bytes:       7747
                rx packets:     99
                tx bytes:       77200
                tx packets:     76
                signal:         -61 dBm
                tx bitrate:     43.3 MBit/s MCS 4 short GI
        Station d0:23:db:60:db:d1 (on wlan0)
                inactive time:  334 ms
                rx bytes:       27974
                rx packets:     356
```

The next step is to set up a DHCP server for the wireless clients. Click the link next to DHCP Server in the IP settings section, or go to **System > DHCP Server**. More information on configuring DHCP can be found in chapter 2.6.2.



System Name: acm5504-5-3g **Model:** ACM5504-5-3G **Firmware:** 3.6.0b1
Uptime: 4 days, 21 hours, 3 mins, 33 secs **Current User:** root

Disable ☐
Deactivate this network interface.

IP Settings: Wireless Network

Configuration Method ○ DHCP ● Static
The mechanism to acquire IP settings.

IP Address 192.168.10.1
A statically assigned IP address.

Subnet Mask 255.255.255.0
A statically assigned network mask.

Gateway
Default gateway for the unit. Please only set this on one interface.

Primary DNS
A statically assigned primary name server.

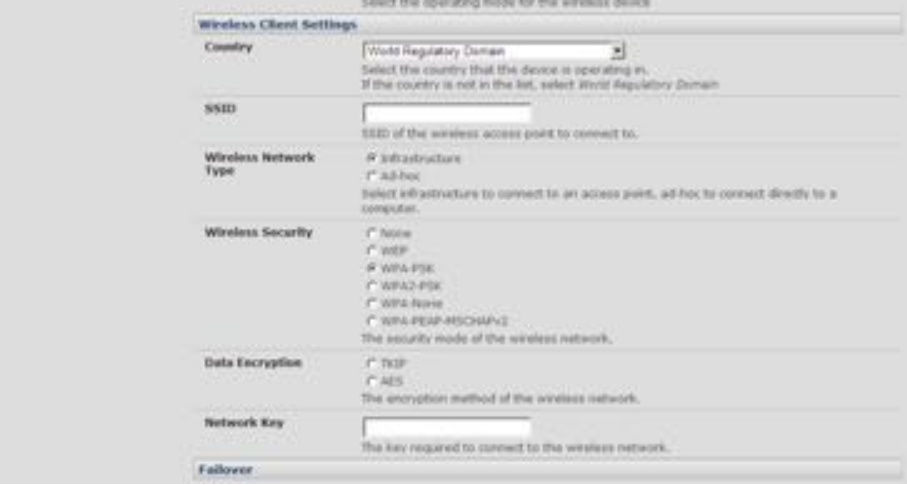
Secondary DNS
A statically assigned secondary name server.

DHCP Server Enabled
Configure a DHCP server for this interface.

IP Alias
Secondary address or comma-separated list of addresses in CIDR notation, e.g. 192.168.1.1/24.

Wireless Settings

Wireless Client/AP ● Wireless Client ○ Wireless AP



Select the operating mode for the wireless device

Wireless Client Settings

Country	World Regulatory Domain Select the country that the device is operating in. If the country is not in the list, select *World Regulatory Domain*
SSID	SSID of the wireless access point to connect to.
Wireless Network Type	● Infrastructure ○ Ad-hoc Select infrastructure to connect to an access point, ad-hoc to connect directly to a computer.
Wireless Security	○ None ○ WEP ● WPA-PSK ○ WPA2-PSK ○ WPA-None ○ WPA-PEAP-MSCHAPv2 The security mode of the wireless network.
Data Encryption	○ TKIP ○ AES The encryption method of the wireless network.
Network Key	The key required to connect to the wireless network.

Failover

If *Wireless Client* is checked the **Wireless Client Settings** section becomes visible.

- Select *DHCP* or *Static* for the *Configuration Method*.

  If *Static* is selected, manually enter the new IP Address, Subnet Mask, Gateway and DNS server details. This selection automatically disables the DHCP client.

  If *DHCP* is selected, the device will look for configuration details from a DHCP server on your management LAN. This selection automatically disables any static address.

Note: the device's MAC address can be found on a label on the base plate.

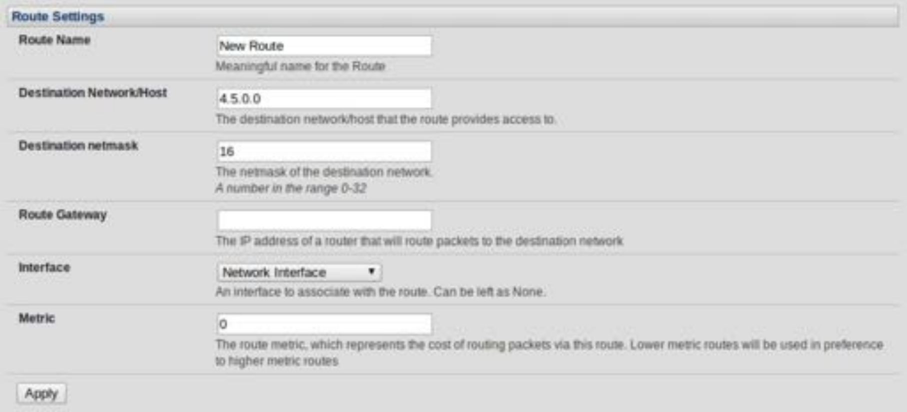
Configure the Wireless client to select the local wireless network which will serve as the main network connection to the *console server*.

- Select the correct country from the *Country* list.

  If the correct country is not listed, select the *World Regulatory Domain*.

- Enter the *SSID* (Set Service Identifier) of the wireless access point the *Wireless Client* will connect to.

- Select the *Wireless Network Type*.



Route Settings

Route Name	New Route Meaningful name for the Route
Destination Network/Host	4.5.0.0 The destination network/host that the route provides access to.
Destination netmask	16 The netmask of the destination network. *A number in the range 0-32*
Route Gateway	The IP address of a router that will route packets to the destination network
Interface	Network Interface An interface to associate with the route. Can be left as None.
Metric	0 The route metric, which represents the cost of routing packets via this route. Lower metric routes will be used in preference to higher metric routes

Select *Infrastructure* to connect to a Wireless AP device. Select *Ad-hoc* to connect directly to a computer.

- Select the *Wireless Security* mode of the wireless network (WEP, WPA, etc)

- Enter the required authentication strings.

When enabled in client mode, the wireless LAN will operate as the main network connection to the device so failover is available (though it not enabled by default).

Use **Failover Interface** to select the device to failover to in case of wireless outage and specify *Probe Addresses* of the peers to probed for connectivity detection.

Note: The **Wireless** *screen in* **Status > Statistics** *will display all the locally accessible wireless LANs (with SSID and Encryption/Authentication settings). You can also use this screen to confirm you have successfully connected to the selected access point. See chapter 11 for more.*

2.6.6. Static routes

Firmware 3.4 and later support *static routes* which provide a quick way to route data from one subnet to different subnet. You can hard code a path that specifies to the *console server* or router to get to a certain subnet by using a certain path. This may be useful for remotely accessing various subnets at a remote site when being accessed using the cellular OOB connection.

To add a static route to the route table of the system:

- Navigate to **System > IP > General Settings**.
- Select the **Route Settings** tab.
- Enter a meaningful *Route Name* for the route.
- In the *Destination Network/Host* field, enter the IP address of the destination network or host that the route provides access to.
- Enter a value in the *Destination netmask* field that identifies the destination network or host.

  Any number between 0 and 32. A subnet mask of 32 identifies a host route.
- Fill the *Route Gateway* field with the IP address of a router that will route packets to the destination network.

  This field may be left blank, depending on your network configuration.
- Select the *Interface* to use to reach the destination

  This field may be left as *None*.
- Enter a value in the *Metric* field that represents the metric of this connection.

  This generally only has to be set if two or more routes conflict or have overlapping targets. Any number equal to or greater than 0.
- Click **Apply**.

Note: The route details page provides a list of network interfaces and modems to which a route can be bound. In the case of a modem, the route will be attached to any dialup session which is establish via that device. A route can be specified with a gateway, an interface or both. If the specified interface is not active for whatever reason, then routes configured for that interface will not be active.

2.7. Configuration over DHCP (ZTP)

Config-over-DHCP is available for all Opengear console managers running firmware release 3.16 or later. Using this feature, Opengear devices can be provisioned during their initial boot from a DHCP server. Provisioning on untrusted networks can be facilitated by providing keys on a USB flash drive.

The typical steps for configuration over a trusted network are:

- Manually configure a same-model Opengear device.
- Save its configuration as an Opengear backup (.opg) file.
- Select **System > Configuration Backup > Remote Backup**.
- Click **Save Backup**.

A backup configuration file — `model-name_iso-format-date_config.opg` — is downloaded from the Opengear device to the local system.

Alternatively, you can save the configuration as an xml file:

- Select **System > Configuration Backup > XML Configuration**.

  An editable field containing the configuration file in XML format is presented.

- Click into the field to make it active.
- If you are running any browser on Windows or Linux, right-click and choose **Select All** from the contextual menu or press Control-A. Then right-click and choose **Copy** from the contextual menu or press Control-C.
- If you are using any browser on macOS, choose **Edit > Select All** or press Command-A. Then choose **Edit > Copy** or press Command-C.
- In your preferred text-editor, create a new empty document, paste the copied data into the empty document and save the file. Whatever file-name you choose, it must include the.xml filename suffix.
- Copy the saved `.opg` or `.xml` file to a public-facing directory on a file server serving at least one of the following protocols: HTTPS, HTTP, FTP or TFTP.

Note: Only HTTPS can be used if the connection between the file server and a to-be-configured Opengear device travels over an untrusted network.

- Configure your DHCP server to include a ‘vendor specific’ option for Opengear devices. (This will be done in a DHCP server-specific way.) The vendor specific option should be set to a string containing the URL of the published `.opg` or `.xml` file in the step above. The option string must not exceed 250 characters and it must end in either `.opg` or `.xml`.
- Connect a new Opengear device (either factory-reset or Config-Erased) to the network and apply power.

Note: it may take up to 5 minutes for the device to find the .opg or .xml file via DHCP, download and install the file, and then reboot itself.

2.7.1. Ensuring the console server is unconfigured.

Console servers exist in two states: configured or unconfigured. For ZTP via Config-over-DHCP to work, a target *console server* must be in an unconfigured state.

Console servers ship unconfigured from the factory: assuming a compatible configuration file is to hand (see below), a newly-unboxed console server can be configured using ZTP

To return an already configured *console server* to its unconfigured state do ether of the following:

- While the *console server* is powered-on, press the recessed **Erase** button twice.

  This button is found on the rear or side of every *console server*.

Alternatively:

- Navigate to **System > Administration**.
- Check the *Config Erase* checkbox.
- Check the *Reboot* checkbox.
- Click **Apply**.

Note: if ZTP is being used to update a working **console server's** *firmware, the extant configuration* **must** *be backed-up before the* **console server** *is unconfigured.*

2.7.2. Example ISC DHCP (dhcpd) server configuration

The following is an example DHCP server configuration fragment for serving an .opg configuration image via the ISC DHCP server, dhcpd:

```
option space opengear  code width 1  length width 1;
option opengear.config-url code 1 = text;
class "opengear-config-over-dhcp-test" {
  match if option vendor-class-identifier ~~ "^Opengear/";
  vendor-option-space opengear;
  option opengear.config-url
  "https://example.com/opg/${class}.opg";
}
```

2.7.3. Setup when the LAN is untrusted

If the connection between the file server and a to-be-configured Opengear device includes an untrusted network, a two-handed approach can mitigate the issue.

Note: this approach introduces two physical steps where trust can be difficult, if not impossible, to establish completely. First, the custody chain from the creation of the data-carrying USB flash drive to its deployment. Second, the hands connecting the USB flash drive to the Opengear device.

- Generate an X.509 certificate for the Opengear device.
- Concatenate the certificate and its private key into a single file named `client.pem`.
- Copy `client.pem` onto a USB flash drive.

- Set up an HTTPS server such that access to the `.opg` or `.xml` file is restricted to clients that can provide the X.509 client certificate generated above.
- Put a copy of the CA cert that signed the HTTP server's certificate — `ca-bundle.crt` — onto the USB flash drive bearing `client.pem`.
- Insert the USB flash drive into the Opengear device before attaching power or network.
- Continue the procedure from 'Copy the saved .opg or .xml file to a public-facing directory on a file server' above using the HTTPS protocol between the client and server.

2.7.4. Prepare a USB drive and create the X.509 certificate and private key

- Generate the CA certificate so the client and server Certificate Signing Requests (CSRs) can be signed.

```
# cp /etc/ssl/openssl.cnf .
# mkdir -p exampleCA/newcerts
# echo 00 > exampleCA/serial
# echo 00 > exampleCA/crlnumber
# touch exampleCA/index.txt
# openssl genrsa -out ca.key 8192
# openssl req -new -x509 -days 3650 -key ca.key -out demoCA/
  \cacert.pem -subj /CN=ExampleCA
# cp demoCA/cacert.pem ca-bundle.crt
```

Note: This procedure generates a certificate called ExampleCA but any allowed certificate name can be used. Also, this procedure uses openssl ca. If your organisation has an enterprise-wide, secure CA generation process, that should be used instead.

- Generate the client certificate.

```
# openssl genrsa -out client.key 4096
# openssl req -new -key client.key -out client.csr -subj \
  /CN=ExampleClient
# openssl ca -days 365 -in client.csr -out client.crt \
          -keyfile ca.key -policy policy_anything -batch -notext
# cat client.key client.crt > client.pem
```

- Format a USB flash drive as a single FAT32 volume.
- Move the `client.pem` and `ca-bundle.crt` files onto the flash drive's root directory.

2.7.5. What an unconfigured console server does on first boot

When an unconfigured console server boots the following steps occur:

- the *console server* starts the `udhcpc` process (via `conman`).
- `udhcpc` transmits a `DHCP DISCOVER` request to the primary Network Interface.

  This request includes a *Vendor Class Indentifier* in the following form:

  Opengear/*model-name*

  For example:

Opengear/ACM5003-M

Note: in unconfigured **console servers**, *the network interface mode is unset and the* `DHCP DISCOVER` *request, therefore, includes a parameter request for Vendor-Specific Information (option 43). Configured* **console servers** *have a* `config.interfaces.wan.mode` *with configuration information included. Consequently, the* `DHCP DISCOVER` *packet sent from such servers does not include an option 43 request.*

- the DHCP server sends a `DHCP OFFER` in reply.

The console server uses the information in the `DHCP OFFER` to

- assign itself the supplied IPv4 address.
- add a default route.
- prepare its DNS resolver.

If the `DHCP OFFER` also includes an `option 43` with `sub-option 1`, the *console server:*

- reads the contents of `sub-option 1` as a white-space delimited list of URLs.
- interprets the URLs as locations for configuration files to use as to configure itself.
- temporarily stores the URLs for later use.

If the `DHCP OFFER` also includes an `option 43` with `sub-option 2`, the *console server:*

- reads the contents of `sub-option 2` as a white-space delimited list of URLs.
- interprets the URLs as locations for firmware images to use to flash the firmware on itself.
- temporarily stores the URLs for later use.

If the `DHCP OFFER` also includes a URL to an NTP server, the *console server:*

- syncronises its system clock to the referenced NTP server.

  see `etc/scripts/udhcpc.script` for details.

2.7.6. Using what an unconfigured console server does on first boot to update firmware

This process requires three things:

- a *console server* running firmware 3.16.6 or later.
- a file containing the current configuration of the *console server* to be updated available at a working URL that is declared in `option 43, sub-option 1` of your DHCP server's `DHCP OFFER`.
- the firmware image to be applied available at a working URL that is declared in `option 43, sub-option 2` of your DHCP server's `DHCP OFFER`.

The working URLs can be offered over `ftp`, `tftp`, `http`, and `https`. However, for `https` to work, the *console server* must be in secure recovery mode. See chapter 2.7.9 for secure recovery mode requirements.

When the *console server* having its firmware updated is unconfigured and restarted it:

- runs `/etc/scripts/backup-url\ loadimage` for each URL included in `option 43 sub-option 2` of the `DHCP OFFER`.

On the first URL to return a firmware image, the *console server:*

- runs `curl` to download the firmware image.
- passes the image to `netflash` as standard input.

`netflash` then:

- checksums and flashes the passed-in image.
- reboots the *console server*.

Note: `netflash` *will not reboot the* **console server** *unless the image passes the checksum.*

Upon rebooting, the *console server:*

- runs `etc/config/.init` to process the firmware image.
- runs `etc/scripts/backup-url` to restore the backed-up configuration using the file declared in `option 43, sub-option 1` of the `DHCP OFFER`. (The script's name is historical: it is based on configuration backup and restore logic.)

2.7.7. The URLs in DCHP OFFER, option 43, sub-option 1

URLs offered in `DCHP OFFER, option 43, sub-option 1` are parsed by `/etc/scripts/backup-url` using substrings in the configuration backup's filename to determine the choice order. The order is as follows:

sub-string	replaced by	example
${mac}	the device's 12-digit MAC address, in lowercase	0013b600b669
${model}	the device's full model name, in lowercase	acm5504-5-g-w-i
${class}	the firmware's hardware class	ACM500x
${version}	the firmware's version number	3.16.6

Once downloaded, a configuration file is checked:

- if it is a `.opg` file, its header is checked for compatibility with the current device.
- if it is a `.xml` file, a parse check is made.

In both cases, if the check fails, the downloaded file is abandoned and the next URL is tried.

2.7.8. Importing the configuration file

Once a downloaded configuration file passes the appropriate check, the *console server*:

- imports the downloaded and checked configuration file.
- checks the configuration file for a hostname to set itself to.

  If no hostname can be set, the *console server* defaults to

  ```
  ${model}-${mac}
  ```

(That is, it sets its hostname to the device's full model name, followed by a hyphen, followed by the device's MAC address.)

- checks that it is still unconfigured.
- sets the network interface mode to DHCP.

  This, in effect, forces the *console server* into a configured state, preventing a reboot loop from occurring.
- returns a `reboot-necessary` flag.

This last action ensures the, now configured, *console server* reboots.

2.7.9. Running a restore or update in secure recovery mode

For a firmware update to run in secure mode (ie, to run over the `https` protocol) `/etc/scripts/backup-url` must find two certificate files in an attached USB storage device.

The first required file is `ca-bundle.crt`. The second required file is whichever one of the following files is found first:

- `client-`*`AABBCCDDEEFF`*`.pem`

  `AABBCCDDEEFF` is the MAC address of the *console server's* primary network interface.
- client-*`MODEL`*.pem

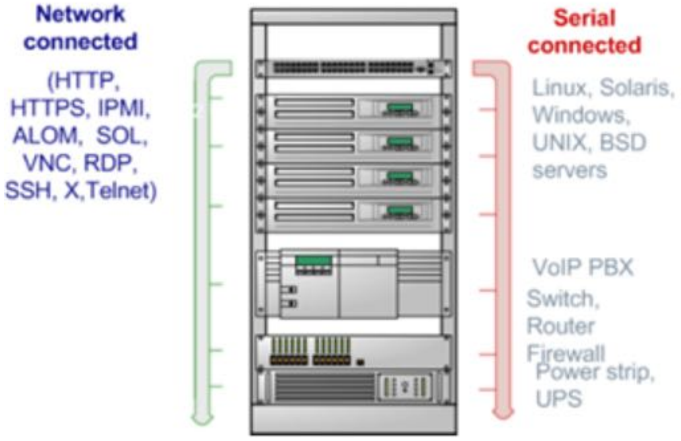
  `MODEL` is the (vendor class) model name in lowercase, truncated to before the first hyphen.
- `client.pem`

See chapter 2.7.4 for how to create these files.

Note: *if both* `ca-bundle.crt` *and a suitable* `*.pem` *file are found, URLs offered by insecure protocols (such as http, ftp, tftp and ftps) are skipped. Once an unconfigured* **console server** *is in secure recovery mode, the firmware and configuration files needed to return it to operational status* **must** *be offered via* `https`.

3. Serial port, host, device & user configuration

The *console server* enables access and control of serially-attached devices and network-attached devices (hosts). The *Administrator* must configure access privileges for each of these devices, and specify the services that can be used to control the devices. The *Administrator* can also set up new users and specify each user's individual access and control privileges.


Network connected
(HTTP, HTTPS, IPMI, ALOM, SOL, VNC, RDP, SSH, X,Telnet)
Serial connected
Linux, Solaris, Windows, UNIX, BSD servers
VoIP PBX
Switch, Router
Firewall
Power strip, UPS

This chapter covers each of the steps in configuring network-connected and serially-attached devices:

step	notes
Serial ports	setting up serially connected device protocols.
Users & Groups	setting up and defining user access permissions.

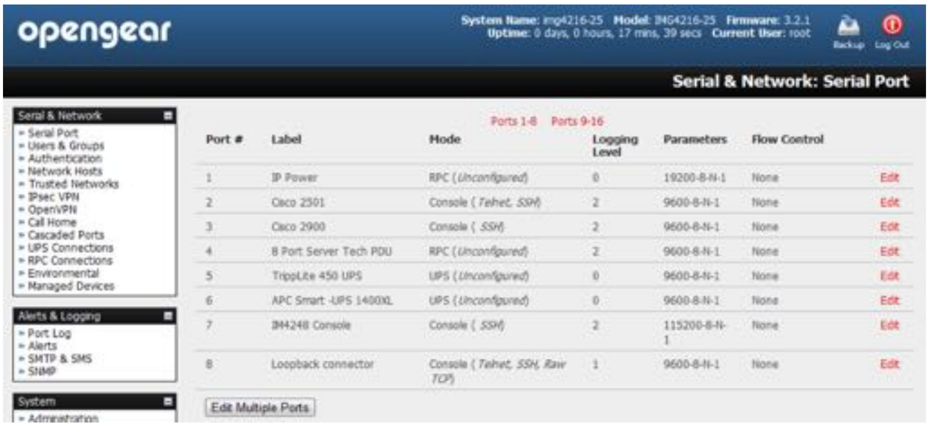
Authentication	also covered in more detail in Chapter 8.
Network hosts	configuring access to network-connected hosts.
Configuring trusted networks	nominate IP addresses trusted users access from.
Serial console port cascading & redirection	
Power (UPS, PDU & IPMI)	
Environmental Monitoring Devices (EMD)	
Serial port redirection	the PortShare client on Windows and Linux.
Managed devices	the consolidated view of all the connections.
IPSec	enabling VPN connections.
OpenVPN	
PPTP	

3.1. Configure serial ports

The first step in configuring a serial port is to set the **Common Settings** such as the protocols and the RS232 parameters that are to be used for the data connection to that port (for example, baud rate).

Then you select what mode the port is to operate in. Each port can be set to support one of these operating modes:

mode	notes
Disabled	The serial port is inactive.
Console server	enables general access to serial console port on the serially attached devices.
Device	sets the serial port up to communicate with an intelligent serial controlled PDU, UPS or Environmental Monitor Devices (EMD).
SDT	enables graphical console access (with RDP, VNC, HTTPS etc.) to hosts that are serially connected.
Terminal server	sets the serial port to await an incoming terminal login session.
Serial bridge	enables the transparent interconnection of two serial port devices over a network.



Port #	Label	Mode	Logging Level	Parameters	Flow Control	
1	IP Power	RPC (*Unconfigured*)	0	19200-8-N-1	None	Edit
2	Cisco 2501	Console (*Telnet, SSH*)	2	9600-8-N-1	None	Edit
3	Cisco 2900	Console (*SSH*)	2	9600-8-N-1	None	Edit
4	8 Port Server Tech PDU	RPC (*Unconfigured*)	2	9600-8-N-1	None	Edit
5	TrippLite 450 UPS	UPS (*Unconfigured*)	0	9600-8-N-1	None	Edit
6	APC Smart -UPS 1400XL	UPS (*Unconfigured*)	0	9600-8-N-1	None	Edit
7	IM4248 Console	Console (*SSH*)	2	115200-8-N-1	None	Edit
8	Loopback connector	Console (*Telnet, SSH, Raw TCP*)	1	9600-8-N-1	None	Edit

- Navigate to **Serial & Network > Serial Port**.

  Details of the currently setup serial ports presents. By default, each serial port is set in *console server* mode.

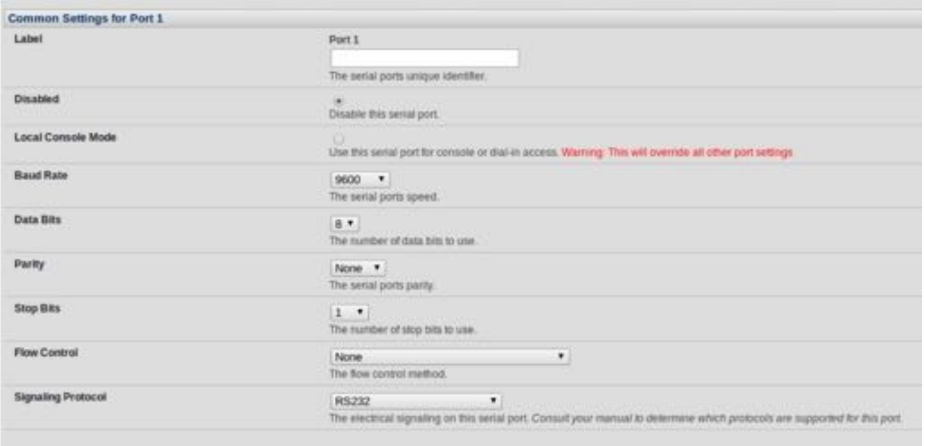
- Click *Edit* to reconfigure a given serial port.
- Reconfigure the common settings (chapter 3.1.1) and the mode (chapters 3.1.2 – 3.1.6) for each port as needed.
- Set up any remote syslog (chapter 3.1.7).
- click **Apply**.

Note: to set the same protocol options for multiple serial ports at once click **Edit Multiple Ports** *and select which ports you wish to configure as a group.*

- if the *console server* has been configured with distributed Nagios monitoring enabled then you will also be presented with **Nagios Settings** options to enable nominated services on the host to be monitored (see chapter 9).

3.1.1. Common settings

There are a number of common settings that can be set for each serial port. These are independent of the mode in which the port is being used. These serial port parameters must be set so they match the serial port parameters on the device you attach to that port.



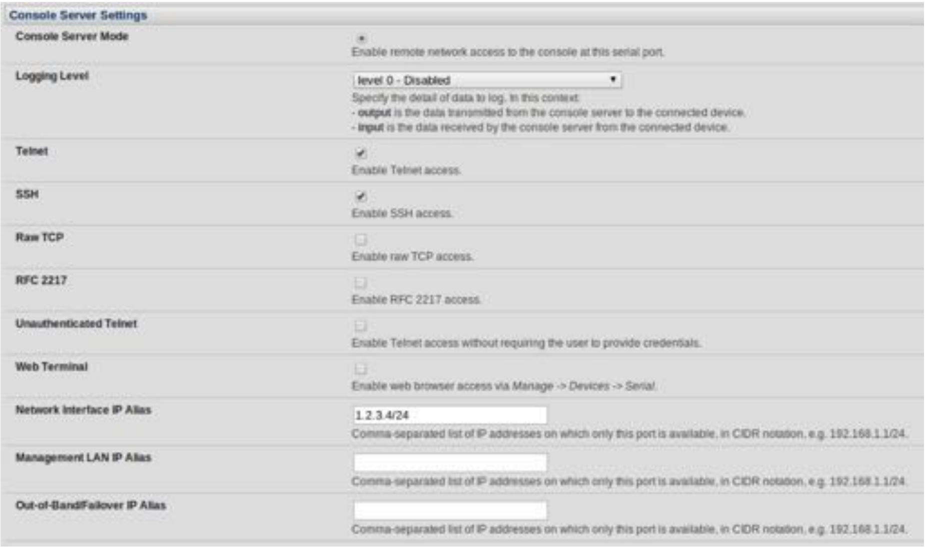
Common Settings for Port 1

Label	Port 1 The serial ports unique identifier.
Disabled	● Disable this serial port.
Local Console Mode	○ Use this serial port for console or dial-in access. Warning: This will override all other port settings
Baud Rate	9600 ▾ The serial ports speed.
Data Bits	8 ▾ The number of data bits to use.
Parity	None ▾ The serial ports parity.
Stop Bits	1 ▾ The number of stop bits to use.
Flow Control	None ▾ The flow control method.
Signaling Protocol	RS232 ▾ The electrical signaling on this serial port. Consult your manual to determine which protocols are supported for this port.

- Specify a *Label* for the port.
- Select the appropriate *Baud Rate*, *Parity*, *Data Bits*, *Stop Bits* and *Flow Control* for each port.
- Set the *Signaling Protocol*. This menu item only presents in ports with RS422/485 options (all ports on ACM5004-2-I, ACM5508-2-I, ACM5504-5-LA/LR/LV-I and ACM5504-5-G-I). The options available are RS232, RS422, RS485 and RS485 Echo mode.
- Set the *Port Pinout*. This menu item only presents for IM7200 ports where pin-out for each RJ45 serial port can be set as either X2 (Cisco Straight) or X1 (Cisco Rolled).
- Before proceeding with further serial port configuration, you should connect the ports to the serial devices they will be controlling, and ensure they have matching settings.

3.1.2. Console server mode

- Select *Console Server Mode* to enable remote management access to the serial console that is attached to this serial port.



Console Server Settings

Console Server Mode	● Enable remote network access to the console at this serial port.
Logging Level	level 0 - Disabled ▾ Specify the detail of data to log. In this context: - **output** is the data transmitted from the console server to the connected device. - **input** is the data received by the console server from the connected device.
Telnet	☑ Enable Telnet access.
SSH	☑ Enable SSH access.
Raw TCP	☐ Enable raw TCP access.
RFC 2217	☐ Enable RFC 2217 access.
Unauthenticated Telnet	☐ Enable Telnet access without requiring the user to provide credentials.
Web Terminal	☐ Enable web browser access via *Manage -> Devices -> Serial.*
Network Interface IP Alias	1.2.3.4/24 Comma-separated list of IP addresses on which only this port is available, in CIDR notation, e.g. 192.168.1.1/24.
Management LAN IP Alias	Comma-separated list of IP addresses on which only this port is available, in CIDR notation, e.g. 192.168.1.1/24.
Out-of-Band/Failover IP Alias	Comma-separated list of IP addresses on which only this port is available, in CIDR notation, e.g. 192.168.1.1/24.

- Set the desired *Logging Level.*

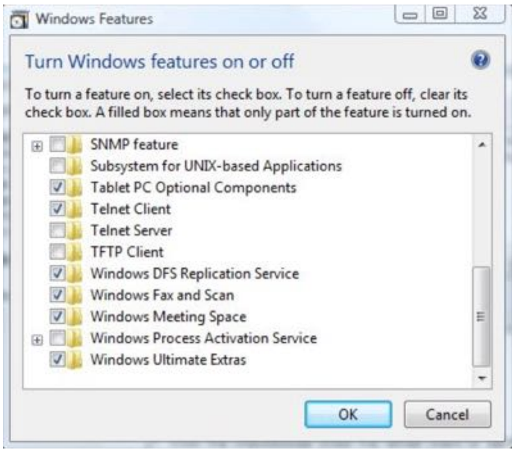
  This specifies the level of information to be logged and monitored (see chapter 6).

- Enable or disble *Telnet* access.

  When the Telnet service is enabled on the *console server*, a Telnet client on a *User's* or *Administrator's* computer can connect to a serial device attached to this serial port on the *console server*. Telnet communications are unencrypted so this protocol is generally recommended only for local or VPN-tunneled connections.

  Windows 2000, Windows XP and Windows NT can run `telnet` from the `cmd.exe` command prompt.

  Windows Vista and later ship with a Telnet client but it is not enabled by default. You can install it as follows.



Windows Features

Turn Windows features on or off

To turn a feature on, select its check box. To turn a feature off, clear its check box. A filled box means that only part of the feature is turned on.

- ☐ SNMP feature
- ☐ Subsystem for UNIX-based Applications
- ☑ Tablet PC Optional Components
- ☑ Telnet Client
- ☐ Telnet Server
- ☐ TFTP Client
- ☑ Windows DFS Replication Service
- ☑ Windows Fax and Scan
- ☑ Windows Meeting Space
- ☐ Windows Process Activation Service
- ☑ Windows Ultimate Extras

- Click the **Start** button.

- Click **Control Panel**.
- Click **Programs**.
- Click **Turn Windows features on or off**.

  If you are prompted for an administrator password or confirmation, type the password or provide confirmation.

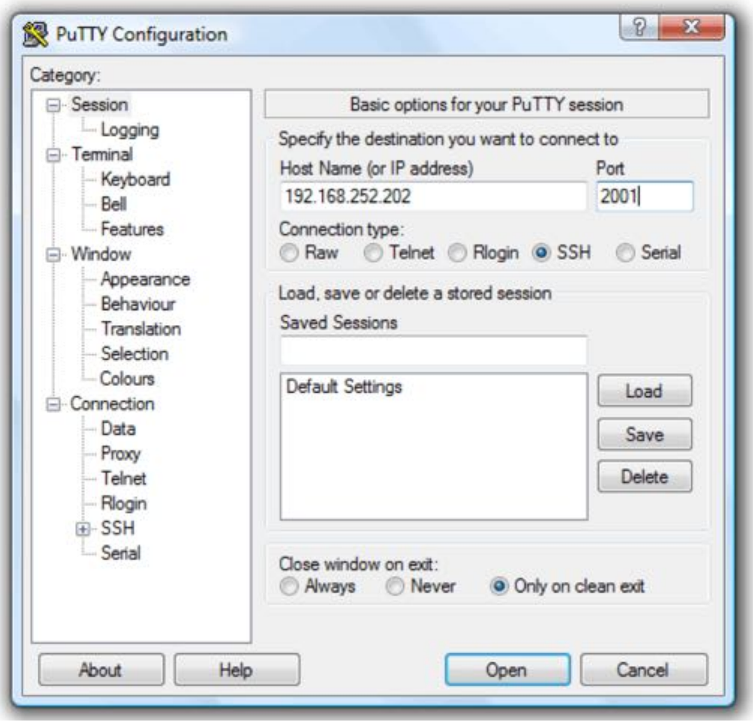
- In the **Windows Features** dialog box, select the **Telnet Client** check box.
- Click **OK**.

  The installation may take several minutes.

If remote communications are being tunneled with *SDT Connector*, then Telnet can be used for securely accessing these attached devices.

Note: In **Console Server** *mode,* **Users** *and* **Administrators** *can use* **SDT Connector** *to set up secure Telnet connections that are SSH tunneled from their client computers to the serial port on the console server.* **SDT Connector** *can be installed on Windows PCs and on most Linux platforms and it enables secure Telnet connections to be selected with a simple point-and-click. To use* **SDT Connector** *to access consoles on the* **console server** *serial ports, you configure* **SDT Connector** *with the* **console server** *as a* **gateway***, then as a* **host***, and you enable Telnet service on Port 2000 + serial port # (that is Ports 2001–2048). See chapter 5 for more details on using SDT Connector for Telnet and SSH access to devices that are attached to the console server serial ports.*

You can also use communications packages like *PuTTY* to set a direct Telnet (or SSH) connection to the serial ports.



Host Name (or IP address): 192.168.252.202

Port: 2001

Connection type: ○ Raw ○ Telnet ○ Rlogin ● SSH ○ Serial

Close window on exit: ○ Always ○ Never ● Only on clean exit

Note: **PuTTY** *supports Telnet (and SSH). Enter the* **console server's** *IP address as the* **Host Name (or IP address)***. Select* **Telnet** *as the protocol and set the* **TCP port** *to 2000 plus the* *physical serial port number (that is a port between 2001 and 2048). Click the* **Open** *button. You may receive a* **Security Alert** *that the host's key is not cached: choose* **yes** *to continue. The login prompt of the remote system connected to the serial port chosen on the* **console server** *will now present. You can login as normal and use the host serial console screen.*

Putty can be downloaded from http://putty.org/.

Note: In **Console Server** *mode, when you connect to a serial port you connect via* `pmshell`*. To generate a BREAK on the serial port type the character sequence* `~b`*. If you're doing this over OpenSSH type* `~~b`*.*

- Enable or disable *SSH* access.

  It is recommended you use SSH as the protocol where the *User* or *Administrator* connects to the *console server* (or connects through the console server to the attached serial consoles) over the Internet or any other public network. This will provide authenticated SSH communications between the SSH client program on the remote user's computer and the *console server*, so the user's communication with the serial device attached to the *console server* is secure

  For SSH access to the consoles on devices attached to the *console server* serial ports, you can use *SDT Connector*. You configure *SDT Connector* with the *console server* as a gateway, then as a host, and you enable SSH service on Port 3000 + serial port #. (That is ports 3001 – 3048). See chapter 5 for more information on using *SDT Connector* for SSH access to devices that are attached to the console server serial ports.

  Also you can use common communications packages, like *PuTTY* or *SSHTerm* to SSH connect directly to port address IP Address:Port 3000 + serial port #. (That is ports 3001 – 3048).

  Alternately SSH connections can be configured using the standard SSH port 22. The serial port being accessed is then identified by appending a descriptor to the username. This syntax supports any of the following descriptors:

  ```
  <username>:<portXX>
  <username>:<port-label>
  <username>:<ttySX>
  <username>:<serial>
  ```

  For example, if a *User* named `fred` wants to access serial port 2, when setting up *SSHTerm* or the *PuTTY* SSH client, instead of typing

  ```
  username = fred
  ssh port = 3002
  ```

  type

  ```
  username = fred:port02
  ```

  or

  ```
  username = fred:ttyS1
  ```

  and

  ```
  ssh port = 22.
  ```

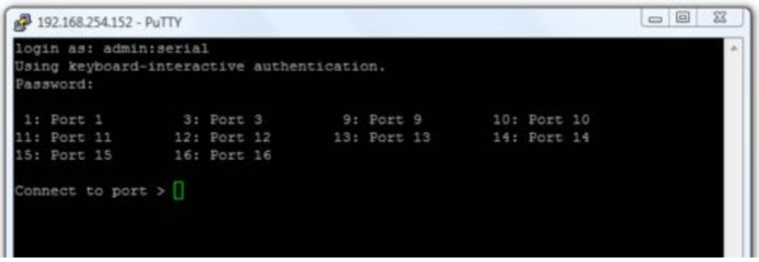
Alternatively, by typing

```
username=fred:serial
```

and

```
ssh port = 22
```

the *User* is presented with a port selection option



```
login as: admin:serial
Using keyboard-interactive authentication.
Password:

 1: Port 1          3: Port 3          9: Port 9          10: Port 10
11: Port 11        12: Port 12        13: Port 13         14: Port 14
15: Port 15        16: Port 16

Connect to port >
```

This syntax enables *Users* to set up SSH tunnels to all serial ports with only a single IP port 22 having to be opened in their firewall or gateway.

Note: In **Console Server** *mode, when you connect to a serial port you connect via* `pmshell`*. To generate a BREAK on the serial port type the character sequence* `~b`*. If you're doing this over OpenSSH type* `~~b`.

- Enable or disable *Raw TCP* access.

  RAW TCP allows connections directly to a TCP socket. Communications programs like *PuTTY* support RAW TCP. This protocol, however, would usually be used by a custom application

  For RAW TCP, the default port address is IP Address:Port 4000 + serial port # (That is ports 4001 – 4048).

  RAW TCP also enables the serial port to be tunneled to a remote console server, so two serial port devices can be transparently interconnect over a network (see chapter 3.1.6).

- Enable or disable *RFC 2217* access.

  Enabling *RFC 2217* access enables serial port redirection on that port. For RFC 2217, the default port address is IP Address:Port 5000 + serial port # (that is Port #s 5001 – 5048).

  Special client software is available for Windows UNIX and Linux that supports RFC 2217 virtual com ports, so a remote host can monitor and manage remote serially attached devices, as though they were connected to the local serial port (see chapter 3.6 for details).

  RFC 2217 also enables the serial port to be tunneled to a remote console server, so two serial port devices can be transparently interconnect over a network (see chapter 3.1.6).

- Enable or disable *Unauthenticated Telnet*.

  Enabling *Unauthenticated Telnet* enables telnet access to the serial port without authentication credentials. When a *user* accesses the *console server* to telnet to a serial port, they are normally given a login prompt. However with unauthenticated telnet they connect directly through to the port without any *console server* login challenge. (If a telnet client does prompt for authentication, any entered data will allow connection.)

This mode is mainly used when you have an external system (such as *conserver*) managing user authentication and access privileges at the serial device level.

Note: only the connection to the **console server** *is unauthenticated. Logging into a device connected to the console server may still require authentication.*

For *Unauthenticated Telnet* the default port address is IP Address:Port 6000 + serial port # (that is Port #s 6001 – 6048).

- Enable or disable *Web Terminal*.

  Enabling *Web Terminal* enables web browser access to the serial port via **Manage > Devices > Serial** using the Management Console's built in AJAX terminal.

  Web Terminal connects as the currently authenticated Management Console user and does not re-authenticate. See chapter 12.3 for more details.

- Enter an *IP Alias* (for the *Network Interface*, *Management LAN* or *Out-of-Band/Failover*).

  A working *IP Alias*, enables access to the serial port using a specific IP address, specified in CIDR format. Each serial port can be assigned one or more IP aliases, configured on a per-network-interface basis.

  A serial port can, for example, be made accessible at both 192.168.0.148 (as part of the internal network) and 10.10.10.148 (as part of the Management LAN). It is also possible to make a serial port available on two IP addresses on the same network (for example, 192.168.0.148 and 192.168.0.248).

  These IP addresses can only be used to access the specific serial port, accessible using the standard protocol TCP port numbers of the *console server* services. For example, SSH on serial port 3 would be accessible on port 22 of a serial port IP alias (whereas on the *console server's* primary address it is available on port 2003).

  This feature can also be configured via the multiple port edit page. In this case the IP addresses are applied sequentially, with the first selected port getting the IP entered and subsequent ones getting incremented, with numbers being skipped for any unselected ports. For example if ports 2, 3 and 5 are selected and the IP alias 10.0.0.1/24 is entered for the Network Interface, the following addresses will be asssigned:

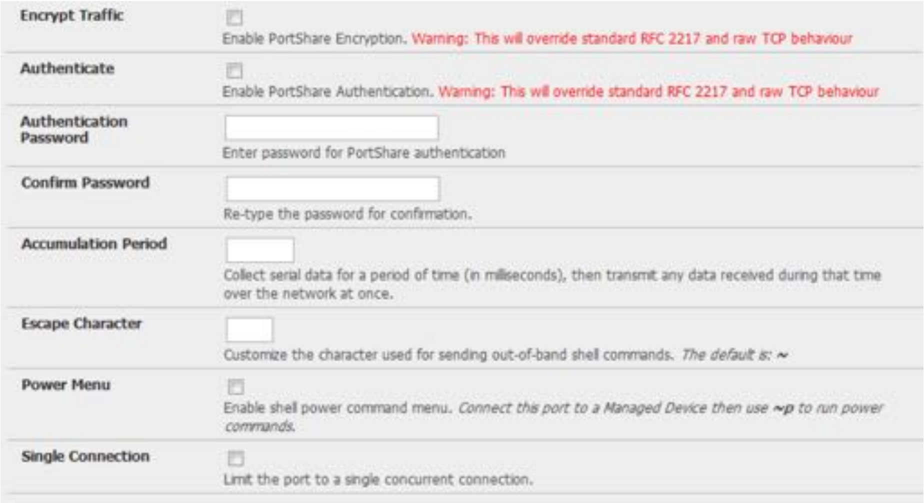
  Port 2: 10.0.0.1/24
  Port 3: 10.0.0.2/24
  Port 5: 10.0.0.4/24

- Enable or disable *Encrypt Traffic* and enable or disable *Authenticate*. (These options should be either enabled or disabled as a pair.)

  Enabling these two options turns on trivial encryption and authentication of RFC2217 serial communications using Portshare. For strong encryption use VPN.

- Set an *Accumulation Period*.

  Once a connection has been established for a particular serial port (such as a RFC2217 redirection or Telnet connection to a remote computer) any incoming characters on that port are forwarded over the network on a character by character basis. The accumulation period changes this by specifying a period of time that incoming characters will be collected before then being sent as a packet over the network.



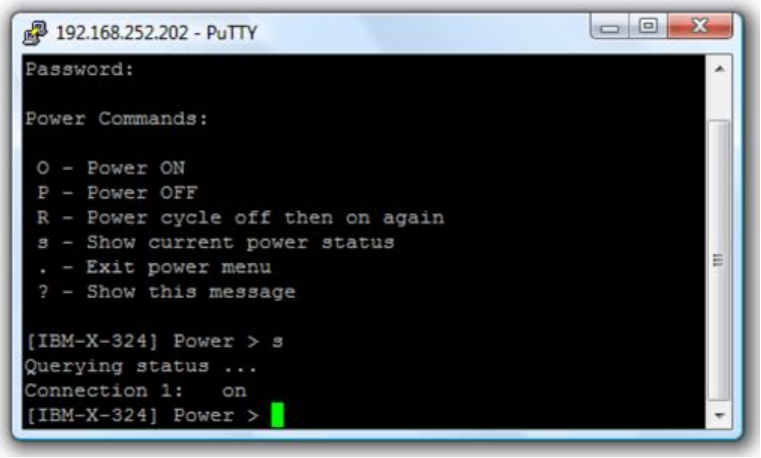
Encrypt Traffic	□ Enable PortShare Encryption. Warning: This will override standard RFC 2217 and raw TCP behaviour
Authenticate	□ Enable PortShare Authentication. Warning: This will override standard RFC 2217 and raw TCP behaviour
Authentication Password	Enter password for PortShare authentication
Confirm Password	Re-type the password for confirmation.
Accumulation Period	Collect serial data for a period of time (in milliseconds), then transmit any data received during that time over the network at once.
Escape Character	Customize the character used for sending out-of-band shell commands. *The default is: ~*
Power Menu	□ Enable shell power command menu. *Connect this port to a Managed Device then use ~p to run power commands.*
Single Connection	□ Limit the port to a single concurrent connection.

- Set a custom *Escape Character*.

  This enables you to change the character used for sending escape characters. The default is ~.

- Enable or disable the *Power Menu*.

  This setting enables the shell power command so a user can control the power connection to a Managed Device from the command line when they are telnet- or ssh-connected to the device. To operate the Managed Device must be set up with both its Serial port connection and Power connection configured. The command to bring up the power menu is ~p.



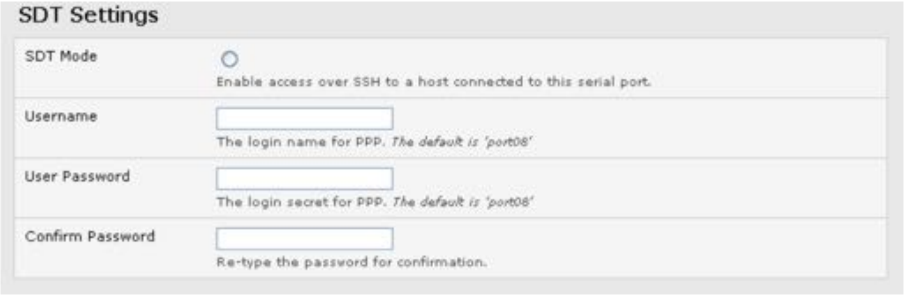
```
Password:

Power Commands:

 O - Power ON
 P - Power OFF
 R - Power cycle off then on again
 s - Show current power status
 . - Exit power menu
 ? - Show this message

[IBM-X-324] Power > s
Querying status ...
Connection 1:   on
[IBM-X-324] Power >
```

- Enable or disable *Single Connection*.

  Enabling this setting limits the port to a single connection. If this is enabled and multiple users have access privileges for a particular port, only one user at a time can be accessing that port (that is, port snooping is not permitted).

3.1.3. SDT mode

This Secure Tunneling setting allows port forwarding of RDP, VNC, HTPP, HTTPS, SSH, Telnet and other LAN protocols through to computers which are locally connected to the console server by their serial COM port. However such port forwarding requires a PPP link to be set up over this serial port.



SDT Settings

SDT Mode ○
Enable access over SSH to a host connected to this serial port.

Username
The login name for PPP. *The default is 'port08'*

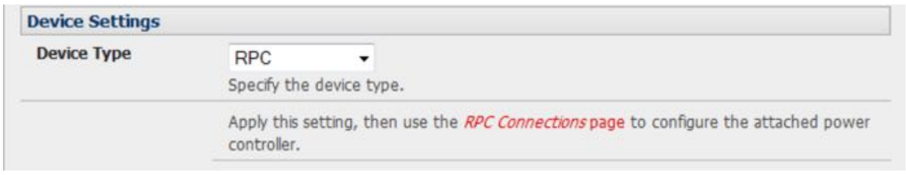
User Password
The login secret for PPP. *The default is 'port08'*

Confirm Password
Re-type the password for confirmation.

For configuration details refer to chapter 5.6.

3.1.4. Device (RPC, UPS, EMD) mode

This mode configures the selected serial port to communicate with a serial controlled Uninterruptable Power Supply (UPS), Remote Power Controller / Power Distribution Units (RPC) or Environmental Monitoring Device (EMD).



Device Settings

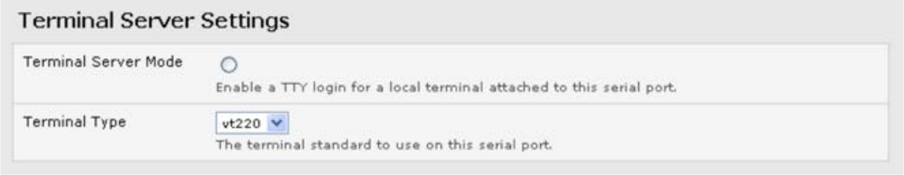
Device Type RPC
Specify the device type.

Apply this setting, then use the *RPC Connections* page to configure the attached power controller.

- Select the desired *Device Type* (UPS, RPC or EMD).
- Proceed to the appropriate device configuration page: **Serial & Network > UPS Connections**, **RPC Connection** or **Environmental**) as detailed in chapter 7.

3.1.5. Terminal server mode

- Enable *Terminal Server Mode* and set the *Terminal Type* (vt220, vt102, vt100, Linux or ANSI) to enable a *getty* on the selected serial port.



Terminal Server Settings

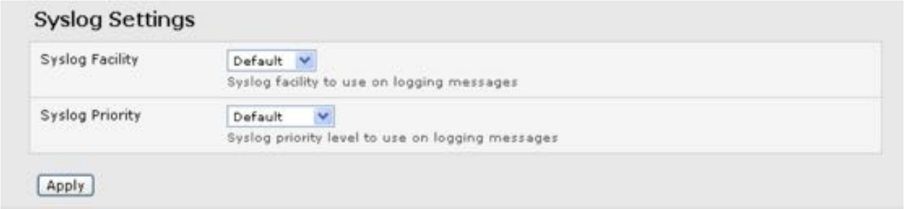
Terminal Server Mode ○
Enable a TTY login for a local terminal attached to this serial port.

Terminal Type vt220
The terminal standard to use on this serial port.

The *getty* will then configure the port and wait for a connection to be made. An active connection on a serial device is usually indicated by the Data Carrier Detect (DCD) pin on the serial device being raised. When a connection is detected, the getty program issues a login: prompt, and then invokes the login program to handle the actual system login.

Note: Selecting Terminal Server mode will disable Port Manager for that serial port, so data is no longer logged for alerts etc.

3.1.6. Serial bridging mode

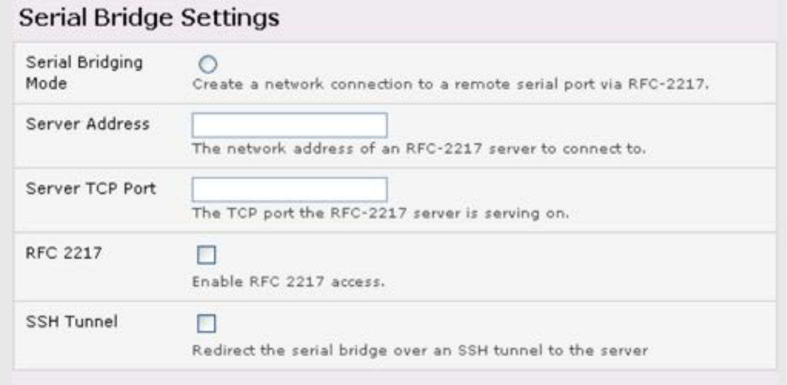


Syslog Settings

Syslog Facility	Default Syslog facility to use on logging messages
Syslog Priority	Default Syslog priority level to use on logging messages

Apply

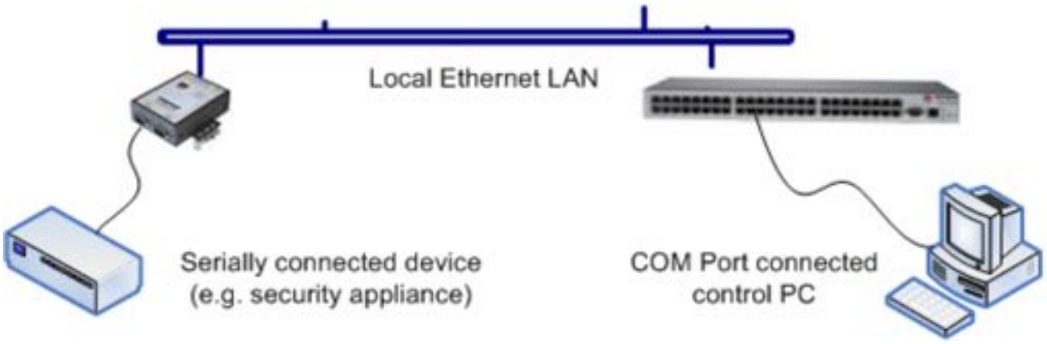
With serial bridging, the serial data on a nominated serial port on one *console server* is encapsulated into network packets and then transported over a network to a second *console server* where is then represented as serial data. So the two *console servers* effectively act as a virtual serial cable over an IP network.



Serial Bridge Settings

Serial Bridging Mode	○ Create a network connection to a remote serial port via RFC-2217.
Server Address	The network address of an RFC-2217 server to connect to.
Server TCP Port	The TCP port the RFC-2217 server is serving on.
RFC 2217	□ Enable RFC 2217 access.
SSH Tunnel	□ Redirect the serial bridge over an SSH tunnel to the server

One *console server* is configured to be the Server. The Server serial port to be bridged is set in Console Server mode with either RFC2217 or RAW enabled (as described in chapter 3.1.2).



For the Client *console server*, the serial port to be bridged must be set in Bridging Mode.

- Enable *Serial Bridging Mode* and specify the IP address of the Server *console server* and the TCP port address of the remote serial port (for RFC2217 bridging this will be 5001-5048).
- By default the bridging client will use RAW TCP so you must select RFC2217 if this is the console Server mode you have specified on the server *console server*.
- You may secure the communications over the local Ethernet by enabling SSH however you will need to generate and upload keys (see chapter 14).

3.1.7. Syslog

In addition to inbuilt logging and monitoring (which can be applied to serial-attached and network-attached management accesses, as covered in chapter 6) the *console server* can also be configured to support the remote syslog protocol on a per serial port basis.

- Select the *Syslog Facility* and *Syslog Priority* fields to enable logging of traffic on the selected serial port to a syslog server and to appropriately sort and action those logged messages (for example, redirect them or send an alert email).

For example if the computer attached to serial port 3 should never send anything out on its serial console port, the *Administrator* can set the *Syslog Facility* for that port to local0 (local0 – local7 are meant for site local values), and the *Syslog Priority* to critical. At this priority, if the *console server* syslog server does receive a message, it will automatically raise an alert. See chapter 6 for more.

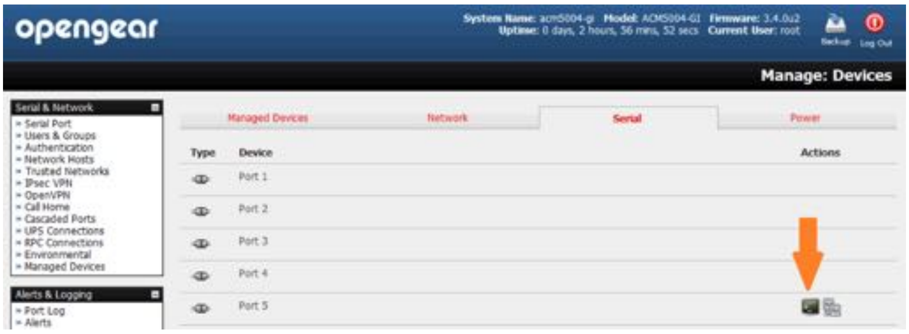
3.1.8. NMEA streaming

The ACM5004-G-I, ACM5504-5-G(-W)-I, ACM5504-5-LA/LR/LV-I, ACM7000-L and IM4200-G can provide GPS NMEA data streaming from the internal GPS /cellular modem. This data stream presents as a serial data stream on port 5 on the ACM models. For the IM4200-G with an internal cellular modem, the NMEA data stream presents on ports 9/17/33/49 for the IM4208/16/32/48 models.

The Common Settings (baud rate etc.) are ignored when configuring the NMEA “serial port”. However you can specify the Fix Frequency (i.e. this GPS fix rate determines how often GPS fixes are obtained). You can also apply all the Console Server Mode, Syslog and Serial Bridging settings to this port.

Note: The NMEA Streaming menu item should display on the **Serial & Network > Serial Port** *menu. However for earlier revision ACM5004-G-I units you may need to update the setfset settings from the command line.*
`setfset -r` *lists all of the current feature set variables.*
You look for the `factory_opts` *variable, and then add 3g-gps to it.*
For example, `factory_opts=rs485,3g,ind`.
To update it to 3g-gps, you do the following:
`setfset -u factory_opts=rs485,3g-gps,ind`.
Then run `setfset -r` *again, and make sure you can see the update.*

You can use *pmshell*, *webshell*, *SSH*, *RFC2217* or *RawTCP* to get at the stream:

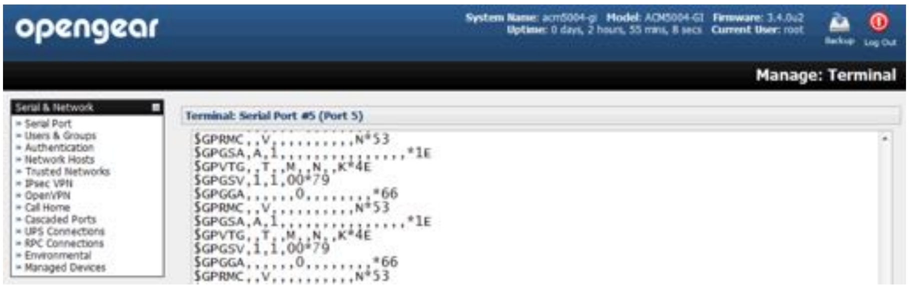


System Name: acm5004-gi **Model:** ACM5004-GI **Firmware:** 3.4.0u2
Uptime: 0 days, 2 hours, 56 mins, 52 secs **Current User:** root

Manage: Devices

Type	Device	Actions
	Port 1	
	Port 2	
	Port 3	
	Port 4	
	Port 5	

For example, using the *Web Terminal:*



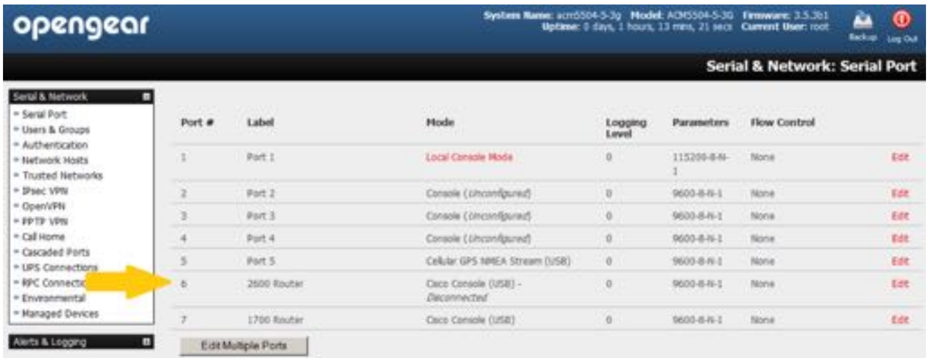
```
$GPRMC,,V,,,,,,,,,,N*53
$GPGSA,A,1,,,,,,,,,,,,,,,*1E
$GPVTG,,T,,M,,N,,K*4E
$GPGSV,1,1,00*79
$GPGGA,,,,,,0,,,,,,,,*66
$GPRMC,,V,,,,,,,,,,N*53
$GPGSA,A,1,,,,,,,,,,,,,,,*1E
$GPVTG,,T,,M,,N,,K*4E
$GPGSV,1,1,00*79
$GPGGA,,,,,,0,,,,,,,,*66
$GPRMC,,V,,,,,,,,,,N*53
```

Note: This GPS support is also available for IM4200-G with an internal cellular modem. The NMEA data stream presents on ports 9/17/33/49 for the IM4208/16/32/48 models.

3.1.9. Cisco USB console connection

The ACM5000-, ACM5500-, and IM4200-family console servers support direct USB 2.0 connection to one or two Cisco USB console ports (in addition to the traditional RS-232 serial console port connections).

With such a USB console connection, users can send IOS commands through the USB console port remotely (using a browser and the console server's built-in AJAX terminal) or monitor messages from the Cisco USB console ports and take rule book actions (using the console server's built-in Auto-Response capabilities).



Port #	Label	Mode	Logging Level	Parameters	Flow Control	
1	Port 1	Local Console Mode	0	115200-8-N-1	None	Edit
2	Port 2	Console (*Unconfigured*)	0	9600-8-N-1	None	Edit
3	Port 3	Console (*Unconfigured*)	0	9600-8-N-1	None	Edit
4	Port 4	Console (*Unconfigured*)	0	9600-8-N-1	None	Edit
5	Port 5	Cellular GPS NMEA Stream (USB)	0	9600-8-N-1	None	Edit
6	2600 Router	Cisco Console (USB) - *Disconnected*	0	9600-8-N-1	None	Edit
7	1700 Router	Cisco Console (USB)	0	9600-8-N-1	None	Edit

For configuration and control, these USB consoles are presented as new "serial ports". For example, on an ACM5504-5-G with cellular GPS configured on Port 5 (as shown above), any Cisco USB console ports would present as Port 6 and 7.

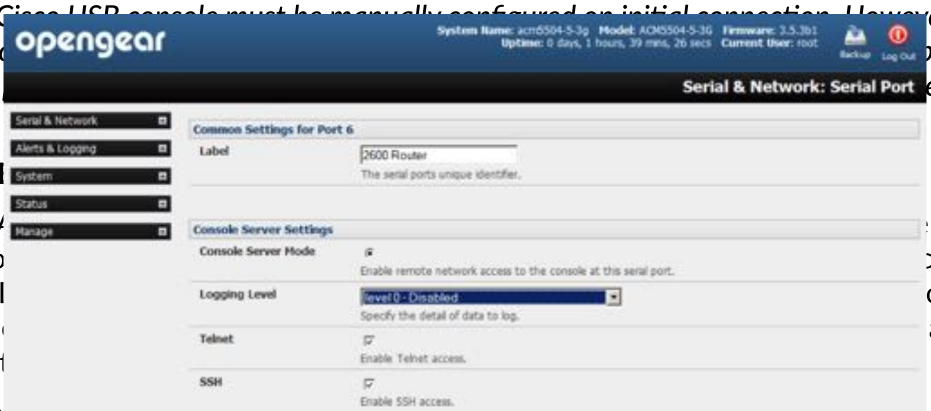
For the IM4200-series (without any internal GPS modem functions) any configured Cisco USB console ports would present as follows:

ports 19 & 10 on the IM4208.
ports 17 & 18 on the IM4216.
ports 33 & 34 on the IM4232.
ports 49 & 50 on the IM4248.

The Common Settings (baud rate etc) are ignored when configuring the Cisco USB "serial port".

However you can apply all the Console Server Mode, Syslog and Serial Bridging settings to this port.

Note: The C... er any USB cons... physical USB ... er cycled.



System Name: acm5504-5-3g Model: ACM5504-5-3G Firmware: 3.5.3b1
Uptime: 0 days, 1 hours, 39 mins, 26 secs Current User: root

Serial & Network: Serial Port

Common Settings for Port 6

Label: 2600 Router
The serial ports unique identifier.

Console Server Settings

Console Server Mode: ☑
Enable remote network access to the console at this serial port.

Logging Level: level 0 - Disabled
Specify the detail of data to log.

Telnet: ☑
Enable Telnet access.

SSH: ☑
Enable SSH access.

3.1.10. USI

Opengear A ... 3.16.5 or later suppo ... cluding Cisco, HP, I ... ons, all the USB ports ... a USB-to-serial adapt

These USB ports are available as regular portmanager ports and are presented numerically in the web UI after all RJ45 serial ports.

The ACM7008-2, for example, has eight RJ45 serial ports on the rear of the console server and four USB ports on the front. In **Serial & Network > Serial Port** these are listed as

port #	connector
1	RJ45
2	RJ45
3	RJ45
4	RJ45
5	RJ45
6	RJ45
7	RJ45
8	RJ45
9	USB
10	USB
11	USB
12	USB

If the particular ACM7008-2 is a cellular model, port #13 — for the GPS — will also be listed.

As a further example, consider the 7216-24U. It has 16 RJ45 serial ports and 24 USB ports on its rear-face as well as two front-facing USB ports and (in the cellular model) a GPS.

The RJ45 serial ports are presented in **Serial & Network > Serial Port** as port numbers 1–16. The 24 rear-facing USB ports take port numbers 17–40, and the front-facing USB ports are listed at port numbers 41 and 42 respectively. And, as with the ACM7008-2, if the particular 7216-24U is a cellular model, the GPS is presented at port number 43.

The common settings (baud rate etc.) are used when configuring the ports, but some operations (for example, sending serial breaks) may not work depending on the implementation of the underlying USB serial chip.

3.1.11. Link layer discovery protocol (LLDP)

The Link Layer Discovery Protocol (LLDP) is a protocol that allows system administrators to glean information about devices physically connected to managed switches. It is available for use on IM7200, CM7100 and ACM7000 devices.

The LLDP service is enabled through the **System > Services** page. When the service is enabled, the `lldpd` daemon is loaded and runs. The **Service Access** tab controls which network interfaces are monitored by the `lldpd` daemon.

When LLDP is granted access to an interface, it will use that interface even if the interface has been disabled via **System > IP**.

LLDP neighbors are visible through the **Status > LLDP Neighbors** page. This page shows neighbors heard, and also indicates the information that the console manager is sending.

Note: although the LLDP service can be granted access to non-ethernet interfaces (for example, G3, G4 and PSTN dial-up interfaces), it currently ignores non-ethernet interfaces.

The `lldpcli` shell client interacts with and configures the running LLDP service.

Persistent custom configuration changes can be added to the system through configuration files placed in `/etc/config/lldpd.d/`. Custom configuration files — which must have filenames ending with `.conf` — will be read and executed by `lldpcli` when the LLDP service starts.

The `/etc/` directory is read-only on Opengear hardware. Most default configuration files otherwise stored in `/etc/` are, on Opengear hardware, in `/etc/config/`, which is writeable.

The default lldpd configuration file — `lldpd.conf` — is stored in `/etc/config/` on Opengear hardware. It is not safe as a store of custom configuration details, however. There are circumstances in which this file is regenerated automatically, in which case all customisations will be lost.

The `etc/config/lldpd.d/` directory, which is also writable and which is created on first boot, is safe to write to. Any Custom LLDP configurations must be stored as `*.conf` files in this directory.

When enabled, LLDP frames issued by an Opengear Console Manager will reveal sensitive information such as hostname, and firmware version.

However, LLDP frames are not passed through by 802.3ab compliant switches, and Opengear Console Managers have the LLDP service disabled by default.

Both `lldpd` and `lldpcli` have standard man pages but, because of space concerns, these pages are not shipped with Opengear hardware.

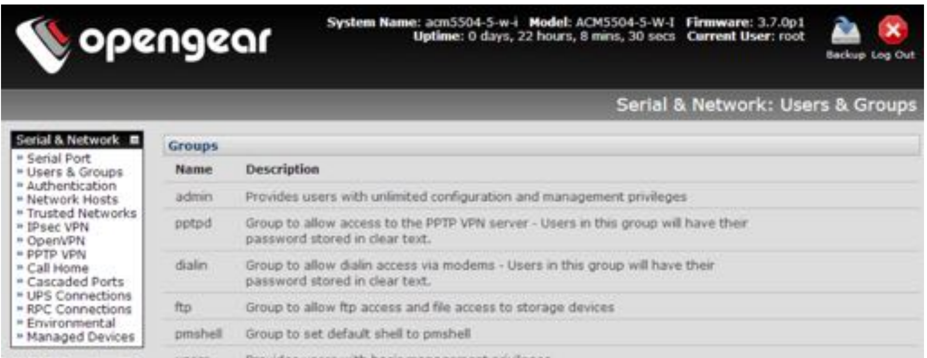
Both man pages are available on the lldpd project web-site however: `man lldpd` is at https://vincentbernat.github.io/lldpd/usage.html#lldpd8; and `man lldpcli` is at https://vincentbernat.github.io/lldpd/usage.html#lldpcli8.

Note: Opengear uses lldpd 0.9.2.

3.2. Add & edit users

The *Administrator* uses this menu selection to set up, edit and delete users and to define the access permissions for each of these users.

Opengear Use

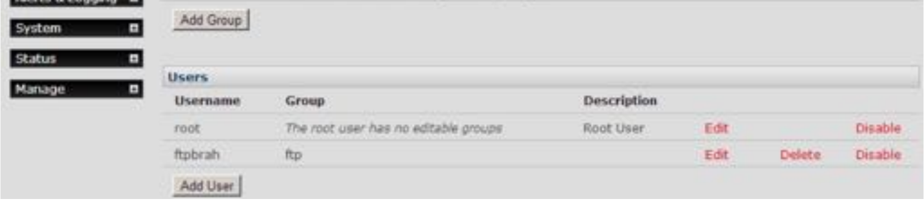


System Name: acm5504-5-w-i Model: ACM5504-5-W-I Firmware: 3.7.0p1
Uptime: 0 days, 22 hours, 8 mins, 30 secs Current User: root

Serial & Network: Users & Groups

Groups

Name	Description
admin	Provides users with unlimited configuration and management privileges
pptpd	Group to allow access to the PPTP VPN server - Users in this group will have their password stored in clear text.
dialin	Group to allow dialin access via modems - Users in this group will have their password stored in clear text.
ftp	Group to allow ftp access and file access to storage devices
pmshell	Group to set default shell to pmshell



Users

Username	Group	Description			
root	*The root user has no editable groups*	Root User	Edit		Disable
ftpbrah	ftp		Edit	Delete	Disable

Users can be authorized to access specified services, serial ports, power devices and specified network-attached hosts. These users can also be given full *Administrator* status (with full configuration and management and access privileges).

To simplify user set up, they can be configured as members of Groups. With firmware V3.5.2 and later there are six Groups set up by default (earlier versions only had admin and user by default):

group	description
admin	Provides users with unlimited configuration and management privileges.
pptpd	Group to allow access to the PPTP VPN server. Users in this group will have their password stored in clear text.
dialin	Group to allow access to the PPTP VPN server. Users in this group will have their password stored in clear text.
ftp	Group to allow ftp access and file access to storage devices.
pmshell	Group to set default shell to pmshell.
users	Provides users with basic management privileges.

Membership of the *admin* group provides the user with full Administrator privileges. The admin user (Administrator) can access the console server using any of the services which have been enabled in System: Services e.g. if only HTTPS has been enabled then the Administrator can only access the console server using HTTPS. However once logged in they can reconfigure the console server settings (e.g. to enabled HTTP/Telnet for future access). They can also access any of the connected Hosts or serial port devices using any of the services that have been enabled for these connections. But again the Administrator can reconfigure the access services for any Host or serial port. So only trusted users should have Administrator access

Membership of the *user* group provides the user with limited access to the console server and connected Hosts and serial devices. These Users can access only the Management section of the Management Console menu and they have no command line access to the console server. They also can only access those Hosts and serial devices that have been checked for them, using services that have been enabled

If a user is set up with *pptd*, *dialin*, *ftp* or *pmshell* group membership they will have restricted user shell access to the nominated managed devices but they will not have any direct access to the console server itself. To add this the users must also be a member of the "users" or "admin" groups

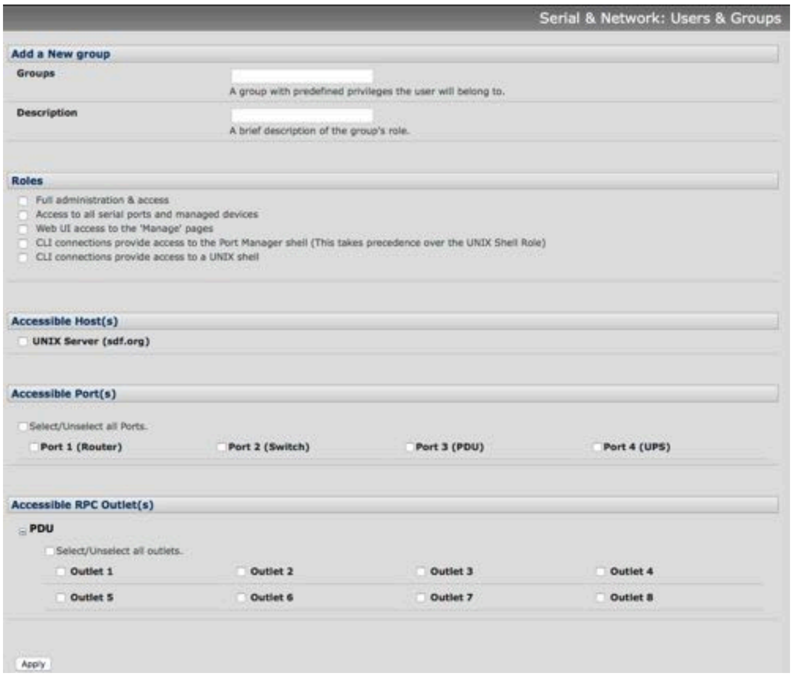
The *Administrator* can also set up additional Groups with specific power device, serial port and host access permissions. However users in these additional groups don't have any access to the Management Console menu nor do they have any command line access to the console server itself.

The *Administrator* can also set up users with specific power device, serial port and host access permissions, who are not a member of any Groups. Similarly these users don't have any access to the Management Console menu nor do they have any command line access to the console server itself.

For convenience the SDT Connector "Retrieve Hosts" function retrieves and auto-configures checked serial ports and checked hosts only, even for admin group users

3.2.1. Setup new groups

To set up new Groups and new users, and to classify users as members of particular Groups:



Serial & Network: Users & Groups

Add a New group

Groups: A group with predefined privileges the user will belong to.

Description: A brief description of the group's role.

Roles

□ Full administration & access
□ Access to all serial ports and managed devices
□ Web UI access to the 'Manage' pages
□ CLI connections provide access to the Port Manager shell (This takes precedence over the UNIX Shell Role)
□ CLI connections provide access to a UNIX shell

Accessible Host(s)

□ UNIX Server (sdf.org)

Accessible Port(s)

□ Select/Unselect all Ports.

□ Port 1 (Router) □ Port 2 (Switch) □ Port 3 (PDU) □ Port 4 (UPS)

Accessible RPC Outlet(s)

PDU

□ Select/Unselect all outlets.

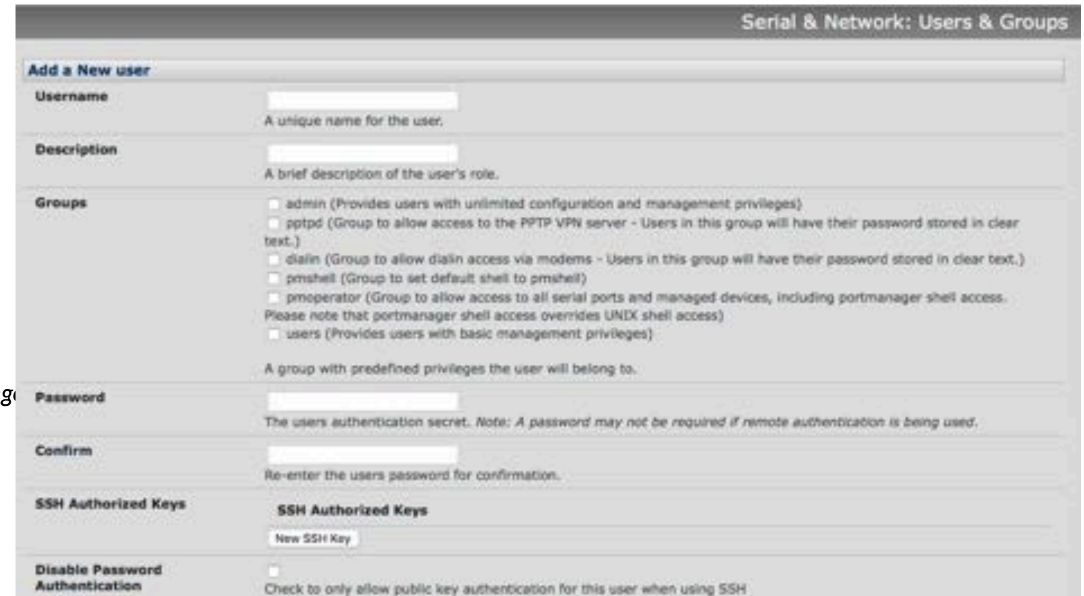
□ Outlet 1	□ Outlet 2	□ Outlet 3	□ Outlet 4
□ Outlet 5	□ Outlet 6	□ Outlet 7	□ Outlet 8

- Select **Serial & Network > Users & Groups** to display the configured Groups and Users.
- Click **Add Group** to add a new Group.
- Add a *Group name* and *Description* for each new Group, then nominate the *Accessible Hosts*, *Accessible Ports* and *Accessible RPC Outlet(s)* that you wish any users in this new Group to be able to access.
- Click **Apply**.
- The *Administrator* can *Edit* or *Delete* any added group.

3.2.2. Setup new users

To set up new users, and to classify users as members of particular Groups:

- Select **Serial & Network > Users & Groups** to display the configured Groups and Users.
- Click *Add User* to add a new user.



Serial & Network: Users & Groups

Add a New user

Username: A unique name for the user.

Description: A brief description of the user's role.

Groups:
□ admin (Provides users with unlimited configuration and management privileges)
□ pptpd (Group to allow access to the PPTP VPN server - Users in this group will have their password stored in clear text.)
□ dialin (Group to allow dialin access via modems - Users in this group will have their password stored in clear text.)
□ pmshell (Group to set default shell to pmshell)
□ pmoperator (Group to allow access to all serial ports and managed devices, including portmanager shell access. Please note that portmanager shell access overrides UNIX shell access)
□ users (Provides users with basic management privileges)

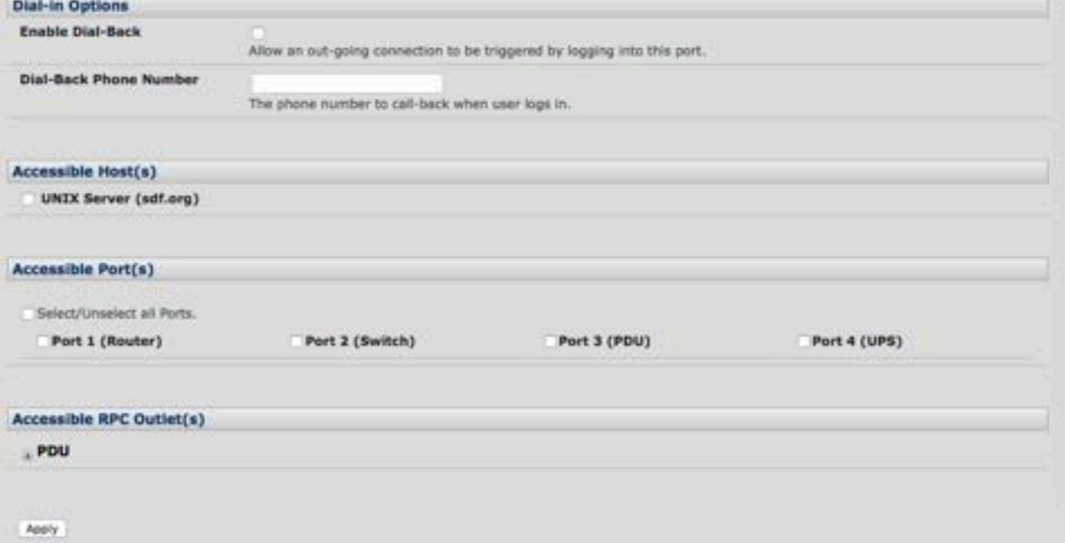
A group with predefined privileges the user will belong to.

Password: The users authentication secret. *Note: A password may not be required if remote authentication is being used.*

Confirm: Re-enter the users password for confirmation.

SSH Authorized Keys: SSH Authorized Keys

Disable Password Authentication: □ Check to only allow public key authentication for this user when using SSH



Dial-in Options

Enable Dial-Back □
Allow an out-going connection to be triggered by logging into this port.

Dial-Back Phone Number
The phone number to call-back when user logs in.

Accessible Host(s)

□ UNIX Server (sdf.org)

Accessible Port(s)

□ Select/Unselect all Ports.

□ Port 1 (Router) □ Port 2 (Switch) □ Port 3 (PDU) □ Port 4 (UPS)

Accessible RPC Outlet(s)

+ PDU

- Add a *Username* for each new user. You may also include information related to the user (e.g. contact details) in the *Description* field.

Note: the **User Name** *can contain from 1 to 127 alphanumeric characters as wel as the following characters:* **- _ .** *(hyphen, underscore, and full-stop or period).*

- Specify which *Group* (or *Groups*) you wish the user to be a member of.
- Add a confirmed *Password* for each new user.

Note: a user's Password can contain up to 254 characters. There are no restrictions on what characters are allowed in a password.

- SSH pass-key authentication can be used. This is more secure than password-based authentication. Paste the public keys of authorized public/private keypairs for this user in the *Authorized SSH Keys* field
- Check *Disable Password Authentication* if you wish to only allow public key authentication for this user when using SSH.
- Check *Enable Dial-Back* in the **Dial-in Options** menu to allow an out-going dial-back connection to be triggered by logging into this port.
- Enter the *Dial-Back Phone Number* to call-back when the user logs in.
- Check specific *Accessible Hosts* and *Accessible Ports* to nominate the serial ports and network connected hosts you wish the user to have access privileges to.
- If there are configured RPCs you can check *Accessible RPC Outlets* to specify which outlets the user is able to control (that is, power on and off).
- Click **Apply**.

  The new user will now be able to access the Network Devices, Ports and RPC Outlets you nominated as accessible plus, if the user is a Group member they can also access any other device/port/outlet that was set up as accessible to the Group

*Note: there are no specific limits on user number; nor on the number of users per serial port or host. So multiple users (***Users** *and* **Administrators***) can control or monitor a port or host. Similarly there are no specific limits on the group number and users can be a member of a number of Groups (and gain the cumulative access privileges of each Group). A user does not have to be a member of any Groups (but if the* **User** *is not even a member of the default user group then cannot use the Management Console to manage ports).*

Note: while there are no specific limits, the time to re-configure does increase as the number and complexity increases. The aggregate number of users and groups should be kept under 250.

The *Administrator* can also edit the access settings for any existing users:

- Select **Serial & Network > Users & Groups** and click *Edit* to modify User access privileges.
- Alternatively click *Delete* to remove the *user* or *Disable* to temporarily block access.

Note: for more on enabling the SDT Connector so each user has secure tunneled remote RPD/VNC/Telnet/HHTP/HTTPS/SoL access to the network connected hosts see chapter 5.

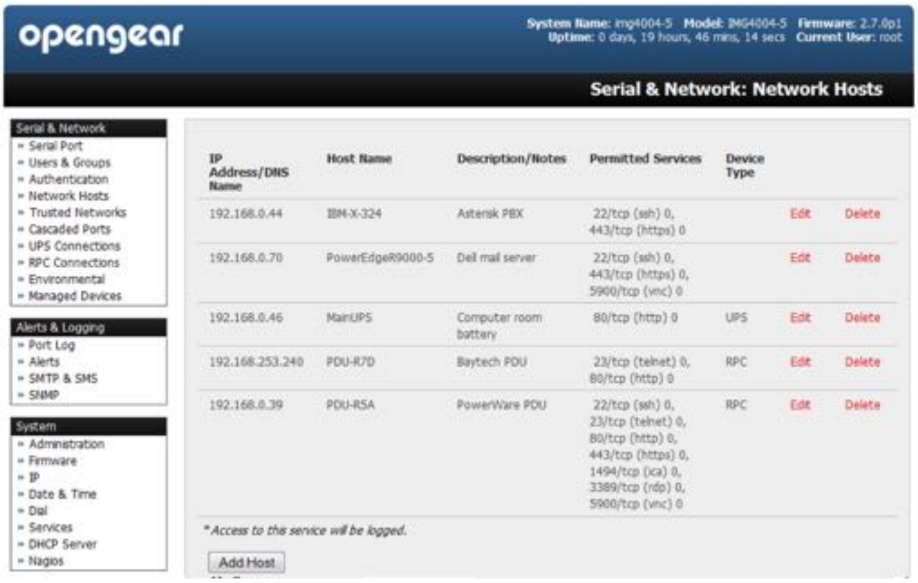
3.3. Authentication

See chapter 8.1 for authentication configuration details.

3.4. Network hosts

To monitor and remotely access a locally networked computer or device (referred to as a Host) identify the Host and specify the TCP or UDP ports/services used to control that Host.

- Select **Serial & Network > Network Hosts.**



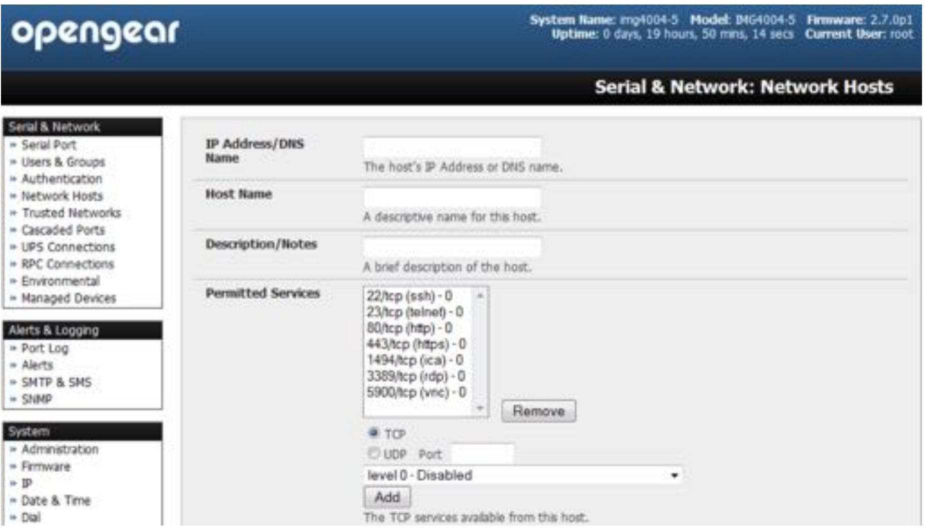
System Name: img4004-5 **Model:** IMG4004-5 **Firmware:** 2.7.0p1
Uptime: 0 days, 19 hours, 46 mins, 14 secs **Current User:** root

IP Address/DNS Name	Host Name	Description/Notes	Permitted Services	Device Type		
192.168.0.44	IBM-X-324	Asterisk PBX	22/tcp (ssh) 0, 443/tcp (https) 0		Edit	Delete
192.168.0.70	PowerEdgeR9000-5	Dell mail server	22/tcp (ssh) 0, 443/tcp (https) 0, 5900/tcp (vnc) 0		Edit	Delete
192.168.0.46	MainUPS	Computer room battery	80/tcp (http) 0	UPS	Edit	Delete
192.168.253.240	PDU-R7D	Baytech PDU	23/tcp (telnet) 0, 80/tcp (http) 0	RPC	Edit	Delete
192.168.0.39	PDU-RSA	PowerWare PDU	22/tcp (ssh) 0, 23/tcp (telnet) 0, 80/tcp (http) 0, 443/tcp (https) 0, 1494/tcp (ica) 0, 3389/tcp (rdp) 0, 5900/tcp (vnc) 0	RPC	Edit	Delete

**Access to this service will be logged.*

All network-connected Hosts that have been enabled for access present as well as the related access TCP ports/services.

- Click **Add Host** to enable a new Host or select **Edit** to update an extant Host's settings.
- Enter the *IP Address* or the *DNS Name* and *Host Name* (up to 254 alphanumeric characters) for the new network connected Host.



System Name: img4004-5 **Model:** IMG4004-5 **Firmware:** 2.7.0p1
Uptime: 0 days, 19 hours, 50 mins, 14 secs **Current User:** root

IP Address/DNS Name
The host's IP Address or DNS name.

Host Name
A descriptive name for this host.

Description/Notes
A brief description of the host.

Permitted Services
22/tcp (ssh) - 0
23/tcp (telnet) - 0
80/tcp (http) - 0
443/tcp (https) - 0
1494/tcp (ica) - 0
3389/tcp (rdp) - 0
5900/tcp (vnc) - 0

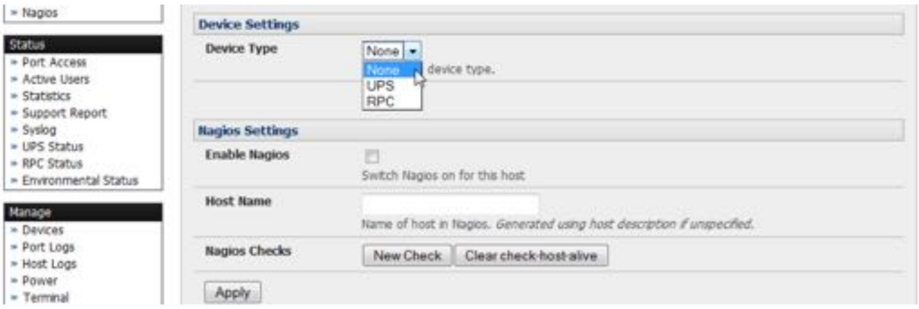
● TCP
○ UDP Port
level 0 - Disabled
The TCP services available from this host.

- enter a *Description* (this is an optional step).
- Add or edit the *Permitted Services* (or TCP/UDP port numbers) that are authorized to be used in controlling this host.

  Only these permitted services will be forwarded through by SDT to the Host. All other services (TCP/UDP ports) will be blocked.
- Set the *Logging Level*.

  This specifies the level of information to be logged and monitored for each Host access. See chapter 6 for more.
- If the Host is a PDU or UPS power device or a server with IPMI power control, specify RPC (for IPMI and PDU) or UPS and the Device Type.

  The *Administrator* can configure these devices and enable which users have permissions to remotely cycle power etc. (see chapter 7). Otherwise leave the *Device Type* set to *None*.



Device Settings

Device Type: None (None / UPS / RPC) device type.

Nagios Settings

Enable Nagios: □ Switch Nagios on for this host

Host Name: Name of host in Nagios. *Generated using host description if unspecified.*

Nagios Checks

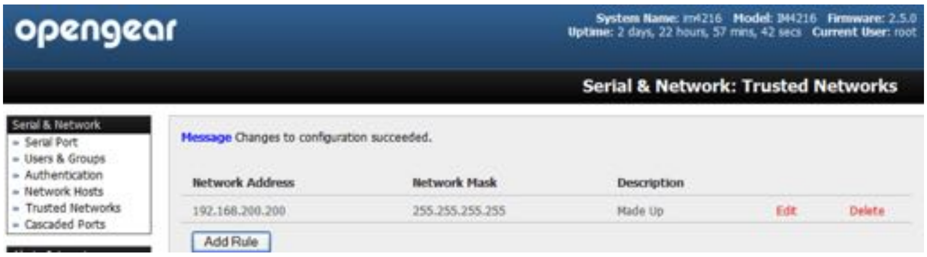
- If the *console server* has been configured with distributed Nagios monitoring enabled then you will also be presented with Nagios Settings options to enable nominated services on the Host to be monitored. See Chapter 9 for more.
- Click **Apply**.

  This will create the new Host and also create a new Managed Device (with the same name).

3.5. Trusted networks

The **Trusted Networks** facility allows you an nominate specific IP addresses that users (*Administrators* and *Users*) must be located at, to have access to console server serial ports:

- Select **Serial & Network > Trusted Networks**.
- Click **Add Rule** to add a new trusted network.



System Name: im4216 Model: IM4216 Firmware: 2.5.0
Uptime: 2 days, 22 hours, 57 mins, 42 secs Current User: root

Serial & Network: Trusted Networks

Message Changes to configuration succeeded.

Network Address	Network Mask	Description
192.168.200.200	255.255.255.255	Made Up

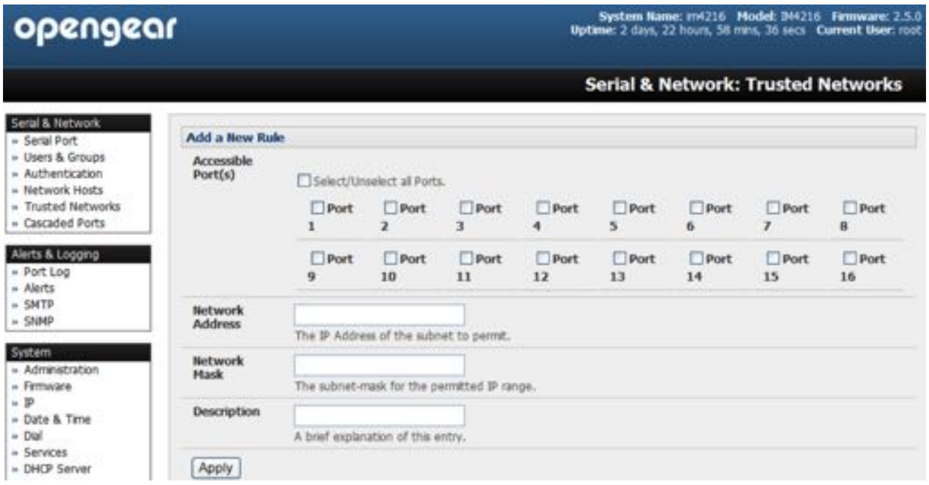
Note: In the absence of Rules, there are no access limitations as to the IP address at which **Users** *or* **Administrators** *can be located.*

- Select the *Accessible Port(s)* that the new rule is to be applied to.
- Enter the *Network Address* of the subnet to be permitted access.
- Specify the range of addresses that are to be permitted by entering a Network Mask for that permitted IP range.
- For example, to permit all *users* located in the 204.15.5.0 Class C network to connect to the nominated port, would add the following **Trusted Network** rule:

  Network IP address: 204.15.5.0
  Subnet Mask 255.255.255.0

- To permit only the user located at a specific IP address (in this case 204.15.5.13) to connect:

  Network IP address: 204.15.5.13
  Subnet Mask 255.255.255.255



System Name: im4216 **Model:** IM4216 **Firmware:** 2.5.0
Uptime: 2 days, 22 hours, 58 mins, 36 secs **Current User:** root

Serial & Network: Trusted Networks

Add a New Rule

Accessible Port(s)
□ Select/Unselect all Ports.
□ Port 1 □ Port 2 □ Port 3 □ Port 4 □ Port 5 □ Port 6 □ Port 7 □ Port 8
□ Port 9 □ Port 10 □ Port 11 □ Port 12 □ Port 13 □ Port 14 □ Port 15 □ Port 16

Network Address
The IP Address of the subnet to permit.

Network Mask
The subnet-mask for the permitted IP range.

Description
A brief explanation of this entry.

- To allow all users operating from within a specific range of IP addresses (in this case the 30 addresses from 204.15.5.129 to 204.15.5.158) to be permitted connection to the nominated port:

  Network IP address: 204.15.5.128
  Subnet Mask 255.255.255.224

- Click **Apply**.

Note: The above **Trusted Networks** *will limit access by* **Users** *and* **Administrators** *to the console serial ports. However they do not restrict access by the* **Administrator** *to the console server itself or to attached hosts. To change the default settings for this access, you will to need to edit the* **IPtables** *rules as described in chapter 14.*

3.6. Serial port cascading

Cascaded Ports enables you to cluster distributed *console servers* so up to 1000 serial ports can be configured and accessed through one IP address and managed through the one Management Console. One *console server*, the Master, controls other console servers as Slave units and all the serial ports on the Slave units appear as if they are part of the Master.

Opengear's clustering connects each Slave to the Master with an SSH connection. This is done using public key authentication so the Master can access each Slave using the SSH key pair (rather than using passwords). This ensures secure authenticated communications between Master and Slaves enabling the Slave *console server* units to be distributed locally on a LAN or remotely around the world.

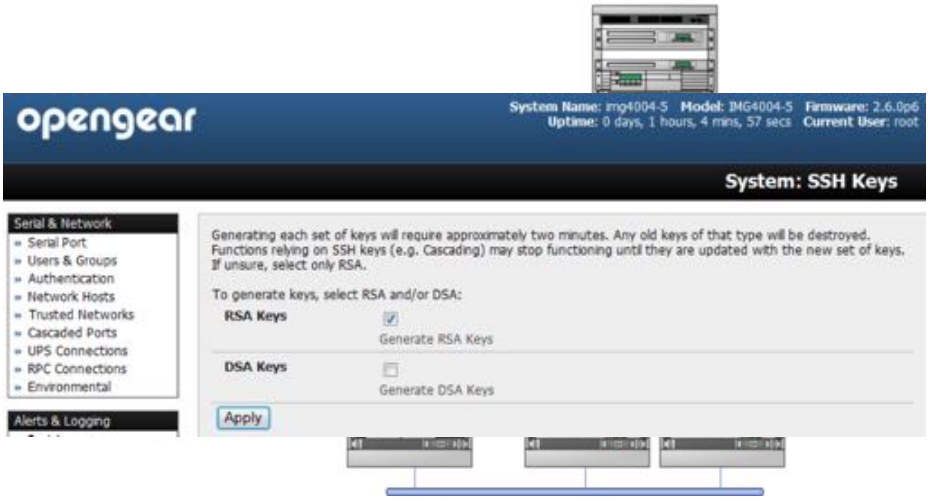
3.6.1. Automatically generate & upload SSH keys

To set up public key authentication first generate an RSA or DSA key pair and upload them into the master and slave *console servers*. This can be done automatically from the Master.

- Select **System > Administration** on the master's Management Console.
- Check *Generate SSH keys* automatically.
- click **Apply**.

Next select whether to generate keys using RSA and/or DSA (if unsure, select only RSA).

Generating each set of keys will require approximately two minutes and the new keys will destroy any old keys of that type that may previously been uploaded. Also while the new generation is underway on the master functions relying on SSH keys (e.g. cascading) may stop functioning until they are updated with the new set of keys. To generate keys:



System Name: img4004-5 Model: IMG4004-5 Firmware: 2.6.0p6
Uptime: 0 days, 1 hours, 4 mins, 57 secs Current User: root

System: SSH Keys

Generating each set of keys will require approximately two minutes. Any old keys of that type will be destroyed. Functions relying on SSH keys (e.g. Cascading) may stop functioning until they are updated with the new set of keys. If unsure, select only RSA.

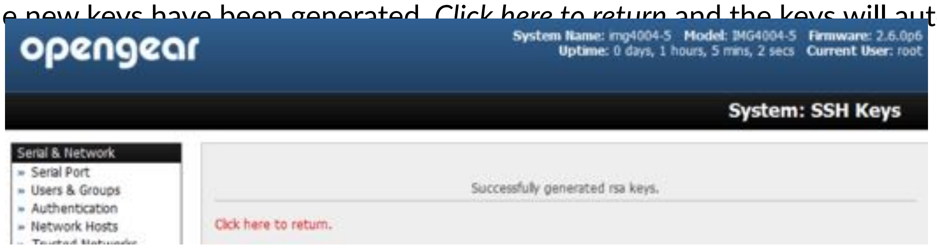
To generate keys, select RSA and/or DSA:

RSA Keys ☑ Generate RSA Keys

DSA Keys ☐ Generate DSA Keys

Apply

- Check *RSA Keys*, *DSA Keys*, or both.
- Click **Apply**.
- Once the new keys have been generated, *Click here to return* and the keys will automatically



System Name: img4004-5 Model: IMG4004-5 Firmware: 2.6.0p6
Uptime: 0 days, 1 hours, 5 mins, 2 secs Current User: root

System: SSH Keys

Successfully generated rsa keys.

Click here to return.

be uploaded to the master and connected slaves.

3.6.2. Manually generate & upload SSH keys

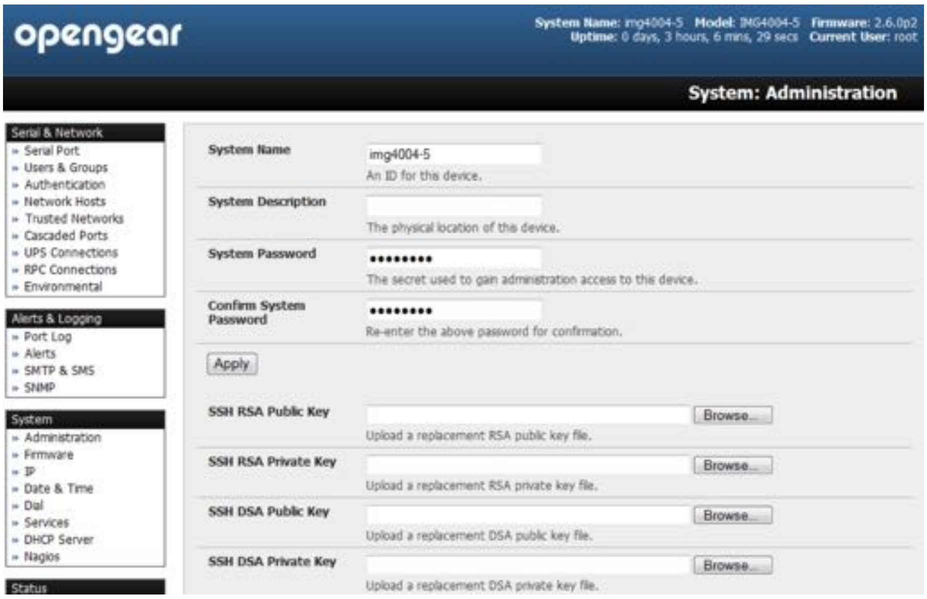
To manually upload the key public and private key pair to the Master console server:

- Select **System > Administration** on the master's Management Console.
- Browse to the location you have stored RSA (or DSA) Public Key and upload it to *SSH RSA (DSA) Public Key*.
- Browse to the stored RSA (or DSA) Private Key and upload it to *SSH RSA (DSA) Private Key*.
- Click **Apply**.

Next, you must register the Public Key as an Authorized Key on the slave. In the simple case with only one master with multiple slaves, you need only upload the one RSA or DSA public key for each slave.

Note: The use of key pairs can be confusing as in many cases one file (Public Key) fulfills two roles – Public Key and Authorized Key. For a more detailed explanation see the Authorized Keys section of chapter 14.6. Also refer to this chapter if you need to use more than one set of Authorized Keys in the slave.

- Select **System > Administration** on the slave's Management Console.



System Name: img4004-5 Model: IMG4004-5 Firmware: 2.6.0p2
Uptime: 0 days, 3 hours, 6 mins, 29 secs Current User: root

System Name: img4004-5
An ID for this device.

System Description:
The physical location of this device.

System Password: ••••••••
The secret used to gain administration access to this device.

Confirm System Password: ••••••••
Re-enter the above password for confirmation.

SSH RSA Public Key:
Upload a replacement RSA public key file.

SSH RSA Private Key:
Upload a replacement RSA private key file.

SSH DSA Public Key:
Upload a replacement DSA public key file.

SSH DSA Private Key:
Upload a replacement DSA private key file.

- Browse again to the stored RSA (or DSA) Public Key and upload it to Slave's **SSH Authorized Key**.
- Click **Apply**.

The next step is to *Fingerprint* each new slave-master connection. This once-off step will validate that you are establishing an SSH session to who you think you are. On the first connection the Slave will receive a fingerprint from the Master which will be used on all future connections.

- Log in to the master *console server* as *root*.

- Establish an SSH connection to the remote slave host:

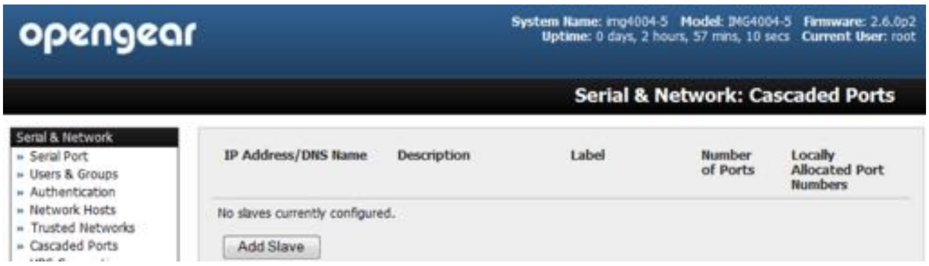
```
# ssh remote-host-name
```

Once the SSH connection has been established you will be asked to accept the key. Answer yes and the fingerprint will be added to the list of known hosts. For more detail on Fingerprinting see chapter 14.6.

Note: If you are asked to supply a password, then there has been a problem with uploading keys. The keys should remove any need to supply a password.

3.6.3. Configure the slaves and their serial ports

You can now begin setting up the slaves and configuring slave serial ports from the master *console server*.


opengear
System Name: img4004-5 Model: IMG4004-5 Firmware: 2.6.0p2
Uptime: 0 days, 2 hours, 57 mins, 10 secs Current User: root
Serial & Network: Cascaded Ports
Serial & Network
» Serial Port
» Users & Groups
» Authentication
» Network Hosts
» Trusted Networks
» Cascaded Ports
Add Slave

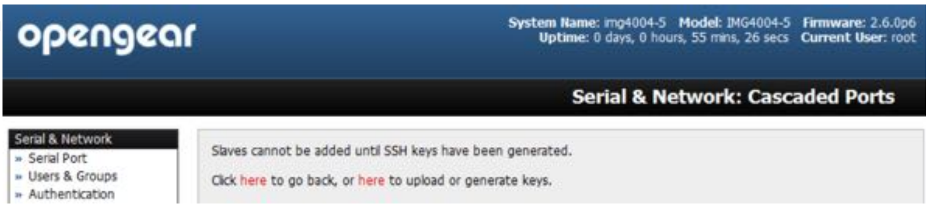
IP Address/DNS Name	Description	Label	Number of Ports	Locally Allocated Port Numbers

No slaves currently configured.

- Select **Serial & Network > Cascaded Ports** on the master's Management Console.
- Click **Add Slave** to add clustering support.

Note: you cannot add any slaves until you have automatically or manually generated SSH keys.

To define a


opengear
System Name: img4004-5 Model: IMG4004-5 Firmware: 2.6.0p6
Uptime: 0 days, 0 hours, 55 mins, 26 secs Current User: root
Serial & Network: Cascaded Ports
Serial & Network
» Serial Port
» Users & Groups
» Authentication

Slaves cannot be added until SSH keys have been generated.

Click here to go back, or here to upload or generate keys.

- Enter the remote *IP Address* (or DNS Name) for the Slave *console server*.
- Enter a brief *Description* and a short *Label* for the slave

  Use a convention here that enables effective management of large networks of clustered console servers and the connected devices.
- Enter the full number of serial ports on the slave unit in *Number of Ports*.
- Click **Apply**.

  This will establish the SSH tunnel between the master and the new slave.

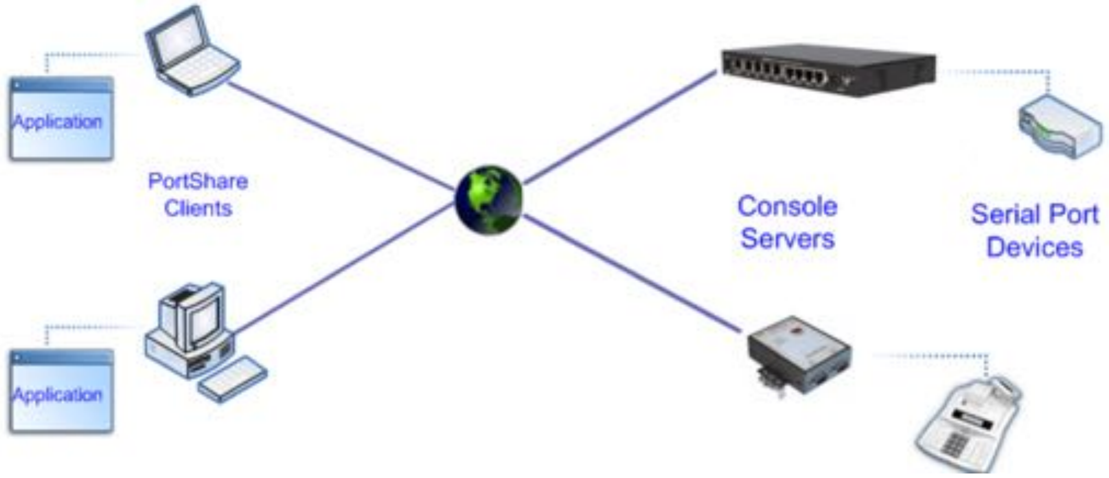
The **Serial & Network > Cascaded Ports** menu displays all the slaves and the port numbers that have been allocated on the master. If the master console server has 16 ports of its own then ports 1–16 are pre-allocated to the master, so the first slave added will be assigned port number 17 onwards.

Once you have added all the slave *console servers*, the slave serial ports and the connected devices are configurable and accessible from the master's Management Console menu and accessible through the Master's IP address.

- Select the appropriate **Serial & Network > Serial Port** and *Edit* to configure the serial ports on the slave.
- Select the appropriate **Serial & Network > Users & Groups** to add new users with access privileges to the slave serial ports (or to extend existing users access privileges).
- Select the appropriate **Serial & Network > Trusted Networks** to specify network addresses that can access nominated slave serial ports.
- Select the appropriate **Alerts & Logging > Alerts** to configure slave port *Connection*, *State Change* or *Pattern Match* alerts.
- click **Apply**.

  The configuration changes made on the master are propagated out to all the Slaves.

3.6.4. Managing the slaves



The master is in control of the slave serial ports. So for example if change a *User* access privileges or edit any serial port setting on the master, the updated configuration files will be sent out to each slave in parallel. Each slave will then automatically make changes to their local configurations (and only make those changes that relate to its particular serial ports).

You can still use the local slave Management Console to change the settings on any slave serial port (such as alter the baud rates). However these changes will be overwritten next time the master sends out a configuration file update.

Also while the master is in control of all slave serial port related functions, it is not master over the slave network host connections or over the slave console server system itself.

So slave functions such as IP, SMTP & SNMP Settings, Date &Time, DHCP server must be managed by accessing each slave directly and these functions are not over written when configuration changes are propagated from the master. Similarly the slaves Network Host and IPMI settings have to be configured at each slave.

Also the master's Management Console provides a consolidated view of the settings for its own and the entire slave's serial ports, however the master does not provide a fully consolidated view. For example if you want to find out who's logged in to cascaded serial ports from the master, you'll see that **Status > Active Users** only displays those users active on the master's ports, so you may need to write custom scripts to provide this view. This is covered in chapter 10.

3.7. Serial port redirection (PortShare)

Opengear's *PortShare* software delivers the virtual serial port technology your Windows and Linux applications need to open remote serial ports and read the data from serial devices that are connected to your *console server*.

PortShare is supplied free with each console server and you are licensed to install PortShare on one or more computers for accessing any serial device connected to a console server port.

PortShare for Windows
The `portshare_setup.exe` program is included on the CD supplied with your *console server*. A copy can be freely downloaded from the ftp site. Refer to the PortShare User Manual and Quick Start for details on installation and operation.

PortShare for Linux
The *PortShare* driver for Linux maps the console server serial port to a host `tty` port. Opengear has released the portshare-serial-client as an open source utility for Linux, AIX, HPUX, SCO, Solaris and UnixWare. This utility can be freely downloaded from the ftp site.

The *PortShare* serial port redirector allows you to use a serial device connected to the remote console server as if it were connected to your local serial port. The `portshare-serial-client` creates a pseudo tty port, connects the serial application to the pseudo tty port, receives data from the pseudo tty port, transmits it to the *console server* through network and receives data from the *console server* through network and transmits it to the pseudo-tty port.

The `.tar` file can be freely downloaded from the ftp site. Refer to the PortShare User Manual and Quick Start for details on installation and operation.

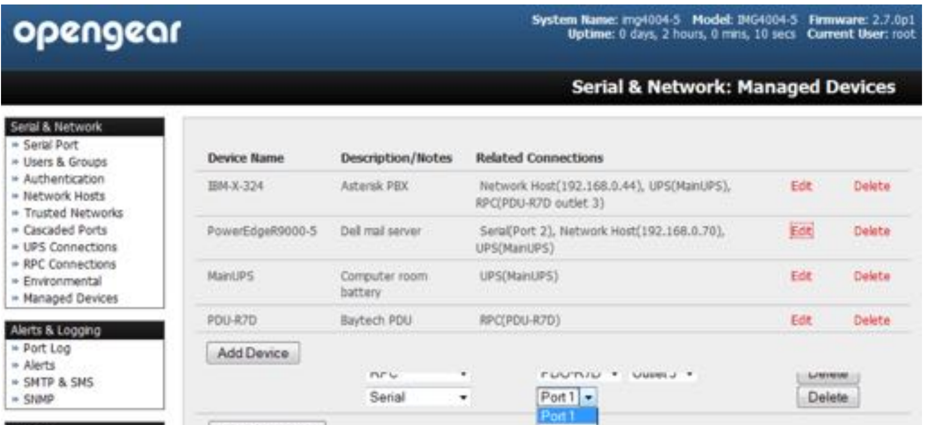
3.8. Managed devices

Managed Devices presents a consolidated view of all the connections to a device that can be accessed and monitored through the console server. To view the connections to the devices:

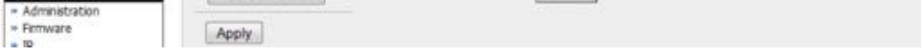
- Select **Serial & Network > Managed Devices**.

This screen displays all the Managed Device with their Description, Notes and lists of all the configured Connections:

Serial Port #	if serially connected.
USB	if USB connected.
IP Address	if network connected.
Power PDU/outlet	if applicable.
UPS connections	if applicable.



Device Name	Description/Notes	Related Connections		
IBM-X-324	Asterisk PBX	Network Host(192.168.0.44), UPS(MainUPS), RPC(PDU-R7D outlet 3)	Edit	Delete
PowerEdgeR9000-5	Dell mail server	Serial(Port 2), Network Host(192.168.0.70), UPS(MainUPS)	Edit	Delete
MainUPS	Computer room battery	UPS(MainUPS)	Edit	Delete
PDU-R7D	Baytech PDU	RPC(PDU-R7D)	Edit	Delete

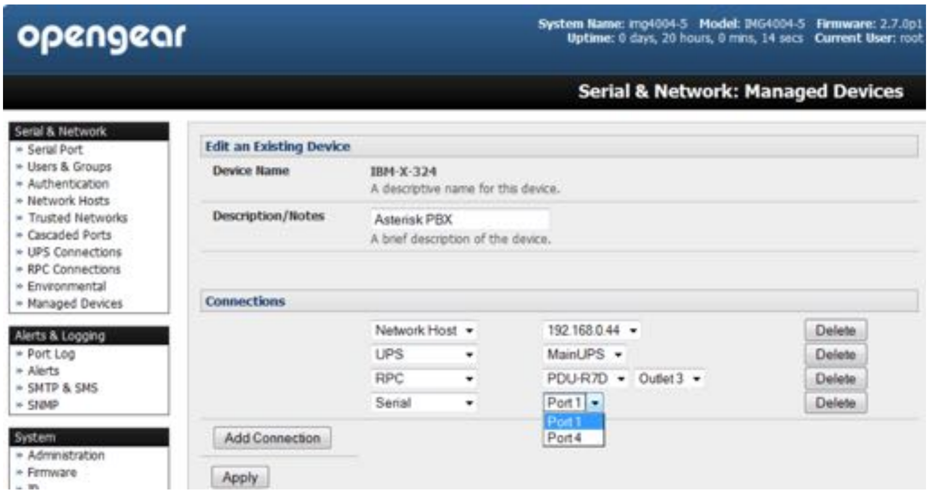


Devices such as servers will commonly have more than one power connection and more than one network connection (for example, for BMC/service processor).

All users can view (but not edit) these Managed Device connections by selecting **Manage > Devices**. The *Administrator* can edit, add to and delete Managed Devices and connections.

To edit an existing device and add a new connection:

- Select **Serial & Network > Managed Devices**.
- Click **Edit**.
- Click **Add Connection**.
- Select the connection type for the new connection (Serial, Network Host, UPS or RPC).
- Select the specific connection from the presented list of configured unallocated hosts/ports/outlets.



System Name: img4004-5 Model: IMG4004-5 Firmware: 2.7.0p1
Uptime: 0 days, 20 hours, 0 mins, 14 secs Current User: root

Serial & Network: Managed Devices

Edit an Existing Device

Device Name: IBM-X-324
A descriptive name for this device.

Description/Notes: Asterisk PBX
A brief description of the device.

Connections

Network Host	192.168.0.44	
UPS	MainUPS	
RPC	PDU-R7D	Outlet 3
Serial	Port 1 Port 1 Port 4	

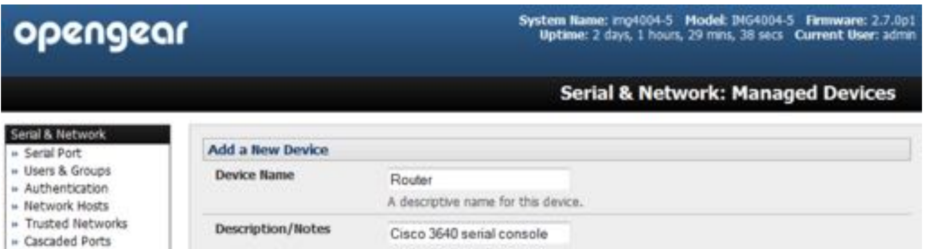
To add a new network connected Managed Device:

- The *Administrator* adds a new network connected Managed Device using **Add Host** on the **Serial & Network > Network Host** menu. This automatically creates a corresponding new Managed Device (as covered in chapter 3.4).
- When adding a new network connected RPC or UPS power device, you set up a Network Host, designate it as RPC or UPS, then go to **RPC Connections** (or **UPS Connections**) to configure the relevant connection.
- A corresponding new Managed Device (with the same *Name* and *Description* as the RPC/UPS Host) is not created until this connection step is completed (see chapter 8).

Note: the outlet names on a newly created PDU will, by default, be "Outlet 1" and "Outlet 2". When you connect an particular Managed Device (that draws power from the outlet) the outlet will take up the name of the powered Managed Device.

To add a new serially connected Managed Device:

- Configure the serial port using the **Serial & Network > Serial Port** menu (see chapter 3.1).
- Select **Serial & Network > Managed Devices**.



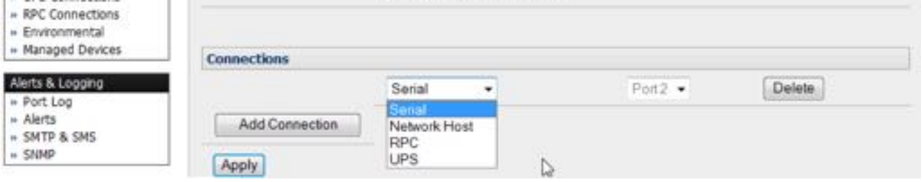
System Name: img4004-5 Model: IMG4004-5 Firmware: 2.7.0p1
Uptime: 2 days, 1 hours, 29 mins, 38 secs Current User: admin

Serial & Network: Managed Devices

Add a New Device

Device Name: Router
A descriptive name for this device.

Description/Notes: Cisco 3640 serial console



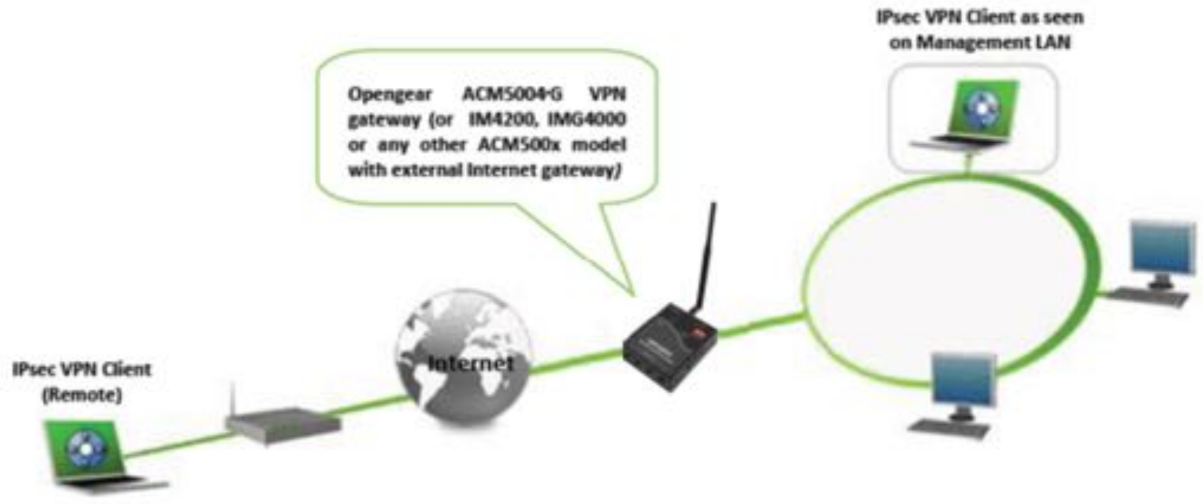
- Click **Add Device**.
- Enter a *Device Name* and *Description* for the Managed Device.
- Click **Add Connection** and select *Serial* and the *Port* that connects to the Managed Device.
- click **Add Connection** to add a UPS/RPC power connection or network connection or another serial connection.
- Click **Apply**.

Note: To set up a new serially connected RPC UPS or EMD device, you configure the serial port, designate it as a Device then enter a Name and Description for that device in the Serial & Network: RPC Connections (or UPS Connections or Environmental). When applied, this will automatically create a corresponding new Managed Device with the same Name and Description as the RPC/UPS Host (see chapter 7).

Note: the outlet names on the PDU will, by default, be "Outlet 1" and "Outlet 2". When you connect a particular Managed Device (that draws power from the outlet) the outlet will take up the name of the powered Managed Device.

3.9. IPsec VPN

The ACM7000, ACM5500, ACM5000, CM7100, IM7200 and IM4200 family of advanced console servers include Openswan, a Linux implementation of the IPsec (IP Security) protocols, which can be used to configure a Virtual Private Network (VPN). The VPN allows multiple sites or remote administrators to access the Opengear advanced console server (and Managed Devices) securely over the Internet.


IPsec VPN Client as seen on Management LAN
Opengear ACM5004-G VPN gateway (or IM4200, IMG4000 or any other ACM500x model with external Internet gateway)
Internet
IPsec VPN Client (Remote)

The *administrator* can establish an encrypted authenticated VPN connections between advanced console serves distributed at remote sites and a VPN gateway (such as Cisco router running IOS IPsec) on their central office network.

Users and *administrators* at the central office can then securely access the remote *console servers* and connected serial console devices and machines on the Management LAN subnet at the remote location as though they were local.

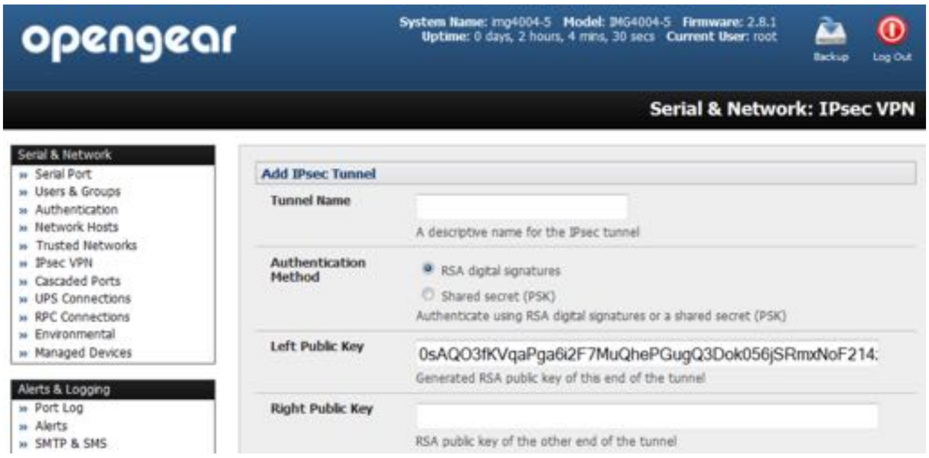
With serial bridging, serial data from controller at the central office machine can be securely connected to the serially controlled devices at the remote sites (see chapter 3.1.)

The road warrior administrator can use a VPN IPsec software client such as TheGreenBow (https://thegreenbow.com/) or Shrew Soft (https://shrew.net/) to remotely access the advanced console server and every machine on the Management LAN subnet at the remote location.

Configuration of IPsec is quite complex so Opengear provides a simple GUI interface for basic set up as described below. However for more detailed information on configuring Openswan IPsec at the command line and interconnecting with other IPsec VPN gateways and road warrior IPsec software see http://wiki.openswan.org and http://opengear.com/faq.html.

3.9.1. Enable the VPN gateway

- Select **Serial & Networks > IPsec VPN**.
- Click **Add**.
- complete the **Add IPsec Tunnel** screen.
- Enter a descriptive name to identify the added IPsec Tunnel. For example *West-St-Outlet*.
- Select the Authentication Method: either *RSA digital signatures* or a *Shared secret (PSK)*.



System Name: img4004-5 Model: IMG4004-5 Firmware: 2.8.1
Uptime: 0 days, 2 hours, 4 mins, 30 secs Current User: root

Add IPsec Tunnel

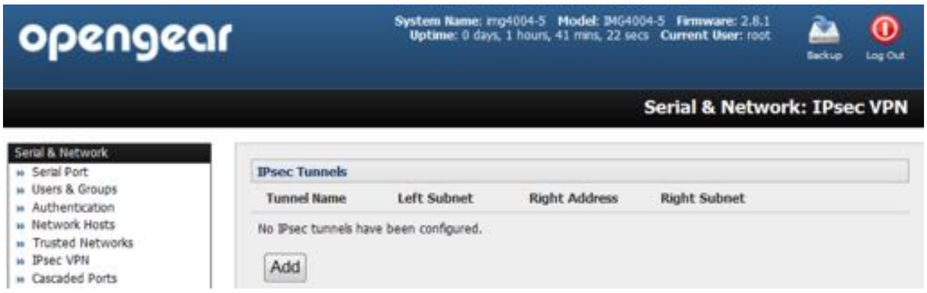
Tunnel Name
A descriptive name for the IPsec tunnel

Authentication Method
● RSA digital signatures
○ Shared secret (PSK)
Authenticate using RSA digital signatures or a shared secret (PSK)

Left Public Key: 0sAQO3fKVqaPga6i2F7MuQhePGugQ3Dok056jSRmxNoF214
Generated RSA public key of this end of the tunnel

Right Public Key
RSA public key of the other end of the tunnel

If you select RSA you will asked to click here to generate keys. This will generate an RSA public key for the console server (the *Left Public Key*). You will need to find out the key to be used on the remote gateway, then cut and paste it into the *Right Public Key*.



System Name: img4004-5 Model: IMG4004-5 Firmware: 2.8.1
Uptime: 0 days, 1 hours, 41 mins, 22 secs Current User: root

IPsec Tunnels

Tunnel Name	Left Subnet	Right Address	Right Subnet

No IPsec tunnels have been configured.

If you select Shared secret you will need to enter a *Pre-shared secret (PSK)*. The PSK must match the PSK configured at the other end of the tunnel.

- In *Authentication Protocol* select the authentication protocol to be used. Either authenticate as part of ESP (*Encapsulating Security Payload*) encryption or separately using the AH (*Authentication Header*) protocol.
- Enter a *Left ID* and *Right ID*. This is the identifier that the Local host/gateway and remote host/gateway use for IPsec negotiation and authentication.

  Each ID must include an @ and can include a fully qualified domain name preceded by @ (for example, left@example.com).
- Enter the public IP or DNS address of this Opengear VPN gateway as the *Left Address*. You can leave this blank to use the interface of the default route.
- In *Right Address*, if the remote end has a static or dyndns address, enter the public IP or DNS address of the remote end of the tunnel. Otherwise leave this blank.
- If the Opengear VPN gateway serves as a VPN gateway to a local subnet (eg, the *console server* has a Management LAN configured) enter the private subnet details in *Left Subnet*.

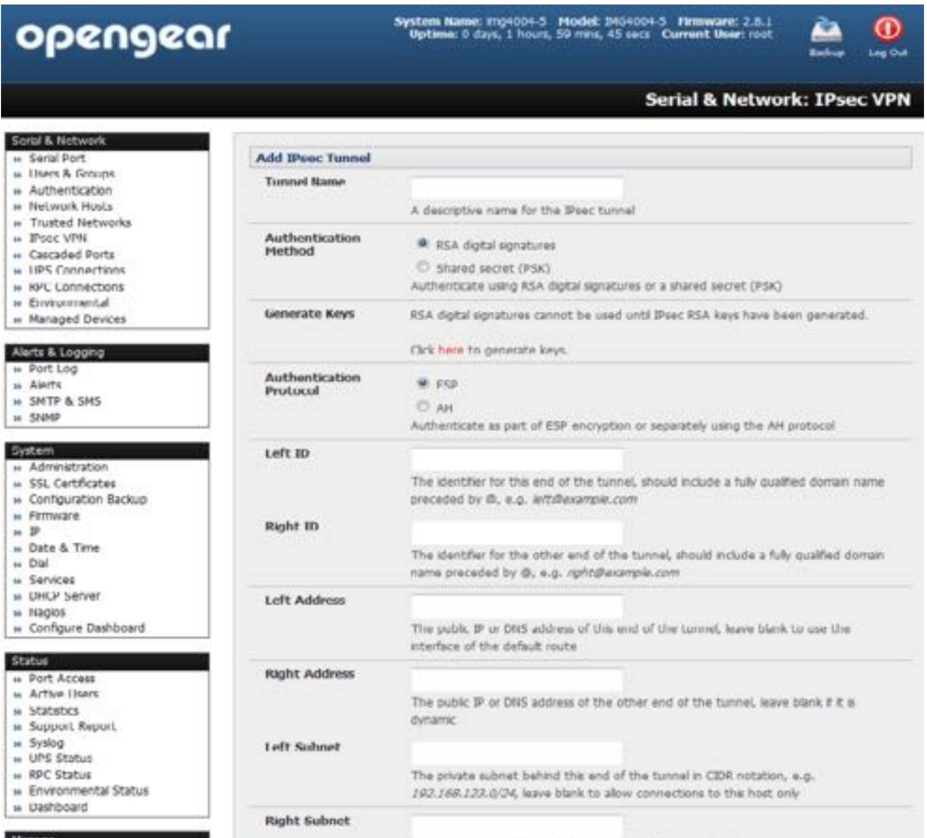
  Use the CIDR notation, where the IP address number is followed by a slash and the number of 'one' bits in the binary notation of the netmask.

  For example 192.168.0.0/24 indicates an IP address where the first 24 bits are used as the network address. This is the same as 255.255.255.0.

  If the VPN access is only to the *console server* itself and to its attached serial console devices then leave *Left Subnet* blank.
- If there is a VPN gateway at the remote end, enter the private subnet details in *Right Subnet*.

  Again use CIDR notation and leave blank if there is only a remote host.
- Select **Initiate Tunnel** if the tunnel connection is to be initiated from the Left console server end.

  This can only be initiated from the VPN gateway (Left) if the remote end was configured



System Name: img4004-5 Model: IM4004-5 Firmware: 2.8.1
Uptime: 0 days, 1 hours, 59 mins, 45 secs Current User: root

Add IPsec Tunnel

Tunnel Name
A descriptive name for the IPsec tunnel

Authentication Method
● RSA digital signatures
○ Shared secret (PSK)
Authenticate using RSA digital signatures or a shared secret (PSK)

Generate Keys
RSA digital signatures cannot be used until IPsec RSA keys have been generated.
Click here to generate keys.

Authentication Protocol
● ESP
○ AH
Authenticate as part of ESP encryption or separately using the AH protocol

Left ID
The identifier for this end of the tunnel, should include a fully qualified domain name preceded by @, e.g. *left@example.com*

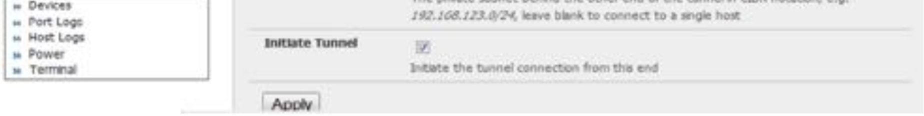
Right ID
The identifier for the other end of the tunnel, should include a fully qualified domain name preceded by @, e.g. *right@example.com*

Left Address
The public IP or DNS address of this end of the tunnel, leave blank to use the interface of the default route

Right Address
The public IP or DNS address of the other end of the tunnel, leave blank if it is dynamic

Left Subnet
The private subnet behind this end of the tunnel in CIDR notation, e.g. *192.168.123.0/24*, leave blank to allow connections to this host only

Right Subnet



192.168.123.0/24, leave blank to connect to a single host

Initiate Tunnel ☑ Initiate the tunnel connection from this end

with a static (or dyndns) IP address.

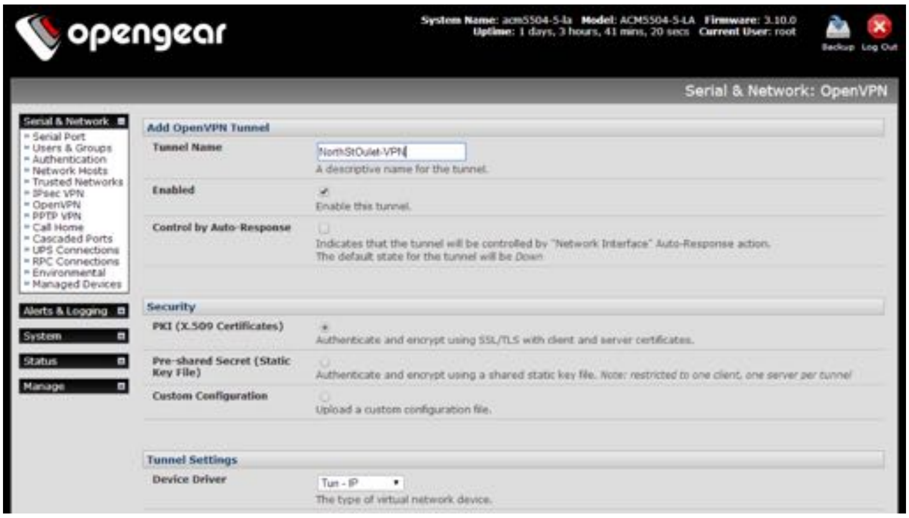
- Click **Apply** to save changes.

Note: It is essential the configuration details set up on the advanced console server (referred to as the Left or Local host) exactly matches the set up entered when configuring the Remote (Right) host/gateway or software client. Refer to the http://www.opengear.com/faq.html for details on configuring these remote ends.

3.10. OpenVPN

The ACM7000, ACM5500, ACM5000, CM7100, IM7200 and IM4200 family of advanced console servers with Firmware v3.2 and later, include OpenVPN. OpenVPN uses the OpenSSL library for encryption, authentication, and certification, which means it uses SSL/TSL (Secure Socket Layer/Transport Layer Security) for key exchange and can encrypt both data and control channels. Using OpenVPN allows for the building of cross-platform, point-to-point VPNs using either X.509 PKI (Public Key Infrastructure) or custom configuration files.

OpenVPN allows secure tunneling of data through a single TCP/UDP port over an unsecured network, thus providing secure access to multiple sites and secure remote administration to a console server over the Internet.



System Name: acm5504-5-la **Model:** ACM5504-5-LA **Firmware:** 3.10.0
Uptime: 1 days, 3 hours, 41 mins, 20 secs **Current User:** root

Add OpenVPN Tunnel

Tunnel Name NorthStOulet-VPN
A descriptive name for the tunnel.

Enabled ☑
Enable this tunnel.

Control by Auto-Response □
Indicates that the tunnel will be controlled by "Network Interface" Auto-Response action.
The default state for the tunnel will be *Down*

Security

PKI (X.509 Certificates) ●
Authenticate and encrypt using SSL/TLS with client and server certificates.

Pre-shared Secret (Static Key File) ○
Authenticate and encrypt using a shared static key file. *Note: restricted to one client, one server per tunnel*

Custom Configuration ○
Upload a custom configuration file.

Tunnel Settings

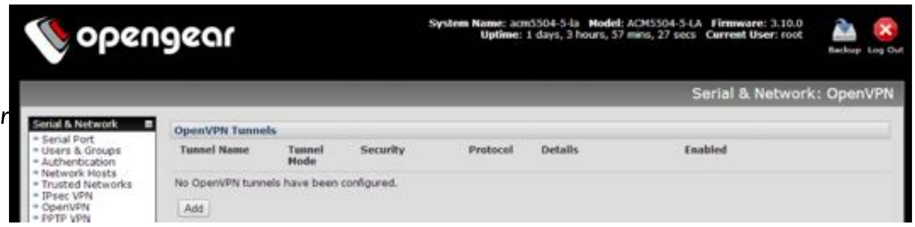
Device Driver Tun - IP
The type of virtual network device.

OpenVPN also allows the use of Dynamic IP addresses by both the server and client thus providing client mobility. For example, an OpenVPN tunnel may be established between a roaming windows client and an Opengear advanced console server within a data center.

Configuration of OpenVPN can be complex so Opengear provides a simple GUI interface for basic set up as described below. However for more detailed information on configuring OpenVPN Access server or client refer to the HOW TO and FAQs at https://openvpn.net/.

3.10.1. Enable the OpenVPN

- Select **Serial & Netwoks > OpenVPN**.
- Click **Add**.



System Name: acm5504-5-la **Model:** ACM5504-5-LA **Firmware:** 3.10.0
Uptime: 1 days, 3 hours, 57 mins, 27 secs **Current User:** root

OpenVPN Tunnels

Tunnel Name	Tunnel Mode	Security	Protocol	Details	Enabled

No OpenVPN tunnels have been configured.

- Fill-out the required fields on the **Add OpenVPN Tunnel** screen.
- Enter a descriptive name to identify the added IPsec Tunnel. For example *West-St-Outlet*.
- Select the authentication method to be used.

  To authenticate using certificates select *PKI (X.509 Certificates)*.

  To authenticate using a custom configuration select *Custom Configuration* to upload custom configuration files.

Note: Custom configurations must be stored in `/etc/config`.

If you select PKI (public key infrastructure) you will need to establish:

- a separate certificate (also known as a public key).

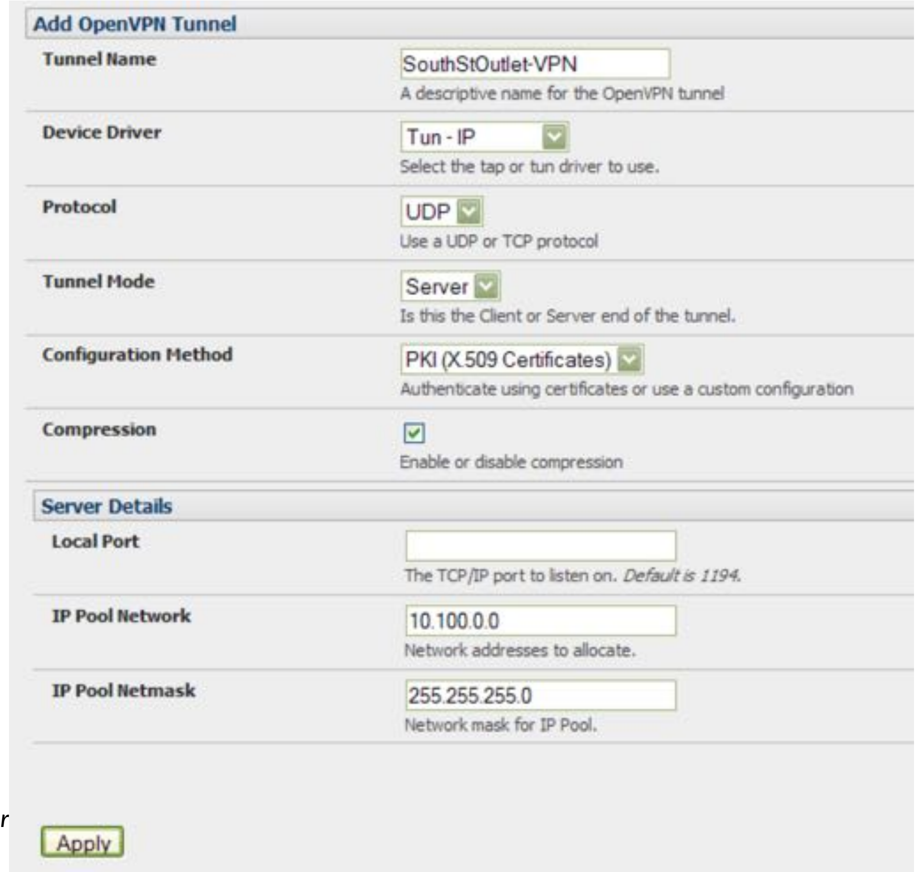
  This Certificate File will be a `*.crt` file type.
- a Private Key for the server and each client.

  This Private Key File will be a `*.key` file type.
- A master Certificate Authority (CA) certificate and key which is used to sign each of the server and client certificates.

  This Root CA Certificate will be a `*.crt` file type.

For a server you may also need `dh1024.pem` (Diffie Hellman parameters).

See http://openvpn.net/easyrsa.html for a guide to basic RSA key management. For alternative authentication methods see http://openvpn.net/index.php/documentation/howto.html#auth. For more information also see http://openvpn.net/howto.html.



Add OpenVPN Tunnel

Tunnel Name	SouthStOutlet-VPN A descriptive name for the OpenVPN tunnel
Device Driver	Tun - IP Select the tap or tun driver to use.
Protocol	UDP Use a UDP or TCP protocol
Tunnel Mode	Server Is this the Client or Server end of the tunnel.
Configuration Method	PKI (X.509 Certificates) Authenticate using certificates or use a custom configuration
Compression	☑ Enable or disable compression

Server Details

Local Port	 The TCP/IP port to listen on. *Default is 1194.*
IP Pool Network	10.100.0.0 Network addresses to allocate.
IP Pool Netmask	255.255.255.0 Network mask for IP Pool.

- Select the **Device Driver** to be used, either *Tun-IP* or *Tap-Ethernet*.

  The TUN (network tunnel) and TAP (network tap) drivers are virtual network drivers that support IP tunneling and Ethernet tunneling, respectively. TUN and TAP are part of the Linux kernel.

- Select either *UDP* or *TCP* as the *Protocol*.

  UDP is the default and preferred protocol for OpenVPN.

- In **Tunnel Mode**, nominate whether this is the *Client* or *Server* end of the tunnel.

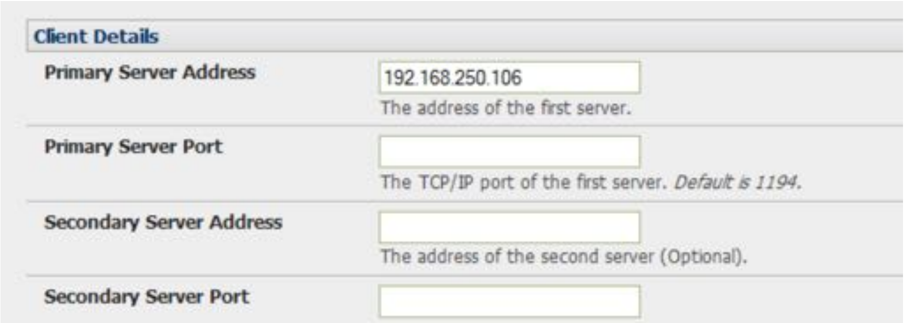
  When running as a server, the advanced console server supports multiple clients connecting to the VPN server over the same port.

- Check or uncheck the **Compression** button to enable or disable compression.

3.10.2. Configure as server or client

- Complete the **Client Details** or **Server Details** depending on the Tunnel Mode selected.

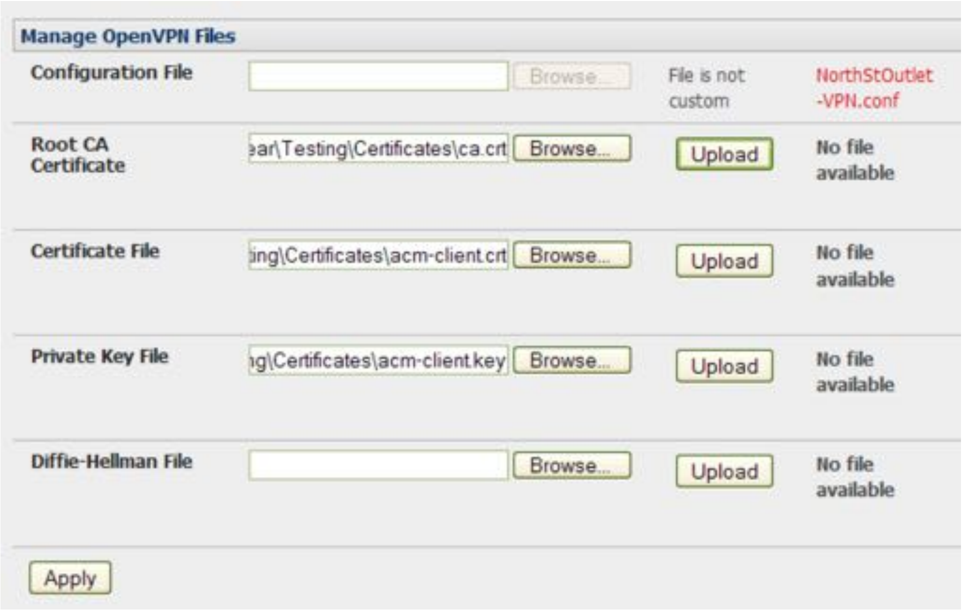
  If **Client** is selected, the *Primary Server Address* will be the address of the OpenVPN Server.



Client Details

Primary Server Address	192.168.250.106 The address of the first server.
Primary Server Port	The TCP/IP port of the first server. *Default is 1194.*
Secondary Server Address	The address of the second server (Optional).
Secondary Server Port	

If **Server** is selected, enter the IP Pool Network address and the IP Pool Network mask for the IP Pool. The IP Pool Network provides addresses for connecting clients.

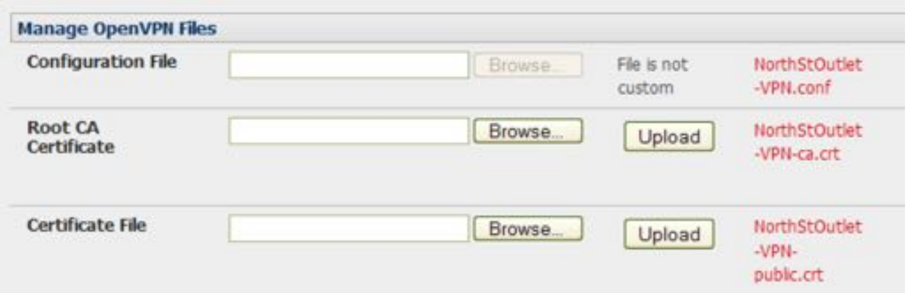


Manage OpenVPN Files

Configuration File		Browse...	File is not custom	NorthStOutlet-VPN.conf
Root CA Certificate	ear\Testing\Certificates\ca.crt	Browse...	Upload	No file available
Certificate File	ing\Certificates\acm-client.crt	Browse...	Upload	No file available
Private Key File	ng\Certificates\acm-client.key	Browse...	Upload	No file available
Diffie-Hellman File		Browse...	Upload	No file available

- Click **Apply**.
- To enter authentication certificates and files, **Edit** the OpenVPN tunnel.
- Select the **Manage OpenVPN Files** tab. Upload or browse to relevant authentication certificates and files.
- Click **Apply**.

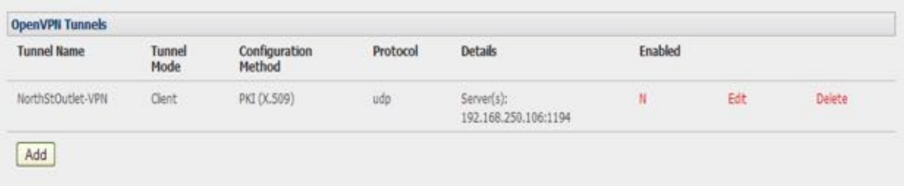
  Saved files will be displayed in red to the right-hand side of the Upload button.



Manage OpenVPN Files

Configuration File	Browse...	File is not custom	NorthStOutlet-VPN.conf
Root CA Certificate	Browse...	Upload	NorthStOutlet-VPN-ca.crt
Certificate File	Browse...	Upload	NorthStOutlet-VPN-public.crt

- To enable OpenVPN, **Edit** the OpenVPN tunnel.
- Check the **Enabled** checkbox.
- Click **Apply**.
- Select **Status > Statistics** to verify that the tunnel is operational.



OpenVPN Tunnels

Tunnel Name	Tunnel Mode	Configuration Method	Protocol	Details	Enabled		
NorthStOutlet-VPN	Client	PKI (X.509)	udp	Server(s): 192.168.250.106:1194	N	Edit	Delete

Add

Note: the **console server** *system time must be correct, otherwise authentication issues can arise.*

3.10.3. Windows OpenVPN client & server setup

Windows does not come standard with any OpenVPN server or client. This section outlines the installation and configuration of a Windows OpenVPN client or a Windows OpenVPN server and setting up a VPN connection to a console server.

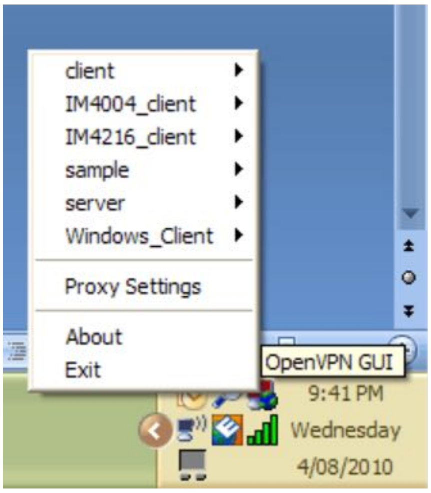
Console servers with firmware V3.5.2 and later will generate Windows client config automatically from the GUI for Pre-shared Secret (Static Key File) configurations.

Alternately *OpenVPN GUI for Windows* software (which includes the standard OpenVPN package plus a Windows GUI) can be downloaded from https://openvpn.net/.

Once installed on the Windows machine, an OpenVPN icon will present in the Notification Area located in the right side of the taskbar.

- Right click on this icon to start (and stop) VPN connections, and to edit configurations and view logs.

When the OpenVPN software is started, the `C:\Program Files\OpenVPN\config` folder will be scanned for `.opvn` files. This folder is rechecked for new configuration files whenever the OpenVPN GUI icon is right-clicked.



So once the OpenVPN client is installed, a configuration file will need to be created.

- Using a text editor, create an `xxxx.ovpn` file and save in `C:\Program Files\OpenVPN\config\`. For example, `C:\Program Files\OpenVPN\config\client.ovpn`.
- An example OpenVPN Windows client configuration file:

```
# description: IM4216_client
client
proto udp
verb 3
dev tun
remote 192.168.250.152
port 1194
ca c:\\openvpnkeys\\ca.crt
cert c:\\openvpnkeys\\client.crt
key c:\\openvpnkeys\\client.key
nobind
persist-key
persist-tun
comp-lzo
```

- An example OpenVPN Windows server configuration file:

```
server 10.100.10.0 255.255.255.0
port 1194
keepalive 10 120
proto udp
mssfix 1400
persist-key
persist-tun
dev tun
ca c:\\openvpnkeys\\ca.crt
cert c:\\openvpnkeys\\server.crt
key c:\\openvpnkeys\\server.key
dh c:\\openvpnkeys\\dh.pem
```

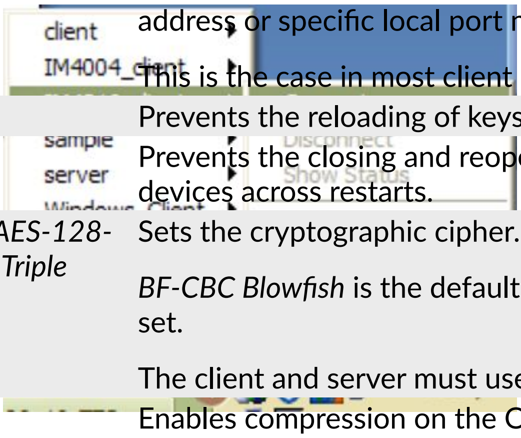
```
comp-lzo
verb 1
syslog IM4216_OpenVPN_Server
```

The Windows client/server configuration file options are:

options	description
# comments and notes	Lines beginning with # are ignored by OpenVPN.
client or server	Specify whether this will be a client or server configuration file. In the server configuration file, define the IP address pool and netmask. For example *server 10.100.10.0 255.255.255.0*
proto *[udp | tcp]*	Set the protocol. Client and server must be the same.
mssfix *size*	Set a packet's maximum size. Only useful for UDP if problems occur.
verb *level*	Set log-file verbosity. Values range from 0–15. 0 = silent except for fatal errors. 3 = medium output logging. Good for general use. 5 = helps with debugging connection problems. 9 = extremely verbose. Excellent for troubleshooting.
dev *[tun | tap]*	Set *dev tun* to create a routed IP tunnel. Set *dev tup* to create an Ethernet tunnel. Client and server must be the same.
remote *host*	Set the hostname or IP address of the OpenVPN server. Mandatory but a client-only setting.
Port	The UDP or TCP port of the OpenVPN server.
Keepalive *ping-value down-value*	Uses `ping` to keep the OpenVPN session alive. For example: `Keepalive 10 120` pings the server every ten seconds and assumes the remote peer is down if no ping is received after 120 seconds (two minutes).
http-proxy *proxy-server proxy-port-#*	If a proxy is required to access a server, enter the proxy-server's hostname or IP address and its port #.
ca *file-name*	Enter the CA certificate file name and location The same CA certificate can be used by the server and all clients. Ensure each \ in the directory path is escaped. For example `c:\openvpnkeys\ca.crt` must be entered as `c:\\openvpnkeys\\ca.crt`

cert *file-name*	Enter the client’s or server’s certificate file name and location Each client should have its own certificate and key files. As above, each \ in the directory path must be escaped.
key *file-name*	Enter the client’s or server’s key file name and location Each client should have its own certificate and key files. As above, each \ in the directory path must be escaped.
dh *file-name*	Enter the path to thekey with the Diffie-Hellman parameters. A server-only setting.
Nobind	Used when clients do not need to bind to a local address or specific local port number. This is the case in most client configurations.
persist-key	Prevents the reloading of keys across restarts.
persist-tun	Prevents the closing and reopening of TUN/TAP devices across restarts.
cipher *[BF-CBC Blowfish | AES-128-CBC AES | DES-EDE3-CBC Triple DES]*	Sets the cryptographic cipher. *BF-CBC Blowfish* is the default if no cipher is explicitly set. The client and server must use the same settings.
comp-lzo	Enables compression on the OpenVPN link.

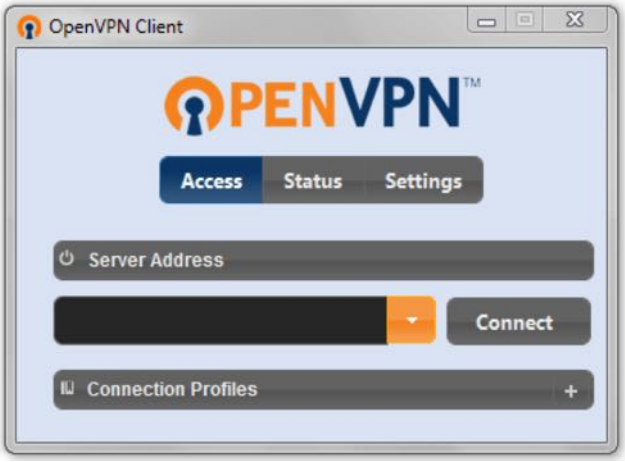
3. **Select** the newly created client or server configuration.



- Click **Connect** in the presented sub-menu.
- The log file will display as the connection is established.
- Once established, the OpenVPN icon will display a message notifying of the successful connection and assigned IP.

  This information, as well as the time the connection was established, is available anytime by scrolling over the OpenVPN icon.

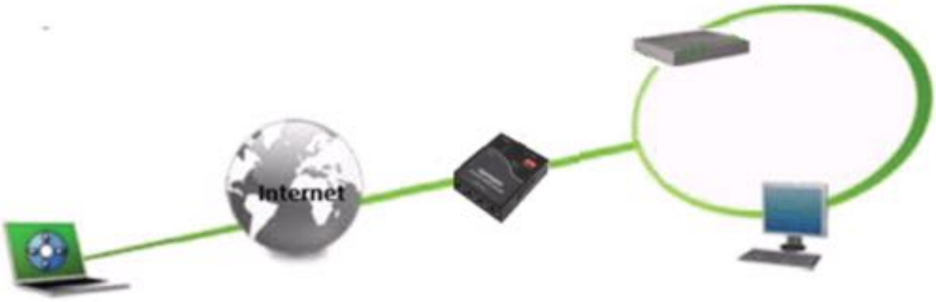
Note: An alternate, open-source OpenVPN Windows client can be downloaded from https://openvpn.net/index.php/open-source/downloads.html. See https://openvpn.net/index.php/access-server/docs for help.



3.11. PPTP VPN

The ACM7000, ACM5500, ACM5000, CM7100, IM7200 and IM4200 family of advanced *console servers* with firmware v3.5.2 and later, include a PPTP (Point-to-Point Tunneling Protocol) server.

PPTP is typically used for communications over a physical or virtual serial link. The PPP endpoints define a virtual IP address to themselves. Routes to networks can then be defined with these IP addresses as the gateway, which results in traffic being sent across the tunnel. PPTP establishes a tunnel between the physical PPP endpoints and securely transports data across the tunnel.



The strength of PPTP is its ease of configuration and integration into existing Microsoft infrastructure. It is generally used for connecting single remote Windows clients.

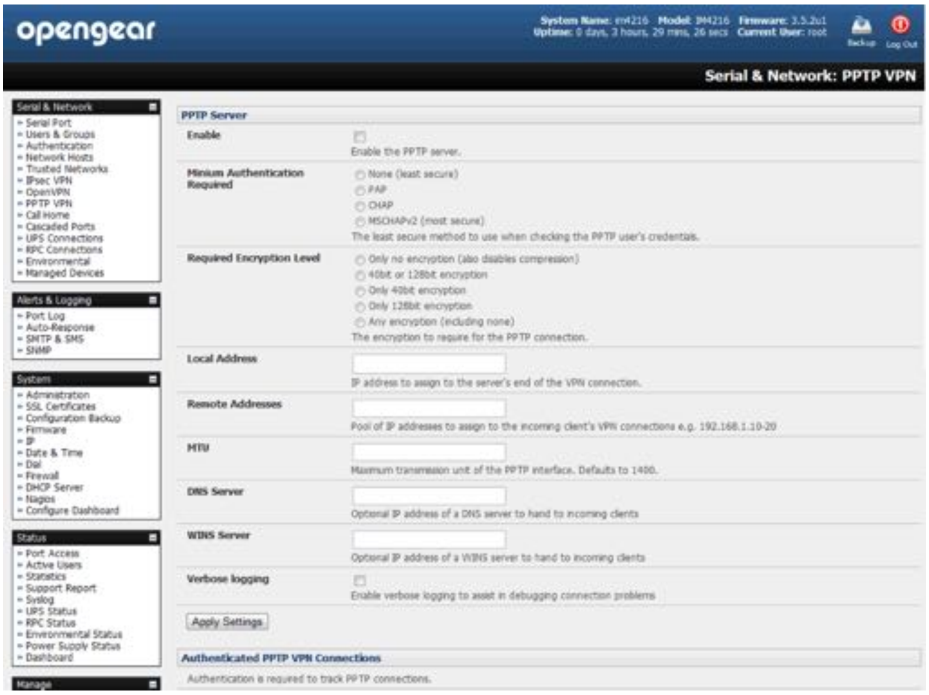
If you take your portable computer on a business trip, you can dial a local number to connect to your Internet access service provider (ISP) and then create a second connection (tunnel) into your office network across the Internet and have the same access to your corporate network as if you were connected directly from your office. Similarly, telecommuters can also set up a VPN tunnel over their cable modem or DSL links to their local ISP.

To set up a PPTP connection from a remote Windows client to your Opengear appliance and local network:

- Enable and configure the PPTP VPN server on your Opengear appliance.
- Set up VPN user accounts on the Opengear appliance and enable the appropriate authentication.
- Configure the VPN clients at the remote sites. The client does not require special software as the PPTP Server supports the standard PPTP client software included with Windows NT and later.
- Connect to the remote VPN.

3.11.1. Enable the PPTP VPN server

- Select **PPTP VPN** on the **Serial & Networks** menu.
- Click the *Enable* check box to enable the PPTP Server.



System Name: im4216 Model: IM4216 Firmware: 3.5.2u1
Uptime: 0 days, 3 hours, 29 mins, 26 secs Current User: root

PPTP Server

Enable □
Enable the PPTP server.

Minium Authentication Required
○ None (least secure)
○ PAP
○ CHAP
○ MSCHAPv2 (most secure)
The least secure method to use when checking the PPTP user's credentials.

Required Encryption Level
○ Only no encryption (also disables compression)
○ 40bit or 128bit encryption
○ Only 40bit encryption
○ Only 128bit encryption
○ Any encryption (including none)
The encryption to require for the PPTP connection.

Local Address
IP address to assign to the server's end of the VPN connection.

Remote Addresses
Pool of IP addresses to assign to the incoming client's VPN connections e.g. 192.168.1.10-20

MTU
Maximum transmission unit of the PPTP interface. Defaults to 1400.

DNS Server
Optional IP address of a DNS server to hand to incoming clients

WINS Server
Optional IP address of a WINS server to hand to incoming clients

Verbose logging □
Enable verbose logging to assist in debugging connection problems

Authenticated PPTP VPN Connections

Authentication is required to track PPTP connections.

- Select the *Minimum Authentication Required*.

  Access is denied to remote users attempting to connect using an authentication scheme weaker than the selected scheme. From strongest to weakest, the schemes are:

  Encrypted Authentication (MS-CHAP v2). The strongest and recommended authentication option.

Weakly Encrypted Authentication (CHAP). This is the weakest type of encrypted password authentication to use. It is not recommended that clients connect using this as it provides very little password protection. Also note that clients connecting using CHAP are unable to encrypt traffic.

Unencrypted Authentication (PAP). This is plain text password authentication. When using this type of authentication, the client password is transmitted unencrypted.

None. No encryption at all.

- Select the *Required Encryption Level*.

  Access is denied to remote users attempting to connect not using this encryption level. *40-bit or 128-bit encryption* is recommended.

- In *Local Address* enter the IP address to assign to the server's end of the VPN connection.
- In *Remote Addresses* enter the pool of IP addresses to assign to the incoming client's VPN connections (for example, 192.168.1.10-20).

  These must be free IP addresses, from the network (typically the LAN) that remote users are assigned while connected to the Opengear appliance.

- Enter the desired value of the Maximum Transmission Unit (MTU) for the PPTP interfaces into the *MTU* field (defaults to 1400).
- In the *DNS Server* field, enter the IP address of the DNS server that assigns IP addresses to connecting PPTP clients.
- In the *WINS Server* field, enter the IP address of the WINS server that assigns IP addresses to connecting PPTP client.
- Enable *Verbose Logging* to assist in debugging connection problems.
- Click **Apply**.

3.11.2. Add a PPTP user

- Navigate to **Serial & Networks > Users & Groups**.
- Complete the fields as covered in chapter 3.2.
- Ensure the *pptpd* Group has been checked, to allow access to the PPTP VPN server.

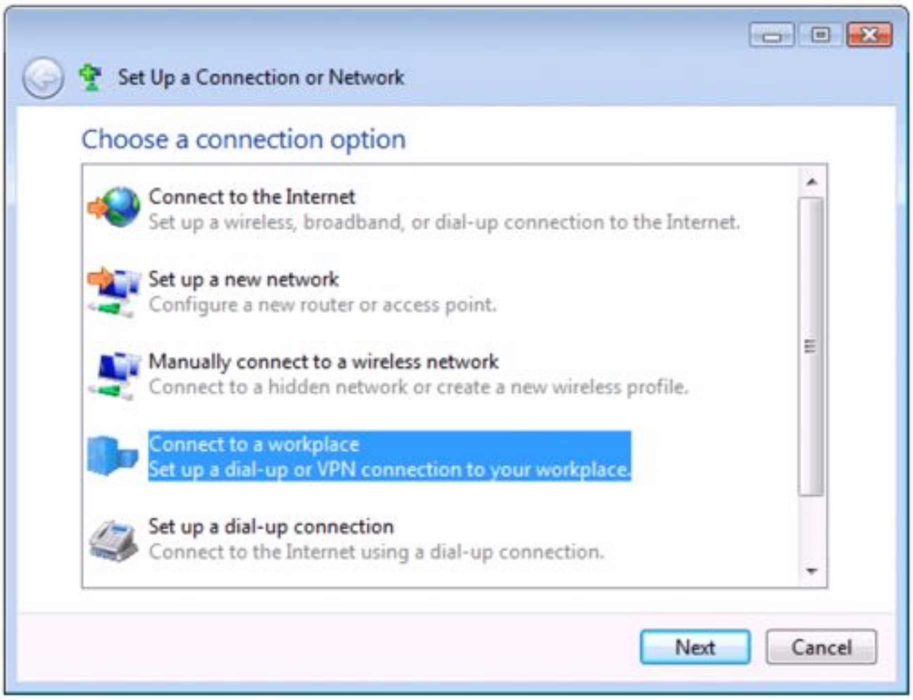
Note: users in this group will have their password stored in clear text.

- Keep note of the username and password for when you connect to the VPN connection.
- Click **Apply**.

3.11.3. Setup a remote PPTP client

Ensure the remote VPN client PC has Internet connectivity. To create a VPN connection across the Internet, you must set up two networking connections. One connection is for the ISP, and the other connection is for the VPN tunnel to the Opengear appliance.

Note: This procedure sets up a PPTP client under Windows 7 Professional. The steps may vary *slightly depending on your network access or if you are using a different version of Windows.*


Set Up a Connection or Network

Choose a connection option

Connect to the Internet
Set up a wireless, broadband, or dial-up connection to the Internet.

Set up a new network
Configure a new router or access point.

Manually connect to a wireless network
Connect to a hidden network or create a new wireless profile.

Connect to a workplace
Set up a dial-up or VPN connection to your workplace.

Set up a dial-up connection
Connect to the Internet using a dial-up connection.

- Login to your Windows system with administrator privileges.
- From the **Network & Sharing Center** in the **Control Panel** select **Network Connections** and create a new connection.
- Select **Use My Internet Connection (VPN)** and enter the IP Address of the Opengear appliance.

Note: *To connect remote VPN clients to the local network, you need to know the user name and password for the PPTP account you added, as well as the Internet IP address of the Opengear appliance. If your ISP has not allocated you a static IP address, consider using a dynamic DNS service. Otherwise you must modify the PPTP client configuration each time your Internet IP address changes.*

3.12. Call home

Console servers with firmware v3.2 and later include *Call Home*. *Call Home* sets up an SSH tunnel from the console server to a central Lighthouse VM, Lighthouse Standard, Lighthouse Enterprise, CMS6100 or VCMS server (referred to herein as *CMS*). The console server then registers as a *candidate* on the *CMS*. Once accepted it becomes a Managed Console Server.

The CMS will then monitor the Managed Console Server, and administrators can access the remote Managed Console Server, through the CMS. This access is available even when the remote console server is behind a third party firewall or has a private IP addresses (which is often the case when the console server is connected via a cellular modem connection).

CMS maintains public key authenticated SSH connections to each Managed Console Server. These connections are used for monitoring, commanding and accessing the Managed Console Servers and the Managed Devices connected to the Managed Console Server.

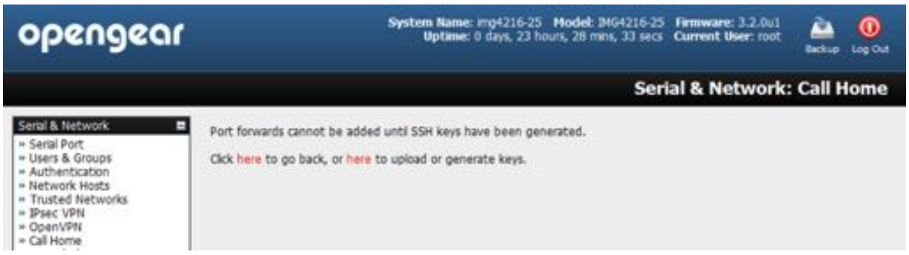
To manage Local Console Servers, or console servers that are reachable from the CMS, the SSH connections are initiated by CMS. To manage Remote Console Servers, or console servers that are firewalled, not routable, or otherwise unreachable from the CMS, the SSH connections are initiated by the Managed Console Server via an initial Call Home connection.

This ensures secure, authenticated communications and enables Managed Console Servers units to be distributed locally on a LAN, or remotely around the world.

3.12.1. Setup call home candidate

To set up the console server as a Call Home management candidate on the CMS:

- Select **Call Home** on the **Serial & Network** menu.

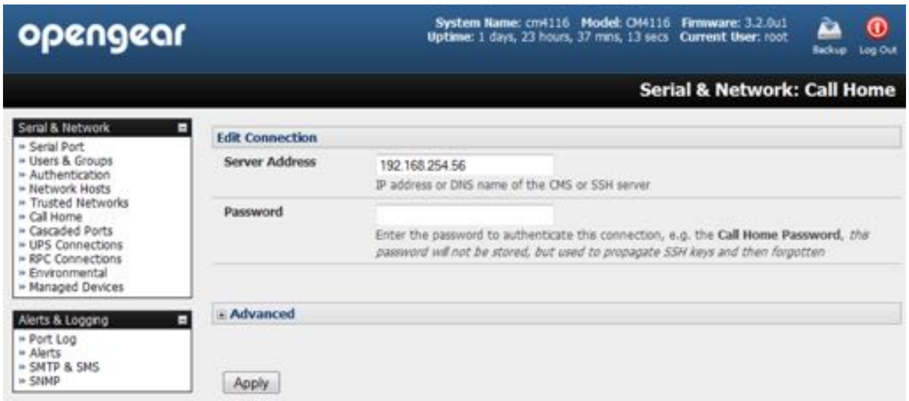


opengear
System Name: img4216-25 Model: IMG4216-25 Firmware: 3.2.0u1
Uptime: 0 days, 23 hours, 28 mins, 33 secs Current User: root
Backup
Log Out
Serial & Network: Call Home
Serial & Network
Serial Port
Users & Groups
Authentication
Network Hosts
Trusted Networks
IPsec VPN
OpenVPN
Call Home

Port forwards cannot be added until SSH keys have been generated.

Click here to go back, or here to upload or generate keys.

- If you have not already generated or uploaded an SSH key pair for this console server, you will need to do so before proceeding (see chapter 2).
- Click **Add**.



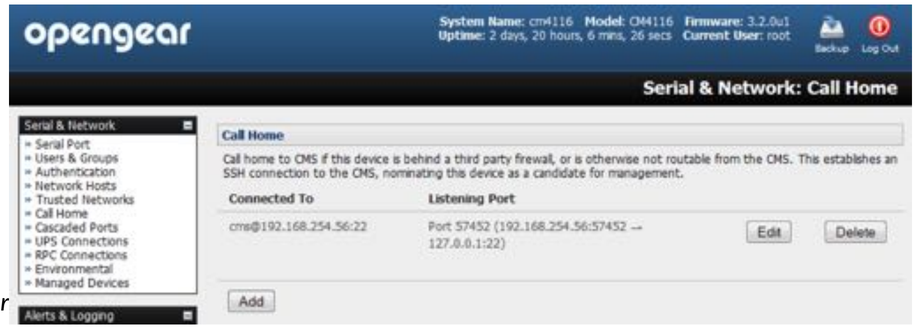
Edit Connection

Server Address: 192.168.254.56
IP address or DNS name of the CMS or SSH server

Password:
Enter the password to authenticate this connection, e.g. the **Call Home Password**, *the password will not be stored, but used to propagate SSH keys and then forgotten*

- Enter the *IP address* or *DNS name* (for example, the dynamic DNS address) of the CMS.
- Enter the *Password* that you configured on the CMS as the Call Home Password.
- Click **Apply**.

This initiates the Call Home connection from the *console server* to the CMS, creating an SSH



Call Home

Call home to CMS if this device is behind a third party firewall, or is otherwise not routable from the CMS. This establishes an SSH connection to the CMS, nominating this device as a candidate for management.

Connected To	Listening Port
cms@192.168.254.56:22	Port 57452 (192.168.254.56:57452 → 127.0.0.1:22)

listening port on the CMS, and setting the *console server* up as a candidate.

Once the candidate has been accepted (as outlined in the next section) an SSH tunnel to the *console server* is redirected back across the Call Home connection. The *console server* becomes a Managed Console Server and the CMS can connect to and monitor it through this tunnel.

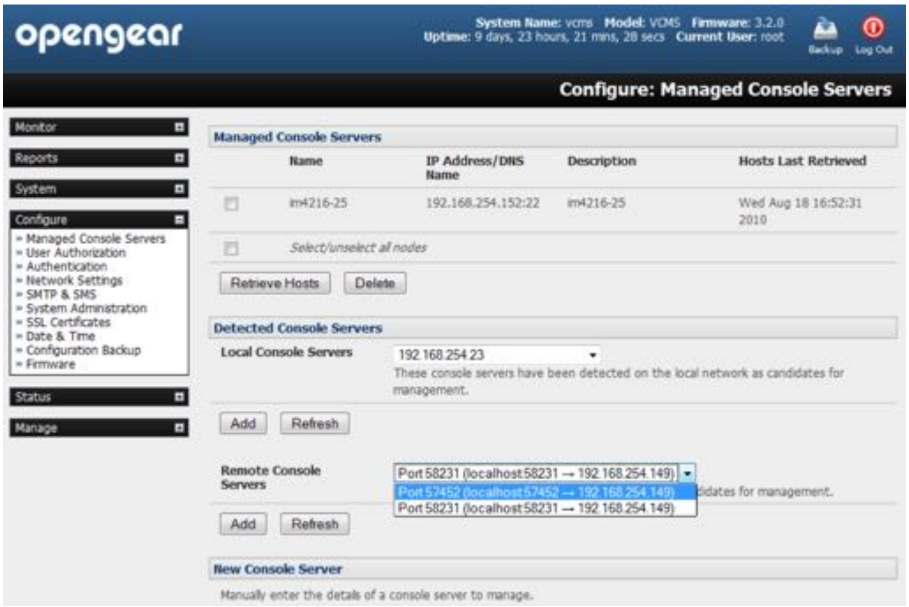
3.12.2. Accept call home candidates as managed consoles

This section gives an overview on configuring a CMS to monitor *console servers* that *Call Home*. For more details refer to the Lighthouse CMS User Manual.

Note: for a CMS to be contacted by the console server it must have a static IP address or, if using DHCP, use a dynamic DNS service.

Enter a *Call Home Password*. This is used to accept connections from candidate *console servers*.

The **Configure > Managed Console Servers** screen on the CMS shows the status of local and remote Managed Console Servers and candidates.



System Name: vcms **Model:** VCMS **Firmware:** 3.2.0
Uptime: 9 days, 23 hours, 21 mins, 28 secs **Current User:** root

Configure: Managed Console Servers

Managed Console Servers

	Name	IP Address/DNS Name	Description	Hosts Last Retrieved
□	im4216-25	192.168.254.152:22	im4216-25	Wed Aug 18 16:52:31 2010
□	*Select/unselect all nodes*			

Detected Console Servers

Local Console Servers: 192.168.254.23
These console servers have been detected on the local network as candidates for management.

Remote Console Servers: Port 58231 (localhost58231 → 192.168.254.149)
Port 57452 (localhost57452 → 192.168.254.149)
Port 58231 (localhost58231 → 192.168.254.149)
…idates for management.

New Console Server

Manually enter the details of a console server to manage.

The **Managed Console Server** section shows the console servers currently being monitored by the CMS.

The **Detected Console Servers** section shows the *Local Console Servers* drop down list (which lists all the *console servers* which are on the same subnet as the CMS but which not currently being monitored) and the *Remote Console Servers* drop down list (which lists all the *console servers* that have established a Call Home connection but which are not currently being monitored). Put another way, the *Remote Console Servers* drop down list lists CMS candidates.

To update either list, click **Refresh**.

To add a *console server* candidate to the **Managed Console Server** list:

- Select it from the **Remote Console Servers** drop down list.
- click **Add**.
- Enter the *IP Address* and *SSH Port* (if these fields have not been auto-completed).

- Enter a *Description* and unique *Name* for the Managed Console Server you are adding.
- Enter the *Remote Root Password* (that is, the System Password that has been set on this Managed Console Server).

  This password is used by the CMS to propagate auto generated SSH keys and then forgotten. It will not be stored.
- Click **Apply**.

  The CMS will now set up secure SSH connections to and from the Managed Console Server and will retrieve its Managed Devices, user account details and configured alerts.

3.12.3. Calling home to a generic central SSH server

If you are connecting to a generic SSH server (not a Lighthouse CMS) you may configure Advanced settings.

- Enter the *SSH Server Port* and *SSH User* to authenticate as.
- Enter the details for the SSH port forward(s) to create.

By selecting Listening Server, you may create a Remote port forward from the Server to this unit, or a Local port forward from this unit to the Server.

- Specify a *Listening Port* to forward from.

  Leave this field blank to allocate an unused port
- Enter the *Target Server* and *Target Port* that will be the recipient of forwarded connections.
- Click **Add**.

3.13. IP passthrough

IP Passthrough is used to make a modem connection (for example, the Opengear's internal cellular modem) appear like a regular Ethernet connection to a third-party downstream router, allowing the downstream router to use the Opengear's modem connection as a primary or backup WAN interface.

The Opengear provides the modem IP address and DNS details to the downstream device over DHCP and transparently passes network traffic to and from the modem and router.

While IP Passthrough essentially turns an Opengear into a modem-to-Ethernet half bridge, some specific layer 4 services (HTTP/HTTPS/SSH) may still be terminated at the Opengear (Service Intercepts). Also, services running on the Opengear can initiate outbound cellular connections independent of the downstream router.

This allows the Opengear to continue to be used for out-of-band management and alerting and also be managed via Lighthouse, while in IP Passthrough mode.

3.13.1. Downstream router setup

To use failover connectivity on the downstream router (aka Failover to Cellular or F2C), it must have two or more WAN interfaces.

Note: Failover in IP Passthrough context is performed entirely by the downstream router, and the built-in out-of-band failover logic on the Opengear itself is not available while in IP Passthrough mode.

- Connect an Ethernet WAN interface on the downstream router to the Opengear's Network Interface or Management LAN port with an Ethernet cable.
- Configure this interface on the downstream router to receive its network settings via DHCP.
- If failover is required, configure the downstream router for failover between its primary interface and the Ethernet port connected to the Opengear.

3.13.2. IP passthrough pre-requisite pre-configuration steps.

Configure the *Network Interface* and, where applicable, *Management LAN* interfaces with static network settings.

- Click **Serial & Network > IP**.
- For *Network Interface* and, where applicable, *Management LAN*, select *Static* for the *Configuration Method* and enter the network settings (see the chapter 2.3 for detailed instructions).
- For the interface connected to the downstream router, you may choose any dedicated private network. This network will only exist between the Opengear and downstream router and will not normally be accessible.
- For the other interface, configure it as you would per normal on the local network.
- For both interfaces, leave *Gateway* blank.

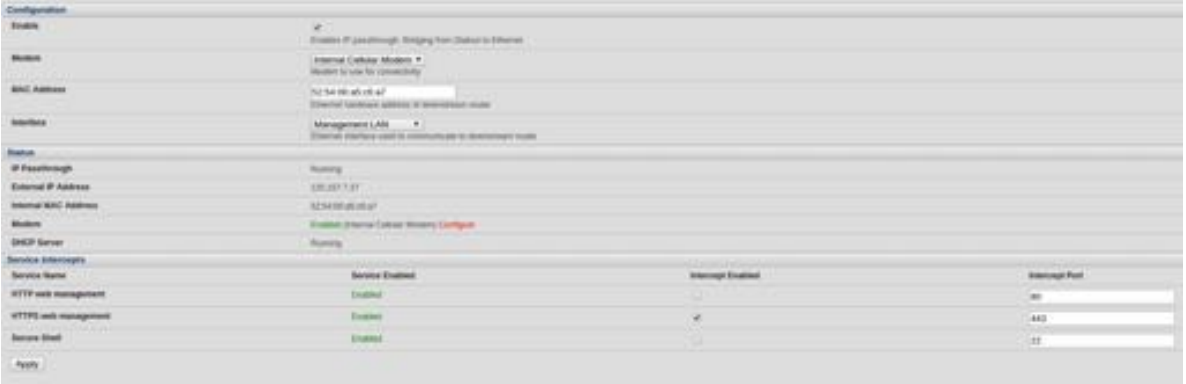
Configure the Opengear modem in Always On Out-of-band mode.

- For a cellular connection, click **System > Dial > Internal Cellular Modem**.
- Select *Enable Dial-Out* and enter carrier details such as *APN* (see chapter 4.6 for detailed instructions).

3.13.3. IP passthrough certification

To configure IP Passthrough:

- Click **Serial & Network > IP Passthrough**.



Configuration

Enable ☑
Enables IP passthrough. Bridging from Dialout to Ethernet

Modem: Internal Cellular Modem
Modem to use for connectivity

MAC Address: 52:54:00:a5:c6:a7
Ethernet hardware address of downstream router

Interface: Management LAN
Ethernet interface used to communicate to downstream router

Status

IP Passthrough	Running
External IP Address	120.157.7.37
Internal MAC Address	52:54:00:a5:c6:a7
Modem	Enabled (Internal Cellular Modem) Configure
DHCP Server	Running

Service Intercepts

Service Name	Service Enabled	Intercept Enabled	Intercept Port
HTTP web management	Enabled	☐	80
HTTPS web management	Enabled	☑	443
Secure Shell	Enabled	☐	22

- check **Enable**.
- Select the *Opengear Modem* to use for upstream connectivity.
- Optionally, enter the *MAC Address* of the downstream router's connected interface.

Note: if an MAC address is not specified, the Opengear will passthrough to the first downstream device requesting a DHCP address.

- Select the *Opengear Ethernet Interface* to use for connectivity to the downstream router
- Click **Apply**.

3.13.4. Service intercepts

These allow the Opengear to continue to provide services for e.g. out-of-band management when in IP Passthrough mode. Connections to the modem address on the specified intercept port(s) will be handled by the Opengear, rather than being passed through to the downstream router.

- For the required service of HTTP, HTTPS or SSH, check **Enable**.
- Optionally, modify the Intercept Port to an alternate port (for example, 8443 for HTTPS).

  Do this if you want the downstream router to remain accessible via its regular port.

3.13.5. IP passthrough status

- Refresh the page to view the **Status** section.

  It displays the modem's External IP Address being passed through, the Internal MAC Address of the downstream router (only populated when the downstream router accepts the DHCP lease), and the overall running status of the IP Passthrough service.

Additionally, you may be alerted to the failover status of the downstream router by configuring a *Routed Data Usage Check* under **Alerts & Logging > Auto-Response**.

3.13.6. Caveats

Some downstream routers may be incompatible with the gateway route. This may happen when IP Passthrough is bridging a 3G cellular network where the gateway address is a point-to-point destination address and no subnet information is available.

The *console server* sends a DHCP netmask of 255.255.255.255. Most devices read this as a *single host route*. As an unusual Ethernet setting, older devices may have issues, however.

Intercepts for local services will not work if the Opengear is using a default route other than the modem. As per normal operation, they will also not work unless the service is enabled and access to the service is enabled (see **System > Services > Service Access > Dialout/Cellular**).

Outbound connections originating from *consoler servers* to remote services are supported (for example, sending SMTP email alerts, SNMP traps, getting NTP time, and IPSec tunnels). There is, however, a miniscule risk of connection failure should both the *console server* and the downstream device try to access the same UDP or TCP port on the same remote host at the same time where they have randomly chosen the same originating local port number.

4. Firewall, failover, & OOB access

The *console server* has a number of out-of-band access capabilities and transparent fail-over features, to ensure high availability. So if there's difficulty in accessing the *console server* through the main network path, all *console server* models provide out-of-band (OOB) access and the Administrator can still access it (and its Managed Devices) from a remote location.

All *console server* models support serially attaching an external dial-up modem and configuring dial-in OOB access. Some models with USB ports support attaching an external USB modem. Some models also come standard with an internal modem. These modems can also be configured for dial-in OOB access.

All *console server* models with an internal or externally attached modem (and V3.4 firmware or later) can be configured for out-dial to be permanently connected .

The advanced console server models can also be configured for transparent out-dial failover. So in the event of a disruption in the principal management network, an external dial-up ppp connection is automatically established.

These advanced *console server* models can also be accessed out-of-band using an alternate broadband link and also offer transparent broadband failover.

Models with an internal cellular modem can be configured for OOB cellular access or for cellular transparent failover or can be configured as a cellular router.

4.1. Dial-up modem connection

To enable dial-in or dial-out you must first ensure there is a modem attached to the *console server*.

All IM4200 and IM7200 models, ACM5508-2-M and ACM5003-M come with an internal modem which can provide for OOB dial-in access. These models will display an Internal Modem Port tab under **System > Dial** as well as the **Serial DB9 Port** tab.

The other CM7100, ACM7000, ACM5500 and ACM5000 models also support external USB modems. The USB modem will be auto-detected and an External USB Modem Port tab will come up under **System > Dial** in addition to the **Serial DB9 Port** tab. All *console server* models support an external modem (any brand) attached via a serial cable to the console/modem port for OOB dial-in access.

The serial ports on the ACM7000, ACM5500 and ACM5000 are, by default, all configured as RJ serial Console Server ports. However Port 1 can be configured to be the Local Console/ Modem port.

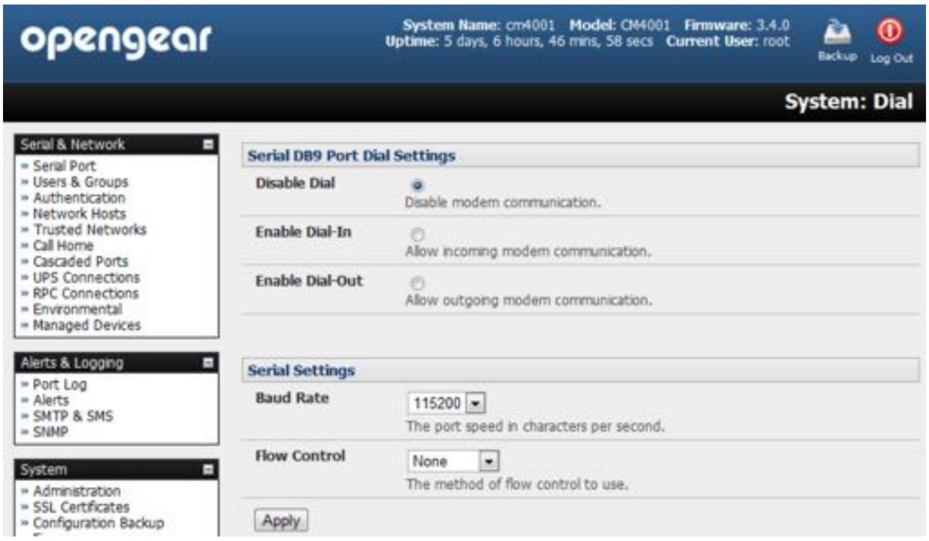
4.2. OOB dial-in access

Once a modem has been attached to the console server you can configure the *console server* for dial-in PPP access. The *console server* will then await an incoming connection from a dial-in at remote site. Next the remote client dial-in software needs to be configured to establish the connection between the *Administrator's* client modem to the dial in modem on the *console server*.

4.2.1. Configure dial-in PPP

Enable PPP access on the internal or externally attached modem:

- Navigate to **System > Dial**.



System Name: cm4001 Model: CM4001 Firmware: 3.4.0
Uptime: 5 days, 6 hours, 46 mins, 58 secs Current User: root

System: Dial

Serial DB9 Port Dial Settings

Disable Dial ● Disable modem communication.

Enable Dial-In ○ Allow incoming modem communication.

Enable Dial-Out ○ Allow outgoing modem communication.

Serial Settings

Baud Rate 115200 The port speed in characters per second.

Flow Control None The method of flow control to use.

Apply

- In the section appropriate to the port being configured (Serial DB9 Port or Internal Modem Port or External USB Port) Select the *Baud Rate* and *Flow Control* that will communicate with the modem.

  By default the modem port on all *console servers* is set with software flow control and the baud rate is set at:

  115200 baud for external modems connected to the local console port on CM7100, IM7200 and IM4200 console servers

9600 baud for the internal modem or external USB modem and for external modems connected to the Console serial ports which have been reassigned for dial-in access (on ACM5000, ACM5500 and ACM7000.

When enabling OOB dial-in it is recommended that the Serial Settings be changed to 38400 *Baud Rate* with Hardware *Flow Control*.

Note: *you can further configure the console/modem port (e.g. to include modem init strings) by editing* `/etc/mgetty.config` *files as described in the chapter 13*.

- Check the *Enable Dial-In Access* check box.
- In the *Remote Address* field, enter the IP address to be assigned to the dial-in client.

  You can select any address for the Remote IP Address. However it must be in the same network range as the Local IP Address (for example, 200.100.1.12 and 200.100.1.67).
- In the *Local Address* field enter the IP address for the Dial-In PPP Server.

  This is the IP address that will be used by the remote client to access console server once the modem connection is established. Again you can select any address for the Local IP Address but it must both be in the same network range as the Remote IP Address.
- The *Default Route* option sets the dialed PPP connection as the default *console server* route.
- The *Custom Modem Initialization* option allows a custom AT string modem initialization string to be entered (e.g. `AT&C1&D3&K3`).
- Select the *Authentication Type* required.

  Access is denied to remote users attempting to connect using an authentication scheme weaker than the selected scheme. The schemes, from strongest to weakest, are:

  Encrypted Authentication (MS-CHAP v2). Recommended. The strongest authentication.

  Weakly Encrypted Authentication (CHAP). This is the weakest encrypted password authentication to use. Not recommended as it provides very little password protection. Also note that clients connecting using CHAP are unable to encrypt traffic.

  Unencrypted Authentication (PAP). This is plain text password authentication. When using this type of authentication, the client password is transmitted unencrypted.

  None. No encryption at all.
- Select the *Required Encryption Level*. Access is denied to remote users attempting to connect not using this encryption level. *40 bit or 128 bit encryption* is recommended.

Note: *Firmware v3.5.2 and later support multiple dial-in users, setup with* `dialin` *Group membership. The User name and Password for the dial-in PPP link, and any dial-back phone numbers are configured during User set up. Earlier firmware only supports one PPP dial-in account.*

Chapter 14 has Linux command examples to control modem port operation at the shell.

4.2.2. Using SDT connector client

Administrators can use their *SDT Connector* client to set up secure OOB dial-in access to remote *console servers*. The *SDT Connector* Java client software provides point-and-click secure remote access. OOB access uses an alternate path for connecting to the console server to that used for regular data traffic.

Start an OOB connection in *SDT Connector* by initiating a dial-up connection, or adding an alternate route to the console server. *SDT Connector* allows for maximum flexibility in this regard, by allowing you to provide your own scripts or commands for starting and stopping the OOB connection. See chapter 5.5 for more.

4.2.3. Setup Windows XP or later client

Navigate to **Start Menu > Control Panel**.

Click **Network Connections**.

Click the **New Connection Wizard**.

Select *Connect to the Internet*

Click **Next**.

On the Getting Ready screen select *Set up my connection manually*.

Click **Next**.

On the Internet Connection screen select **Connect using a dial-up modem**.

Click **Next**.

Enter a *Connection Name* (any name you choose)

Enter the *dial-up Phone number* that will connect thru to the *console server* modem.

Enter the *PPP User name* and *Password* you have set up for the *console server*.

4.2.4. Setup earlier Windows clients

For Windows 2000, the PPP client set up procedure is the same as above, except you get to the **Dial-Up Networking Folder** by clicking **Start** and selecting **Settings**. Then click through **Network > Dial-up Connections > Make New Connection**.

4.2.5. Setup Linux clients

The online tutorial http://yolinux.com/TUTORIALS/LinuxTutorialPPP.html presents a selection of methods for establishing a dial up PPP connection.

- Command line PPP and manual configuration (which works with any Linux distribution).
- Using the `Linuxconf` configuration tool (for Red Hat compatible distributions).

  This configures the scripts `ifup` and `ifdown` to start and stop a PPP connection.
- Using the Gnome control panel configuration tool.
- Using WVDIAL and the Redhat Dialup configuration tool.
- Using the GUI dial program *X-isp*.

Note: for all PPP clients set up TCP/IP as the only protocol enabled; set the Server to assign IP address and do DNS; do not set **console server** *PPP as the default Internet connection.*

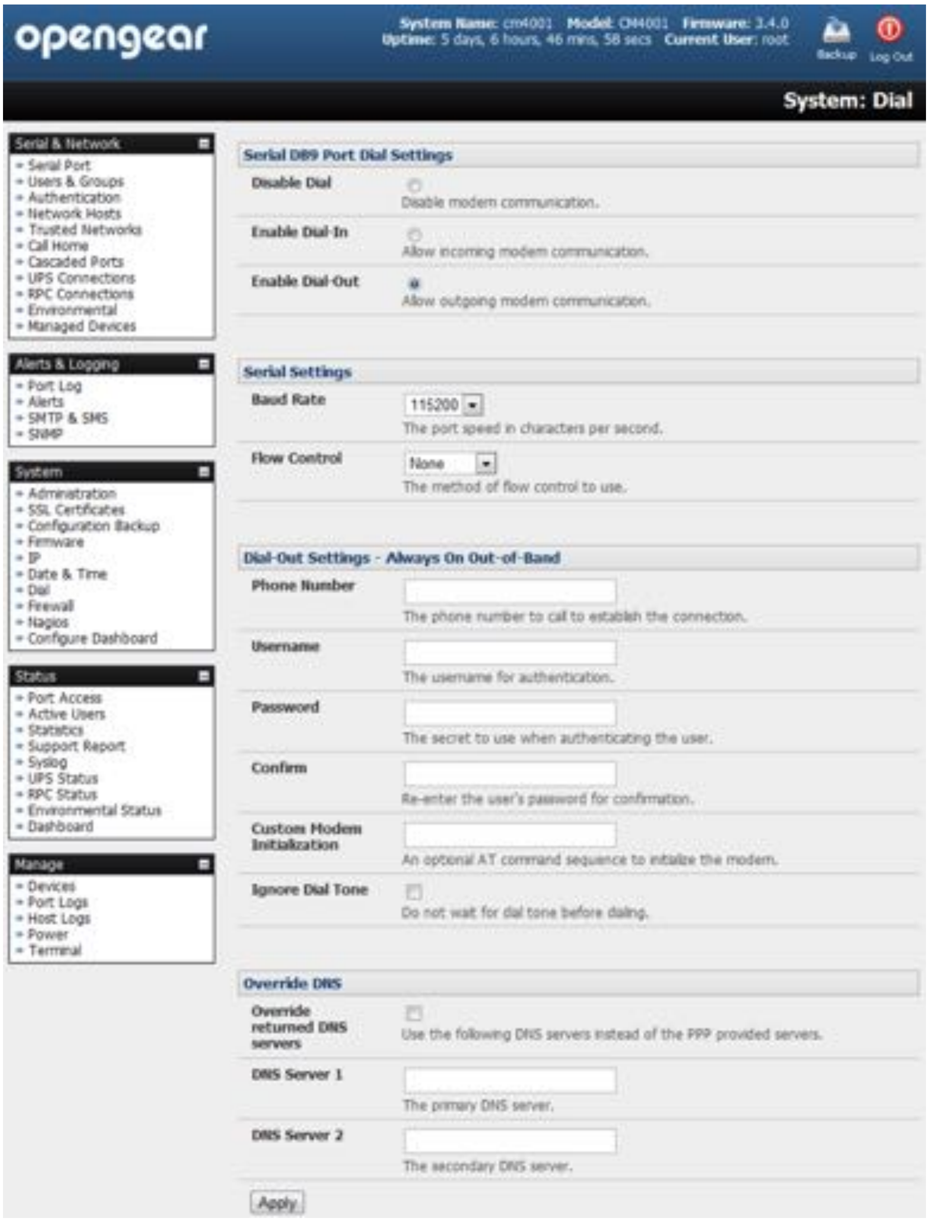
4.3. Dial-out access

A *console server* modem, internal or external, can be set in Failover mode (dialing-out after a `ping` failure) or with always-on dial-out. In either case, if disrupted, the *console server* tries to re-establish connection.

4.3.1. Always-on dial-out

With firmware v3.4 and later *console server* modems can be configured for always-on dial-out, with a permanent external dial-up ppp connection.

- Navigate to **System > Dial**.



System Name: cm4001 **Model:** CM4001 **Firmware:** 3.4.0
Uptime: 5 days, 6 hours, 46 mins, 58 secs **Current User:** root

System: Dial

Serial DB9 Port Dial Settings

Disable Dial ○ Disable modem communication.

Enable Dial-In ○ Allow incoming modem communication.

Enable Dial-Out ● Allow outgoing modem communication.

Serial Settings

Baud Rate 115200 The port speed in characters per second.

Flow Control None The method of flow control to use.

Dial-Out Settings - Always On Out-of-Band

Phone Number The phone number to call to establish the connection.

Username The username for authentication.

Password The secret to use when authenticating the user.

Confirm Re-enter the user's password for confirmation.

Custom Modem Initialization An optional AT command sequence to initialize the modem.

Ignore Dial Tone □ Do not wait for dial tone before dialing.

Override DNS

Override returned DNS servers □ Use the following DNS servers instead of the PPP provided servers.

DNS Server 1 The primary DNS server.

DNS Server 2 The secondary DNS server.

Opengear User Manual, page 109.

- check the *Enable Dial-Out* to allow outgoing modem communications.
- select the *Baud Rate* and *Flow Control* that will communicate with the modem.
- In the **Dial-Out Settings — Always On Out-of-Band** fields enter the access details for the remote PPP server to be called.

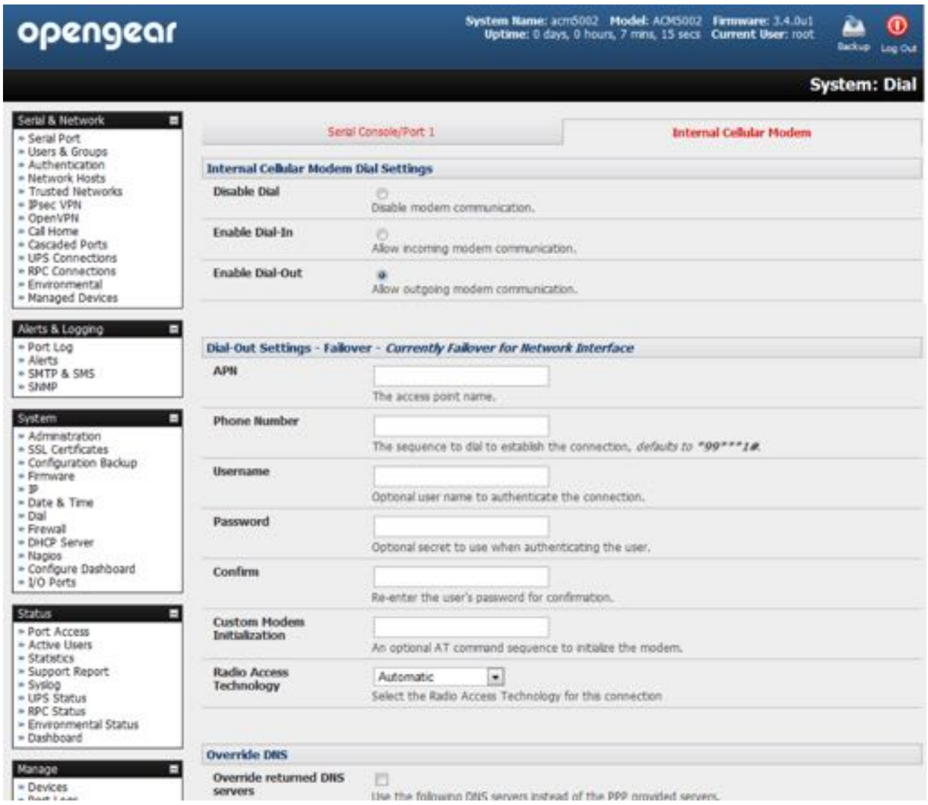
The **Override DNS** section is available for PPP Devices such as modems. **Override DNS** allows the use of alternate DNS servers from those provided by your ISP. For example, an alternative DNS may be required for OpenDNS used for content filtering.

To enable Override DNS:

- check the *Override returned DNS Servers* checkbox.
- Enter the IP address of the alternative DNS servers in the *DNS Server 1* and *DNS Server 2* entry fields.
- Click **Apply**.

4.3.2. Failover dial-out

The ACM7000, ACM5500, ACM5000, CM7100, IM7200 and IM4200 series of advanced *console servers* can be configured so a dial-out PPP connection is automatically set up in the event of a disruption in the principal management network.



System Name: acm5002 **Model:** ACM5002 **Firmware:** 3.4.0u1
Uptime: 0 days, 0 hours, 7 mins, 15 secs **Current User:** root

System: Dial

Internal Cellular Modem Dial Settings

Disable Dial ○ Disable modem communication.

Enable Dial-In ○ Allow incoming modem communication.

Enable Dial-Out ● Allow outgoing modem communication.

Dial-Out Settings - Failover - *Currently Failover for Network Interface*

APN The access point name.

Phone Number The sequence to dial to establish the connection, *defaults to "99***1#*.

Username Optional user name to authenticate the connection.

Password Optional secret to use when authenticating the user.

Confirm Re-enter the user's password for confirmation.

Custom Modem Initialization An optional AT command sequence to initialize the modem.

Radio Access Technology Automatic Select the Radio Access Technology for this connection

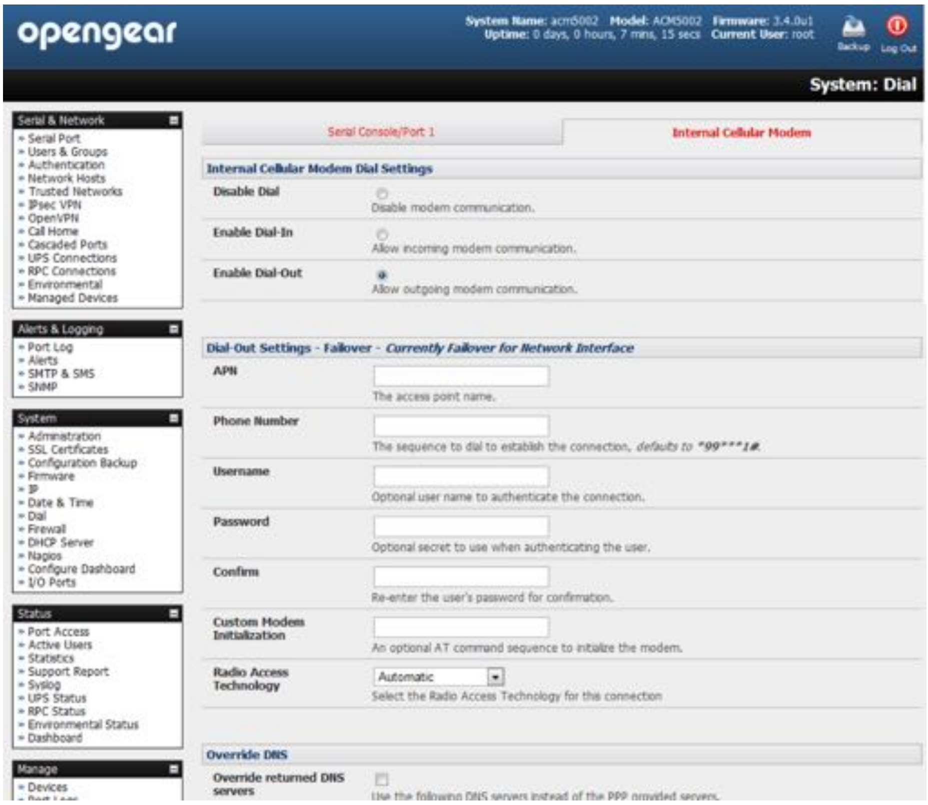
Override DNS

Override returned DNS servers □ Use the following DNS servers instead of the PPP provided servers.

Note: *with firmware v3.0.1 and earlier, only SSH access is enabled on the failover connection. In later firmware versions 3.0.2 and later HTTPS access is also enabled. Once the dial-out PPP connection is established the* **administrator** *can connect to the* **console server** *via SSH (or HTTPS on console servers running firmware 3.0.2 or later) and fix the problem.*

When configuring the principal network connection in **System > IP** specify the *Failover Interface* to be used when a fault has been detected with *Network* or *Network1* (that is, `eth0`). This can be either the *Internal Modem*, *Dial Serial DB9* (if you are using an external modem on the console port), or *USB Modem* (if you are using a plug-on USB modem on an ACM7000, ACM5500 or ACM5000).

- Set the *Probe Addresses* of two sites (the Primary and Secondary) that the IM console server is to ping to determine if *Network* or *Network1* is still operational.
- Navigate to **System > Dial**.
- Select the port to be configured: *Serial DB9 Port*, *PC Card*, or *Internal Modem Port*.



Internal Cellular Modem Dial Settings

Disable Dial ○ Disable modem communication.

Enable Dial-In ○ Allow incoming modem communication.

Enable Dial-Out ● Allow outgoing modem communication.

Dial-Out Settings - Failover - *Currently Failover for Network Interface*

APN: The access point name.

Phone Number: The sequence to dial to establish the connection, *defaults to *99***1#*

Username: Optional user name to authenticate the connection.

Password: Optional secret to use when authenticating the user.

Confirm: Re-enter the user's password for confirmation.

Custom Modem Initialization: An optional AT command sequence to initialize the modem.

Radio Access Technology: Automatic — Select the Radio Access Technology for this connection

Override DNS

Override returned DNS servers □ Use the following DNS servers instead of the PPP provided servers.

- Select the *Baud Rate* and *Flow Control* that will communicate with the modem.
- Check the *Enable Dial-Out Access* checkbox.
- In the **Dial-Out Settings — Always On Out-of-Band** fields enter the access details for the remote PPP server to be called.

The **Override DNS** section is available for PPP Devices such as modems. **Override DNS** allows the use of alternate DNS servers from those provided by your ISP. For example, an alternative DNS may be required for OpenDNS used for content filtering.

To enable Override DNS:

- check the *Override returned DNS Servers* checkbox.
- Enter the IP address of the alternative DNS servers in the *DNS Server 1* and *DNS Server 2* entry fields.

- Click **Apply**.

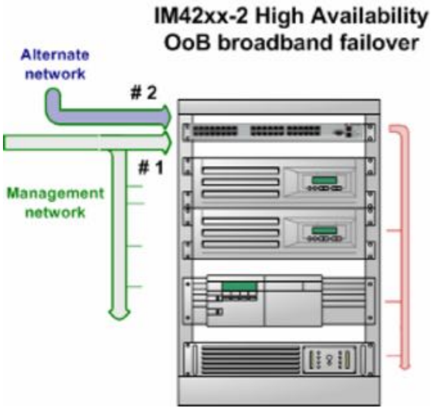
Note: *as of firmware v3.1.0 and later, the advanced* **console server**, *by default*, *supports automatic failure-recovery back to the state extant prior to the failover. The advanced* **console server** *continually pings probe addresses whilst in original and failover states. The original state will automatically be set as a priority and reestablished following three successful pings of the probe addresses during failover. The failover state will be removed once the original state has been re-established.*

4.4. OOB broadband ethernet access

The ACM7000, ACM5500, ACM5000, CM7100, IM7200 and IM4200 family of advanced *console servers* have a second ethernet port which can be configured for alternate and OOB (out-of-band) broadband access.

console server	label indicating second ethernet port
ACM5004-2, ACM5508-2-I/M and ACM5504-3-P	LAN2
CM7100 and ACM7000	NET2
IM4200-2	Network 2
IM4216-34 and ACM5504-5-G(-W)-I)	ETH-1

With two active broadband access paths to these advanced console servers, in the event you are unable to access through the primary management network (LAN1, Network or Network1) you can still access it through the alternate broadband path.



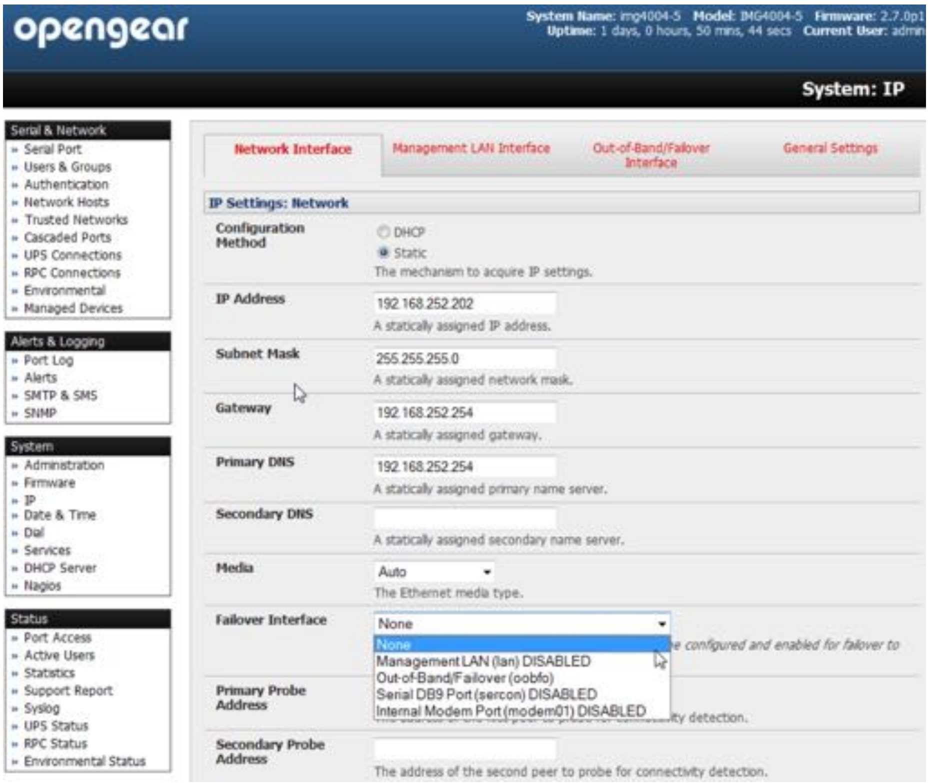
- Navigate to **System > IP**.
- select *Management LAN Interface* (ACM5004-2, CM7100, IM7200, and IM4200).
- configure the *IP Address*, *Subnet Mask*, *Gateway* and *DNS* with the access settings that relate to the alternate link.

Note: *when configuring the principal* **Network Interface** *connection, the* **Failover Interface** *must be set to* **None**.

4.5. Broadband ethernet failover

The second Ethernet port on the ACM7000, ACM5500, ACM5000, CM7100, IM7200 and IM4200 family of advanced *console servers* can also be configured for failover to ensure transparent high availability.

- Navigate to **System > IP > Network Interface**.



IP Settings: Network

Configuration Method: ○ DHCP ● Static
The mechanism to acquire IP settings.

IP Address: 192.168.252.202
A statically assigned IP address.

Subnet Mask: 255.255.255.0
A statically assigned network mask.

Gateway: 192.168.252.254
A statically assigned gateway.

Primary DNS: 192.168.252.254
A statically assigned primary name server.

Secondary DNS:
A statically assigned secondary name server.

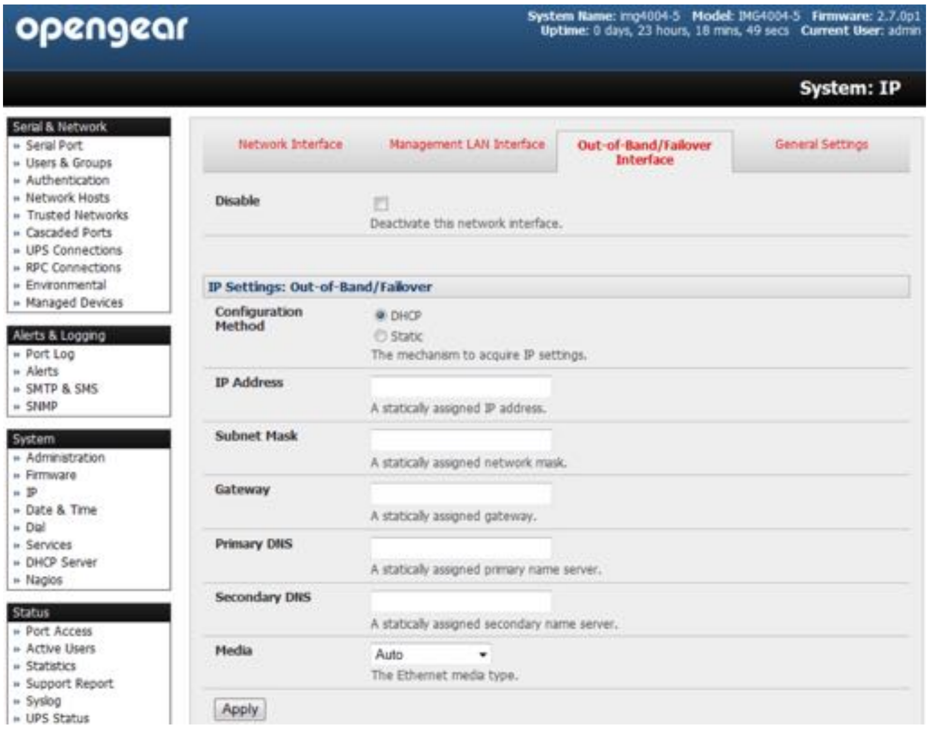
Media: Auto
The Ethernet media type.

Failover Interface: None
None
Management LAN (lan) DISABLED
Out-of-Band/Failover (oobfo)
Serial DB9 Port (sercon) DISABLED
Internal Modem Port (modem01) DISABLED
e configured and enabled for failover to

Primary Probe Address:
ty detection.

Secondary Probe Address:
The address of the second peer to probe for connectivity detection.

- Select *Management LAN* from the *Failover Interface* pop-up menu.
- Enter the Primary Probe Address and the Secondary Probe Address.



Disable: □
Deactivate this network interface.

IP Settings: Out-of-Band/Failover

Configuration Method: ● DHCP ○ Static
The mechanism to acquire IP settings.

IP Address:
A statically assigned IP address.

Subnet Mask:
A statically assigned network mask.

Gateway:
A statically assigned gateway.

Primary DNS:
A statically assigned primary name server.

Secondary DNS:
A statically assigned secondary name server.

Media: Auto
The Ethernet media type.

These are the IP addresses or hostnames of the two hosts (the Primary and Secondary) that the advanced *console server* is to ping to determine if a Network Interface is still operational.

- Select the **Out-of-Band/Failover Interface** tab.
- Enter the **Out-of-Band/Failover** *IP Address*, *Subnet Mask*, and *Gateway* values.

  These values should be the same as used for the **Network Interface**.

In this mode, the **Management LAN Interface** is available as the transparent back-up port to **Network Interface** for accessing the management network. **Management LAN Interface** will automatically and transparently take over the work of **Network Interface**, in the event **Network Interface** becomes unavailable for any reason.

Note: In **console servers** *running firmware v3.0.1 and earlier, only SSH access is enabled on the failover connection. In later firmware versions 3.0.2 and later HTTPS access is also enabled. Once the dial-out PPP connection is established the* **administrator** *can connect to the* **console server** *via SSH (or HTTPS on console servers running firmware 3.0.2 or later) and fix the problem.*

As of firmware v3.1.0 and later, the advanced *console server*, by default**,** supports automatic failure-recovery back to the state extant prior to the failover. The advanced *console server* continually pings probe addresses whilst in original and failover states. The original state will automatically be set as a priority and reestablished following three successful pings of the probe addresses during failover. The failover state will be removed once the original state has been re-established.

For firmware versions prior to v3.1.0 the advanced *console server* does not support automatic failure-recovery back to the original state prior to the failover. To restore networking to a recovered state the following command then needs to be run:

```
rm -f /var/run/*-failed-over && config -r ipconfig
```

If required, you can run a custom bash script when the device fails over. It is possible to use this script to implement automatic failure recovery, depending on your network setup. The script to create is:

```
/etc/config/scripts/interface-failover-alert
```

4.6. Cellular modem connection

The ACM7000, ACM5500, ACM5000, IM7200 and IM4200 family of advanced *console servers* support internal cellular modems.

These modems first need to be installed (as documented in 4.6.1, 4.6.2 and 4.6.3 below) and then set up to validate they can connect to the carrier network (as documented 4.6.4 and 4.6.5 below).

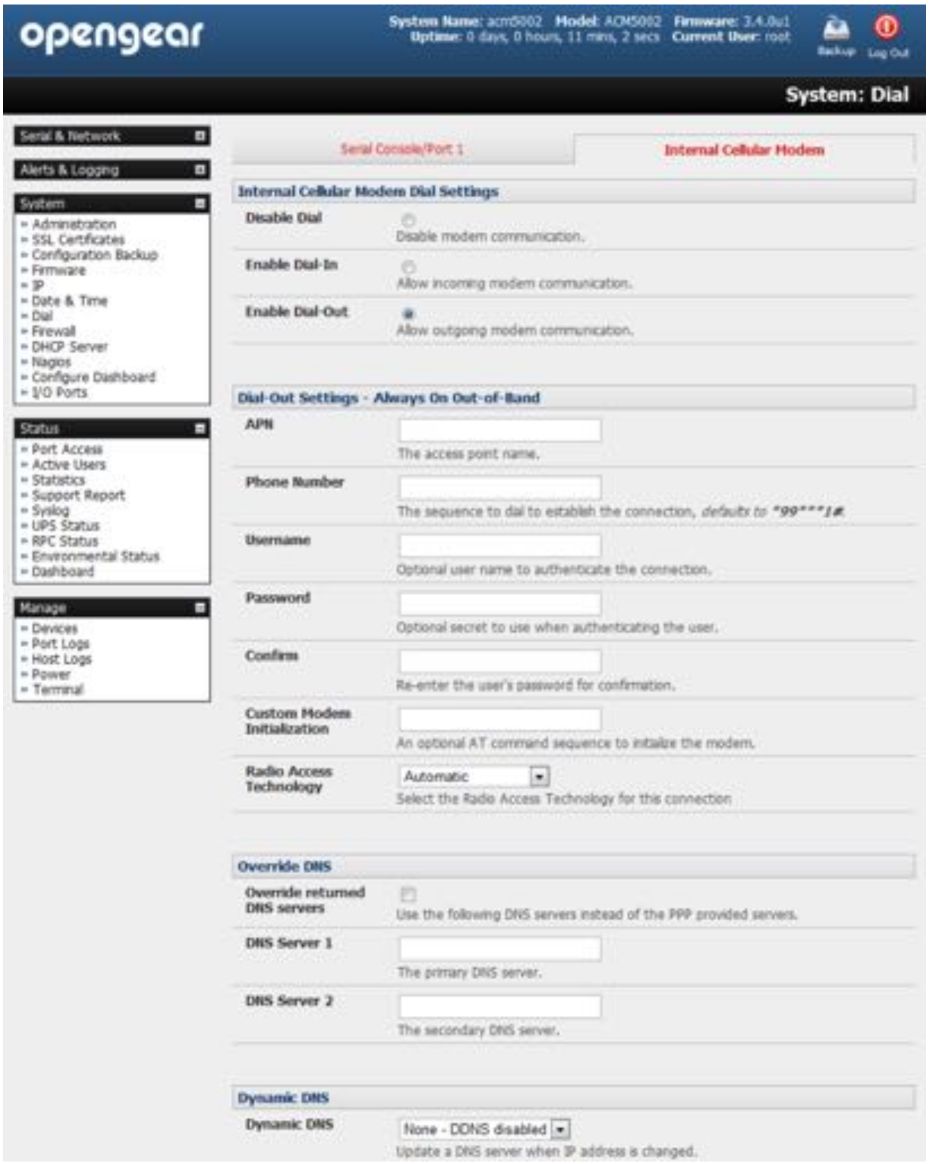
They then can be configured for operation in Always-on cellular router or OOB mode, or in Failover mode (as documented in 4.7 below).

4.6.1. Connecting to a GSM HSUPA/UMTS carrier network

Console server models denoted with **-G** have an internal GSM modem that will connect to any major GSM carrier globally.

Note: before powering on any **-G** *model* **console server** *(for example, the ACM5004-G, ACM5004-G-I, ACM55044-5-G-I or the IM4200-X2-G), install the SIM card provided by your cellular carrier and attach the external aerial. Also, The ACM5004-G(-I) and ACM55044-5-G-I have two cellular status LEDs. The SIM LED on top of the unit should go on solid when a SIM card has been inserted and detected.*

- Navigate to **System > Dial**.
- Click the **Internal Cellular Modem** tab.



System Name: acm5002 Model: ACM5002 Firmware: 3.4.0u1
Uptime: 0 days, 0 hours, 11 mins, 2 secs Current User: root

System: Dial

Internal Cellular Modem Dial Settings

Disable Dial ○ Disable modem communication.

Enable Dial-In ○ Allow incoming modem communication.

Enable Dial-Out ● Allow outgoing modem communication.

Dial-Out Settings - Always On Out-of-Band

APN: The access point name.

Phone Number: The sequence to dial to establish the connection, *defaults to* ***"99***1#***

Username: Optional user name to authenticate the connection.

Password: Optional secret to use when authenticating the user.

Confirm: Re-enter the user's password for confirmation.

Custom Modem Initialization: An optional AT command sequence to intialize the modem.

Radio Access Technology: Automatic. Select the Radio Access Technology for this connection

Override DNS

Override returned DNS servers □ Use the following DNS servers instead of the PPP provided servers.

DNS Server 1: The primary DNS server.

DNS Server 2: The secondary DNS server.

Dynamic DNS

Dynamic DNS: None - DDNS disabled. Update a DNS server when IP address is changed.

- Check the *Enable Dial-Out* radio button in the **Internal Cellular Modem Dial Settings** section.

Your carrier may have provided details for configuring the connection including:

value	description
APN	Access Point Name.

PIN code	If the carrier-provided SIM card is locked, a PIN Code may be required to unlock it.
Phone Number	the dial sequence which establishes the connection. By default this is **99***1#*.
Username	Optional.
Password	Optional.
Custom Modem Initialization	Optional AT command sequence to intialize the modem.

- Enter the carrier's APN.

  Example APNs include:

carrier	APN
AT&T (USA)	i2gold
T-Mobile (USA)	epc.tmobile.com
Internode (Australia)	internode
Telstra (Australia	telstra.internet

Note: the APN is, in most cases, the only value needed. The other fields can be left blank.

- If the SIM Card is configured with a PIN Code, unlock the Card by entering the PIN Code.

Note: if the PIN Code is entered incorrectly three times, the PUK Code will be required to unlock the Card.

You may also need to use **Override DNS** to set alternate DNS servers from those provided by your carrier. If this is necessary:

- On **System > Dial > Internal Cellular Modem**, check the *Override returned DNS servers* checkbox.
- Enter the alternative DNS servers in the *DNS Server 1* and *DNS Server 2* fields.
- Click **Apply**.

  A radio connection will be established with your cellular carrier.

4.6.2. Connecting to a CDMA EV-DO carrier network

Console server models denoted with **-GV** or **-GS** have an internal CDMA modem and will connect to the Verizon network in North America.

After creating an account with the CDMA carrier, some carriers require an additional step to provision the Internal Cellular Modem, known as *Provisioning*. The ACM5004-GV and IM4200-DAC-X2 support

- Over-the-Air Service Provisioning (*OTASP*) where modem-specific parameters can be retrieved via a voice call to a special phone number, and
- a manual process where the phone number and other parameters are entered manually.

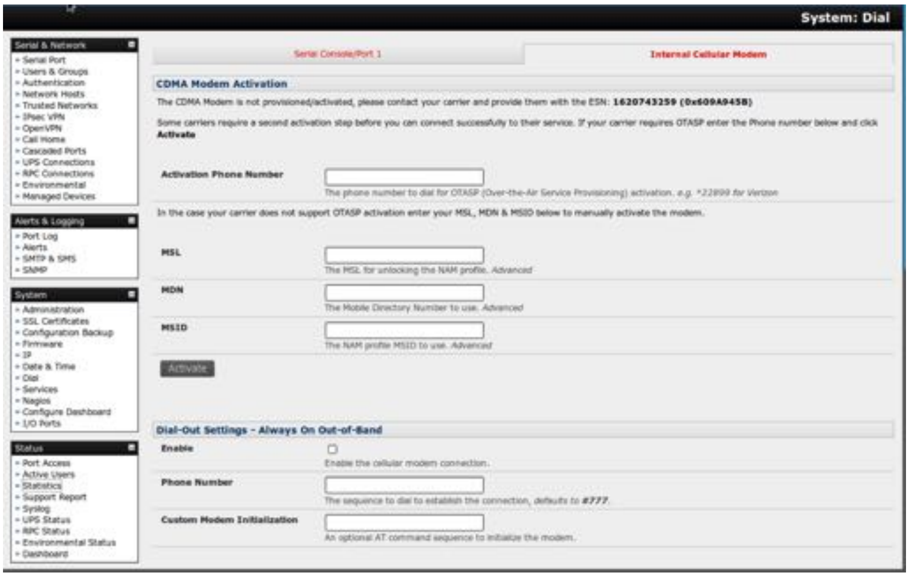
OTASP

Note: before this can be achieved, a working account and an activated device are required. In this case an activated device is an Opengear console server which has had its ESN (Electronic

Serial Number) registered with an appropriate plan on your carrier's account.

- Navigate to **System > Dial**.
- Click the **Internal Cellular Modem** tab.
- Enter the particular phone number which must be dialed to complete OTASP.

  For example, Verizon uses **22899* and Telus uses **22886*.



CDMA Modem Activation

The CDMA Modem is not provisioned/activated, please contact your carrier and provide them with the ESN: **1620743259 (0x609A945B)**

Some carriers require a second activation step before you can connect successfully to their service. If your carrier requires OTASP enter the Phone number below and click **Activate**

Activation Phone Number: The phone number to dial for OTASP (Over-the-Air Service Provisioning) activation. *e.g. *22899 for Verizon*

In the case your carrier does not support OTASP activation enter your MSL, MDN & MSID below to manually activate the modem.

MSL: The MSL for unlocking the NAM profile. *Advanced*

MDN: The Mobile Directory Number to use. *Advanced*

MSID: The NAM profile MSID to use. *Advanced*

Dial-Out Settings - Always On Out-of-Band

Enable: □ Enable the cellular modem connection.

Phone Number: The sequence to dial to establish the connection, defaults to *#777*.

Custom Modem Initialization: An optional AT command sequence to initialize the modem.

- Click **Activate**.

  This initiates the OTASP call.

  The process is successful if no errors are displayed and you no longer see the CDMA Modem Activation form.

  If OTASP is unsuccessful consult the System Logs at **Status > Syslog** for clues to what went wrong.

- When OTASP has completed enable the Internal Cellular Modem by entering the carrier's phone number

  By default, this number is #777.

- click **Apply**.

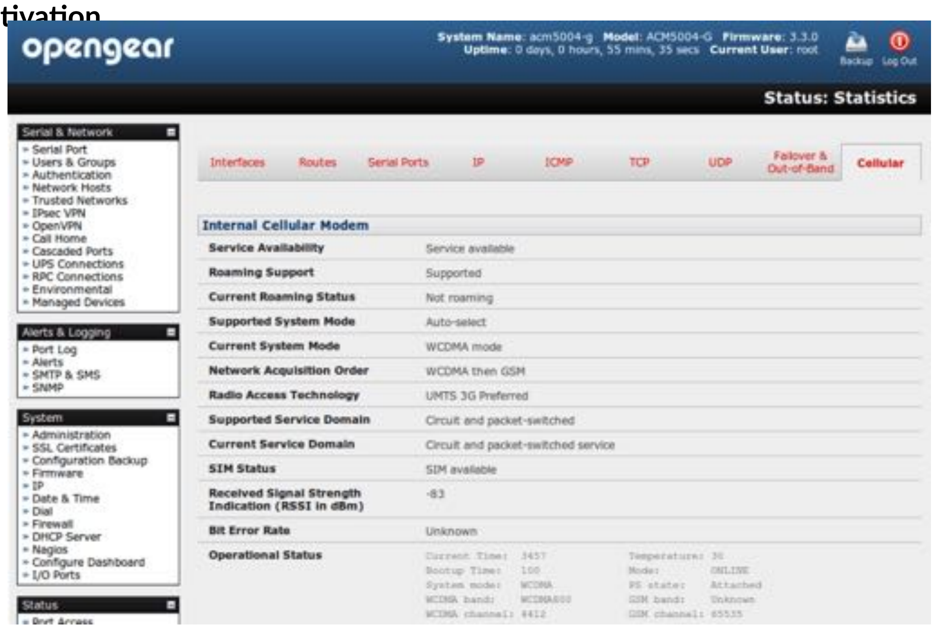
To confirm OTASP success, and to display the modem's current state:

- navigate to **Status> Statistics**.
- click the **Cellular** tab.

  The current state of the modem will present.

OTASP success will result in a valid phone number being placed in the *NAM Profile Account MDN* field.

Manual activation



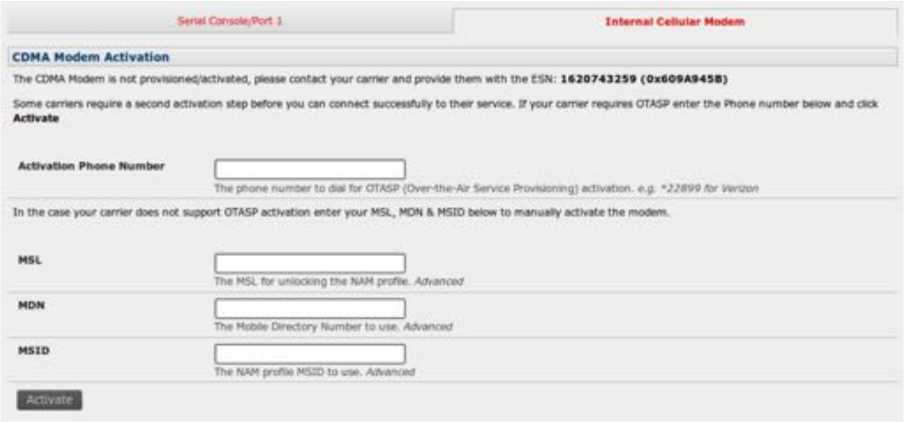
Internal Cellular Modem

Service Availability	Service available
Roaming Support	Supported
Current Roaming Status	Not roaming
Supported System Mode	Auto-select
Current System Mode	WCDMA mode
Network Acquisition Order	WCDMA then GSM
Radio Access Technology	UMTS 3G Preferred
Supported Service Domain	Circuit and packet-switched
Current Service Domain	Circuit and packet-switched service
SIM Status	SIM available
Received Signal Strength Indication (RSSI in dBm)	-83
Bit Error Rate	Unknown
Operational Status	

```
Current Time:   3457           Temperature: 36
Bootup Time:    100            Mode:        ONLINE
System mode:    WCDMA          PS state:    Attached
WCDMA band:     WCDMA800       GSM band:    Unknown
WCDMA channel:  4412           GSM channel: 65535
```

If a carrier does not support OTASP it will be necessary to manually provision the modem.

- Navigate to **System > Dial**.
- Click the **Internal Cellular Modem** tab.



CDMA Modem Activation

The CDMA Modem is not provisioned/activated, please contact your carrier and provide them with the ESN: **1620743259 (0x609A945B)**

Some carriers require a second activation step before you can connect successfully to their service. If your carrier requires OTASP enter the Phone number below and click **Activate**

Activation Phone Number The phone number to dial for OTASP (Over-the-Air Service Provisioning) activation. *e.g. *22899 for Verizon*

In the case your carrier does not support OTASP activation enter your MSL, MDN & MSID below to manually activate the modem.

MSL The MSL for unlocking the NAM profile. *Advanced*

MDN The Mobile Directory Number to use. *Advanced*

MSID The NAM profile MSID to use. *Advanced*

- Enter the *MSL*, *MDN* and *MSID* values.

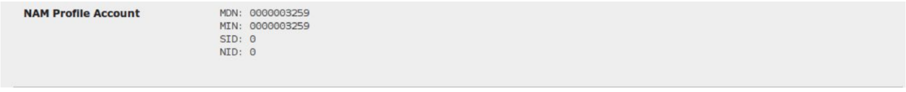
  These values are specific to your carrier and for manual activation you will have to learn what values your carrier uses in each field.

  Verizon, for example, has been known to use an *MSL* of *000000* and the phone number assigned to the Opengear device as both the *MDN* and *MSID* with no spaces or hyphens. So an assigned phone number of *555-123-1234* is entered in the *MDN* and *MSID* fields as *5551231234*.

- Click **Activate**.

If no errors occur you will see the new values entered into the *NAM Profile Account*. To check this:

- navigate to **Status> Statistics**.



NAM Profile Account

```
MDN:  0000003259
MIN:  0000003259
SID:  0
NID:  0
```

- click the **Cellular** tab.

To connect to your carrier's 3G network:

- navigate to **System > Dial**.
- click the **Internal Cellular Modem** tab.
- enter the appropriate *Phone Number*.

  This is usually *#777*.
- If required by your account plan, enter the supplied *Username* and *Password*.
- Check the *Enable* check-box.
- click **Apply**.

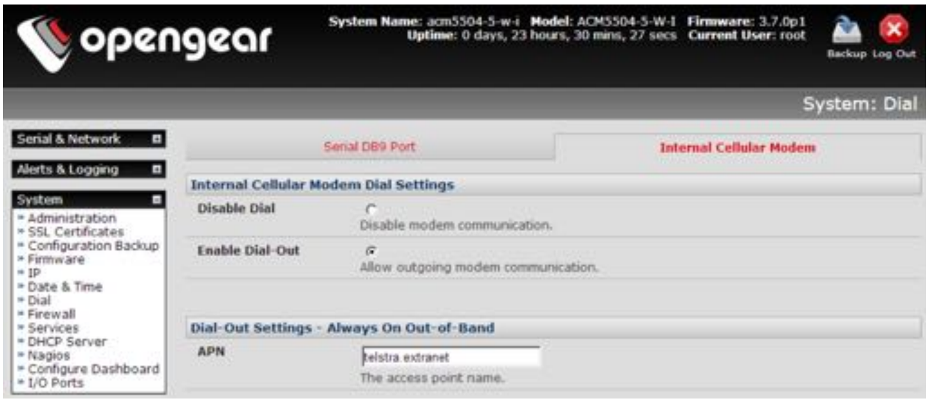
  The *Always On Out-of-Band* connection is initiated.

4.6.3. Connecting to a 4G LTE carrier network

Console server models denoted with **-LV**, **-LA**, or **-LR** have an internal modem that will connect to any major 4G LTE carrier globally.

Note: before powering on any **-LV**, *-LA, or -LR model* **console server**, *install the SIM card provided by your cellular carrier and attach the external aerial.*

- Navigate to **System > Dial**.
- Click the **Internal Cellular Modem** tab.
- Check the *Enable Dial-Out* radio button in the **Internal Cellular Modem Dial Settings** section.


System Name: acm5504-5-w-i Model: ACM5504-5-W-I Firmware: 3.7.0p1
Uptime: 0 days, 23 hours, 30 mins, 27 secs Current User: root

System: Dial

Internal Cellular Modem Dial Settings

Disable Dial ○
Disable modem communication.

Enable Dial-Out ●
Allow outgoing modem communication.

Dial-Out Settings - Always On Out-of-Band

APN: telstra extranet
The access point name.

Your carrier may have provided details for configuring the connection including:

value	description
APN	Access Point Name.
PIN code	If the carrier-provided SIM card is locked, a PIN Code is required to unlock it.
Phone Number	the dial sequence to establish the connection. By default this is **99***1#*.
Username	Optional.

Password Optional.

- Enter the carrier's APN.

  Example APNs include:

carrier	APN
AT&T (USA)	i2gold
T-Mobile (USA)	epc.tmobile.com
Internode (Australia)	internode
Telstra (Australia	telstra.internet

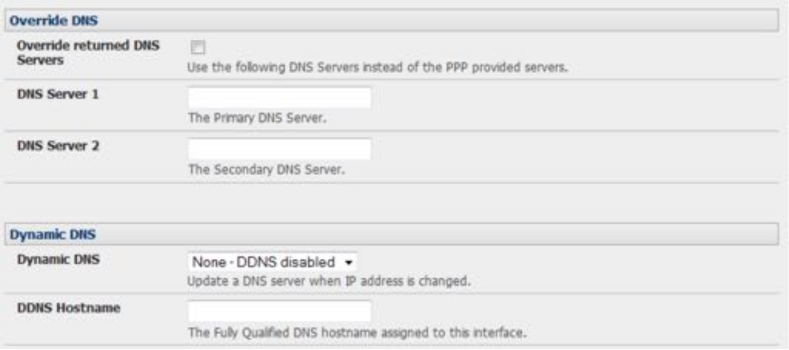
Note: the APN is, in most cases, the only value needed. The other fields can be left blank.

- If the SIM Card is configured with a PIN Code, unlock the Card by entering the PIN Code.

Note: if the PIN Code is entered incorrectly three times, the PUK Code will be required to unlock the Card.

You may also need to use **Override DNS** to set alternate DNS servers from those provided by your carrier. If this is necessary:

- On **System > Dial > Internal Cellular Modem**, check the *Override returned DNS servers* checkbox.



Override DNS

Override returned DNS Servers ☐
Use the following DNS Servers instead of the PPP provided servers.

DNS Server 1
The Primary DNS Server.

DNS Server 2
The Secondary DNS Server.

Dynamic DNS

Dynamic DNS: None - DDNS disabled
Update a DNS server when IP address is changed.

DDNS Hostname
The Fully Qualified DNS hostname assigned to this interface.

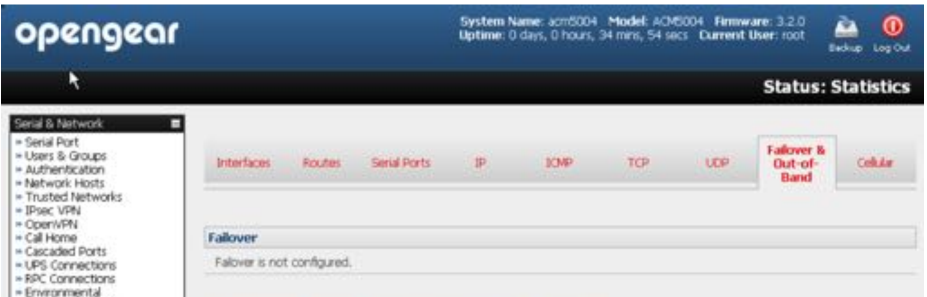
- Enter the alternative DNS servers in the *DNS Server 1* and *DNS Server 2* fields.
- Click **Apply**.

  A radio connection will be established with your cellular carrier.

4.6.4. Verifying the cellular connection

Out-of-band access is enabled by default so the cellular modem connection should now be on. To verify this:

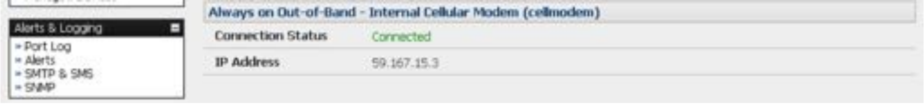
- navigate to **Status > Statistics**.
- select the **Cellular** tab.
- verify the *Mode* is set to *Online*.
- select the **Failover & Out-of-Band** tab.



System Name: acm5004 Model: ACM5004 Firmware: 3.2.0
Uptime: 0 days, 0 hours, 34 mins, 54 secs Current User: root

Failover

Failover is not configured.



Always on Out-of-Band - Internal Cellular Modem (cellmodem)

Connection Status	Connected
IP Address	59.167.15.3

- verify the *Connection Status* reads as *Connected*.

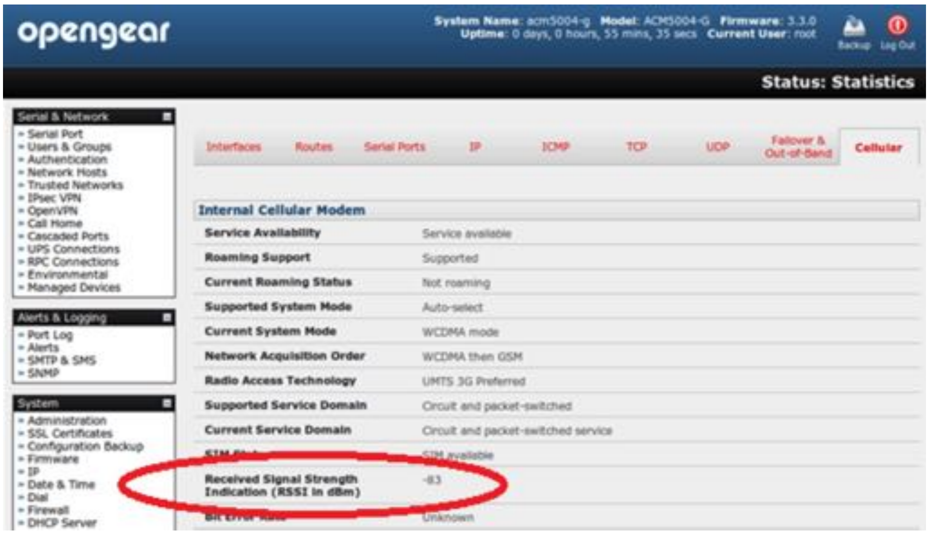
To measure the received signal strength:

- navigate to **Status > Statistics**.

The current state of the cellular modem, including the *Received Signal Strength Indicator* (*RSSI*), will present. Note the RSSI coverage value.

value	description	value	description
≤ -100 dBm	unacceptable	-89 to -70 dBm	medium-to-strong
-99 to -90 dBm	weak-to-medium	≥ -69 dBm	very strong

RSSI is a measure of the Radio Frequency (RF) power present in a received radio signal. It is generally expressed in decibel-milliwatts (dBm). The best throughput comes from placing the receiving device in a location with the highest possible RSSI.



Internal Cellular Modem

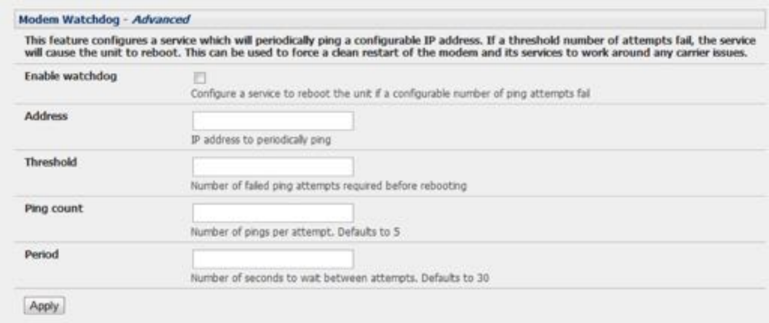
Service Availability	Service available
Roaming Support	Supported
Current Roaming Status	Not roaming
Supported System Mode	Auto-select
Current System Mode	WCDMA mode
Network Acquisition Order	WCDMA then GSM
Radio Access Technology	UMTS 3G Preferred
Supported Service Domain	Circuit and packet-switched
Current Service Domain	Circuit and packet-switched service
SIM Status	SIM available
Received Signal Strength Indication (RSSI in dBm)	-83
Bit Error Rate	Unknown

With the cellular modem connection on the connection status is also visible via the LEDs on top of *console server*.

Note: The ACM5004-G/LR(-I), ACM5504-5-G(-W)-I and ACM5504-5-LA/R/V-I each have two cellular status LEDs. The WWAN LED is OFF when in reset mode or not powered. When powered it will go ON and while searching for service it will flash off briefly every five seconds.

4.6.5. Cellular modem watchdog

As of with firmware V3.5.2u13 and later, when you check the *Enable Dial-Out* check-box at **System > Dial**, you will be given the option to configure a cellar modem watchdog service.


Modem Watchdog - *Advanced*

This feature configures a service which will periodically ping a configurable IP address. If a threshold number of attempts fail, the service will cause the unit to reboot. This can be used to force a clean restart of the modem and its services to work around any carrier issues.

Enable watchdog	□ Configure a service to reboot the unit if a configurable number of ping attempts fail
Address	IP address to periodically ping
Threshold	Number of failed ping attempts required before rebooting
Ping count	Number of pings per attempt. Defaults to 5
Period	Number of seconds to wait between attempts. Defaults to 30

This service will periodically ping a configurable IP address. If a threshold number of consecutive attempts fail, the service will cause the unit to reboot. This can be used to force a clean restart of the modem and its services to work around any carrier issues.

4.6.6. Dual-SIM failover

Some *console server* models (as of 2016/11, the ACM5500-Gx and ACM5500–Lx families) allow you to insert two SIM cards, allowing for selective connection to two carrier networks. The dual-SIM failover feature allows the cell modem to selectively failover to the secondary SIM when communication over the primary SIM fails.

To configure dual-SIM failover:

- navigate to **System > Dial**.
- click the **Internal Cellular Modem** tab.
- in the **SIM Configuration** section, set the *Primary SIM* to either *Bottom Slot or Top Slot*.

  Choose the slot which contains the SIM from your primary carrier network.
- check the *Enable SIM Failover* checkbox.
- specify how the device will failback from the failover SIM to the Primary SIM.

  There are two options:

  On Disconnect. With this option the *console server* will failback to the Primary SIM only after the connection on the failover SIM has failed its ping test.

  On Timeout. With this option, the *console server* will failback to the Primary SIM after the connection on the failover SIM has been up for the timeout period.
- if *On Timeout* is the selected failback option, set the *Failback Timout* value.

  The *Failback Timout* is the number of seconds the failover SIM must be connected before the *console server* switches back to the Primary SIM.

  If no number is entered here, the default value of 600 seconds (10 minutes) applies.
- configure each SIM connection with the information necessary (APN, and, if required, the PIN, Phone Number, Username and Password) to enable it to make a successful connection, assuming sufficient signal strength from the cell service provider.

  See 4.6.1, 4.6.2, and 4.6.3 above for details.
- enter a *Failback Test IP address* for each SIM.

  This IP address is used to `ping` test the status of the cell modem connection and to determine if SIM failover or failback is to take place.
- optionally configure DDNS and the Modem Watchdog (see chapter 4.6.5).

  DDNS, when configured, will be applied to the cell modem dial out connection regardless of which SIM is currently in use.

Note: dual-SIM failover is for dial out connections only.

4.6.7. Multi-carrier cellular support

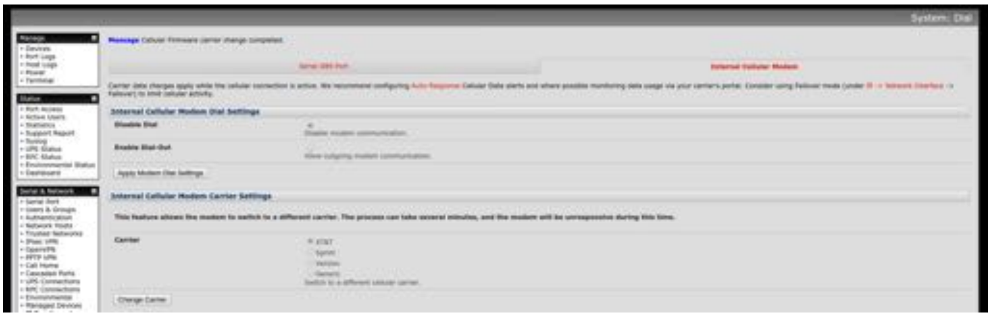
Some cellular carriers require the *console server's* cellular modem to be programmed with carrier-specific firmware to operate on their network. Some *console server* models, however, are equipped with a reprogrammable cellular modem, allowing them to operate on more than one such carrier network.

Note: changes to the cellular modem firmware are unaffected by Opengear firmware upgrades or factory erase/configuration reset operations.

On *console servers* with multi-carrier capability:

- navigate to **System > Dial**.
- select the **Internal Cellular Modem** tab.

  The **Internal Cellular Modem Carrier Settings** section (which provides control over which carrier's firmware is installed on the modem) will present.



Message Cellular Firmware carrier change completed.

Carrier data charges apply while the cellular connection is active. We recommend configuring Auto-Response Cellular Data alerts and where possible monitoring data usage via your carrier's portal. Consider using Failover mode (under IP -> Network Interface -> Failover) to limit cellular activity.

Internal Cellular Modem Dial Settings

Disable Dial ☑ Disable modem communication.

Enable Dial-Out □ Allow outgoing modem communication.

Apply Modem Dial Settings

Internal Cellular Modem Carrier Settings

This feature allows the modem to switch to a different carrier. The process can take several minutes, and the modem will be unresponsive during this time.

Carrier ● AT&T ○ Sprint ○ Verizon ○ Generic
Switch to a different cellular carrier.

Change Carrier

- select the desired *Carrier* radio button.

  The modem's flash memory will have the carrier-specific firmware image installed.

  Flashing takes several minutes during which the cellular modem is unavailable. During this time, the page periodically refreshes with status information.

  Upon successful completion, the page displays the message: *Cellular Firmware carrier change completed*.

Multi-carrier capable models ship with cellular modem firmware for each supported carrier pre-loaded onto internal non-volatile or USB storage. Periodically, new cellular modem firmware becomes available and is published on the Opengear downloads site.

Note: if your unit's cellular connection is operating correctly, there is typically no need to upgrade its cellular firmware.

On *console servers* with multi-carrier capablity, to download and apply new cellular firmware using the Management Console UI:

- navigate to **System > Firmware**.

  A section presents showing the local cellular firmware image status and a **Check for Update** button that starts the firmware update process.

  The **Cellular Firmware Status** section indicates the date of the last firmware download, and shows a cryptographic fingerprint. This can be used to verify the local files' integrity against the fingerprint published in the Opengear Knowledge Base.

- click the **Check for Update** button.

  The Management Console contacts the remote server, ftp://ftp.opengear.com/, and displays an update summary.

  This summary indicates the local and remote fingerprints for comparison, without altering any local files.

- optionally, expand the **Advanced** section.

  This section shows a full list of files to be downloaded or deleted, along with their SHA1 hashes. (Temporary files downloaded during the intial **Check for Updates** may be listed as simple files to copy into place, as they do not have to be re-downloaded.)

- click **Download and Apply**.

Note: the modem will only be flashed if new firmware is available for the currently selected carrier.

During the download and flashing of the firmware, an interstitial screen displays, showing *Currently upgrading cellular modem firmware*. Once completed the status of the firmware update is displayed at **System > Firmware**.

- alternatively, click **Cancel** to reject the update.

It is also possible to control multi-carrier features at the *console server* shell.

- Show currently selected carrier.

  ```
  cellctl -is | egrep "^preferred-carrier" | cut -d " " -f 2
  ```

- Show current modem firmware version.

  ```
  cellctl -is | egrep "^current-firmware" | cut -d " " -f 2
  ```

- List available carriers supported on installed modem.

  ```
  /etc/scripts/cell-fw-update -l
  ```

- Check for availability of firmware updates.

  ```
  /etc/scripts/cell-fw-update -u
  ```

  Output is the remote fingerprint followed by the list of actions that would be taken by `cell-fw-update -d`.

- Download latest firmware for all carriers supported by the modem.

  ```
  /etc/scripts/cell-fw-update -d
  ```

- Flash modem with latest local firmware for carrier.

  ```
  /etc/scripts/cell-fw-update -c <carrier>
  ```

  `<carrier>` is one of the carrier identifiers emitted by `cell-fw-update -l`.

  This command can be used to switch carriers or to update the firmware of the current carrier.

Note: if the firmware version information on the modem is identical, the modem may reject the update without error.

4.7. Cellular operation

When set up as a *console server*, the 3G cellular modem can be set up to connect to the carrier in one of four mode.

OOB mode. In this mode the dial-out connection to the carrier cellular network is always on, awaiting incoming access from a remote site wanting to access to the console server or attached serial consoles/network hosts.

Failover mode. In this mode a dial-out cellular connection is only established in event of a `ping` failure.

Cellular router mode. In this mode, the dial-out connection to the carrier cellular network is always on, and IP traffic is routed between the cellular connected network and the console server's local network ports. This is the default mode of operation for ACM5000-G and ACM5500-L and ACM5500-G models.

Circuit Switched Data (CSD) mode. In this dial-in mode, the cellular modem can receive incoming calls from remote modems who dial a special Data Terminating number. This is a 3G-only mode.

4.7.1. OOB access set-up

In this mode the dial-out connection to the carrier cellular network is always on, awaiting any incoming traffic. By default, the only traffic enabled is incoming SSH access to the console server and its serial ports, and incoming HTTPS access to the *console server*. There is a low level of keep alive and management traffic going over the cellular network. Generally, however, the status reports, alerts and other traffic from the site can be carried over the main network.

This mode is typically used for out of band access to remote sites. Consequently, to be directly accessed, the appliance needs to have a Public IP address and it must not have SSH access firewalled. This OOB mode is the default for IM7200 and IM4200 appliances with internal cellular modems. Out-of-band access is enabled by default and the cellular modem connection is always on.

Almost all carriers offer corporate mobile data service/plans with a Public (static or dynamic) IP address. These plans do, however, often have a service fee attached.

With a static Public IP address plan you can try accessing the *console server* using the Public IP Address provided by the carrier. By default, however, only HTTPS and SSH access is enabled on the OOB connection: you can browse to the console server, but you cannot `ping` it.

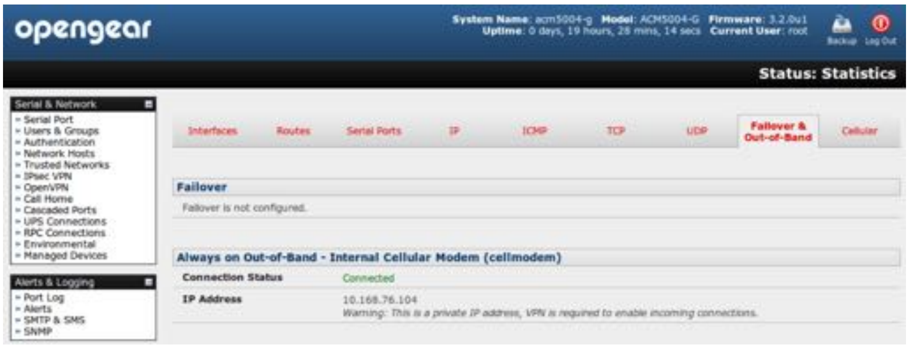
With a dynamic Public IP address plan, a DDNS service will need to be configured to allow the remote *administrator* to initiate incoming access. Once this is done you can then also try accessing the *console server* using the allocated domain name.

By default, most providers offer a consumer-grade service which provides dynamic Private IP address assignments to 3G devices. This IP address is not visible across the Internet but generally it is adequate for home and general business use.

To confirm a consumer-grade service:

- Navigate to the **Status > Statistics.**
- Click the **Failover & Out-of-Band** tab.

- In the **Always on Out-of-Band — Internal Cellular Modem (cellmodem)** section, check the value presented for *IP Address.*



Failover

Failover is not configured.

Always on Out-of-Band - Internal Cellular Modem (cellmodem)

Connection Status: Connected

IP Address: 10.168.76.104

Warning: This is a private IP address, VPN is required to enable incoming connections.

If the value is in one of the private IP Address ranges —

10.0.0.0 – 10.255.255.255
172.16.0.0 – 172.31.255.255
192.168.0.0 – 192.168.255.255

— you have a consumer-grade cellular service.

For inbound OOB connection with such a plan you will need to use Call Home with a Lighthouse/VCMS/CMS6110 or set up a VPN.

In Out of Band access mode, the internal cellular modem will continually stay connected. The alternative is to set up Failover mode on the console server as detailed in the next section.

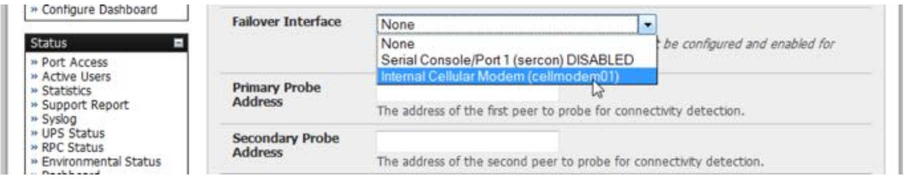
4.7.2. Cellular failover

In this mode a dial-out cellular connection is only established in event of disruption to the main network. The cellular connection normally remains idle and in a low power state. It is only activated in event of a `ping` failure. This standby mode suits remote sites with expensive power or high cellular traffic costs.

In this mode, the appliance continually `pings` nominated probe addresses over the main network connection. In the event of `ping` failure it dials out and sets up a dial-out ppp connection over the cellular modem and access is switched transparently to this network connection. Then when the main network connection is restored, access is switched back.

Once you have configured the carrier connection, the cellular modem can be configured for failover.

This will tell the cellular connection to remain idle in a low power state. If the primary and secondary probe addresses are not available it will bring up the cellular connection and connect back to the cellular carrier.



Failover Interface: None

be configured and enabled for

Primary Probe Address

The address of the first peer to probe for connectivity detection.

Secondary Probe Address

The address of the second peer to probe for connectivity detection.

- Navigate to **System > IP**.

- Select *Internal Cellular Modem (cellmodem01)* from the *Failover Interface* pop-up menu.
- Enter the *Primary Probe Address* and the *Secondary Probe Address*.

  These are the two sites the *console server* `pings` to determine if the principal network is operational.

In event of principal network failure the cellular network connection is activated as the access path to the *console server* and any managed devices.

Note: only HTTPS and SSH access are enabled on the failover connection. This allows an **administrator** *to connect to the* **console server** *to diagnose and correct the network failure without offering third-parties a large attack surface.*

As of firmware v3.1.0, the advanced *console server* supports automatic failure-recovery back to the original state prior to failover by default.

The advanced *console server* continually `pings` probe addresses whilst in original and failover states. The original state will automatically be set as a priority and re-established following three successful `pings` of the probe addresses during failover. The failover state will be removed once the original state has been re-established.

For earlier firmware, which does not support automatic failure-recovery, to restore networking to a recovered state the following command then needs to be run:

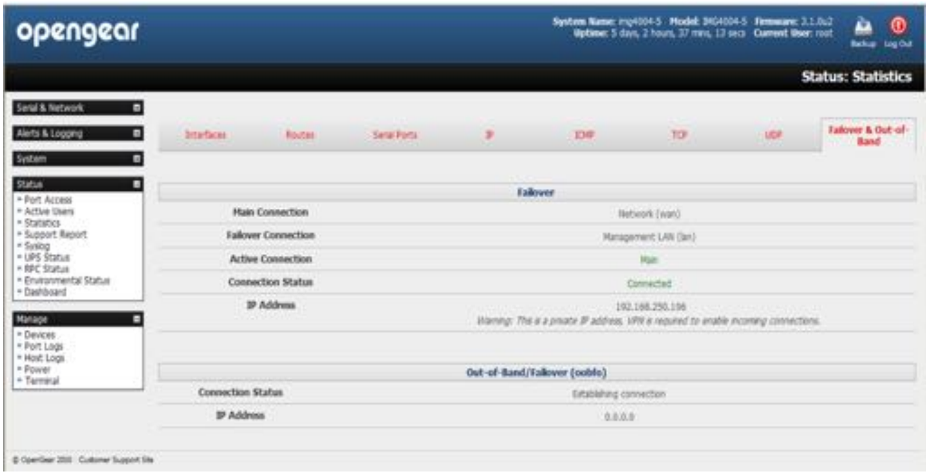
```
rm -f /var/run/*-failed-over && config -r ipconfig
```

If required, you can run a custom bash script when the device fails over. It is possible to use this script to implement automatic failure recovery, depending on your network setup. The script to create is:

```
/etc/config/scripts/interface-failover-alert
```

To check the connection status:

- navigate to **Status > Statistics**.
- click the **Failover & Out-of-Band** tab.
- Note the *Active Connection* value.



Failover

Main Connection: Network (wan)
Failover Connection: Management LAN (lan)
Active Connection: Main
Connection Status: Connected
IP Address: 192.168.250.196
Warning: This is a private IP address. VPN is required to enable incoming connections.

Out-of-Band/Failover (oob)

Connection Status: Establishing connection
IP Address: 0.0.0.0

If the *Main Connection* is good, the *Active Connection* value will be *Main*.

If the *Main Connection* is down, the **Out-of-Band/Failover** section displays information relating to a configured Out-of-Band/Failover interface and the status of that connection. The IP Address of the Out-of-Band/Failover interface will be presented in the Out-of-Band/Failover section once the Out-of-Band/Failover connection has been triggered and made.

4.7.3. Cellular routing

Once you have a configured carrier connection, the cellular modem can be configured to route traffic through the *console server*. This requires setting up forwarding and masquerading as detailed in chapter 4.8.

4.7.4. Cellular CSD dial-in

CSD is a legacy form of data transmission developed for TDMA-based mobile phone systems like GSM. CSD uses a single radio time slot to deliver 9.6kb/s data transmission to the GSM Network and Switching Subsystem where it could be connected through the equivalent of a normal modem to the Public Switched Telephone Network (PSTN) allowing direct calls to any dial-up service.

CSD is provided selectively by carriers and it is important you receive a Data Terminating number as part of the mobile service your carrier provides. This is the number which external modems will call to access the *console server*.

Once you have configured carrier connection, the cellular modem can be configured to receive Circuit Switched Data (CSD) calls.

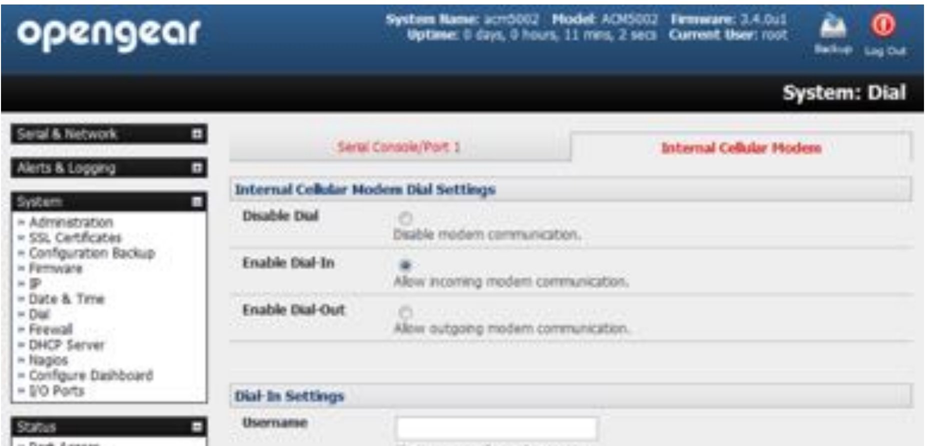
- Navigate to **System > Dial**.
- Click the **Internal Cellular Modem** tab.
- Check the *Enable Dial-In* radio button.
- Enter the required information in the **Dial-In Settings** section.

4.8. Firewalls & forwarding

Console servers with firmware v3.3 and later have basic routing, NAT (Network Address Translation), packet filtering and port forwarding support on all network interfaces.

This enables the console server to function as an Internet or external network gateway, via cellular connections or via other Ethernet networks on two Ethernet port models.

Network Forwarding allows the network packets on one network interface (for example LAN1 aka eth0) to be forwarded to another network interface (for example, LAN2 or dial-out/cellular). So locally networked devices can IP connect through the console server to devices on remote networks.



System Name: acm5002 Model: ACM5002 Firmware: 3.4.0u1
Uptime: 0 days, 0 hours, 11 mins, 2 secs Current User: root

System: Dial

Internal Cellular Modem Dial Settings

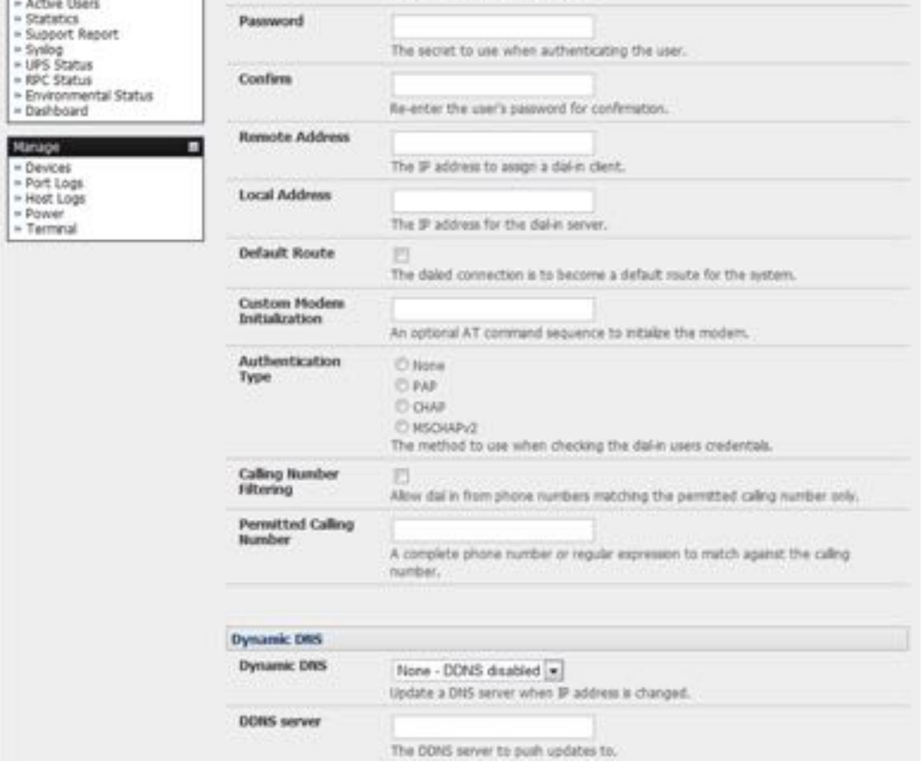
Disable Dial ○ Disable modem communication.

Enable Dial-In ● Allow incoming modem communication.

Enable Dial-Out ○ Allow outgoing modem communication.

Dial-In Settings

Username



Password
The secret to use when authenticating the user.

Confirm
Re-enter the user's password for confirmation.

Remote Address
The IP address to assign a dial-in client.

Local Address
The IP address for the dial-in server.

Default Route □
The dialed connection is to become a default route for the system.

Custom Modem Initialization
An optional AT command sequence to initialize the modem.

Authentication Type
○ None
○ PAP
○ CHAP
○ MSCHAPv2
The method to use when checking the dial-in users credentials.

Calling Number Filtering □
Allow dial in from phone numbers matching the permitted calling number only.

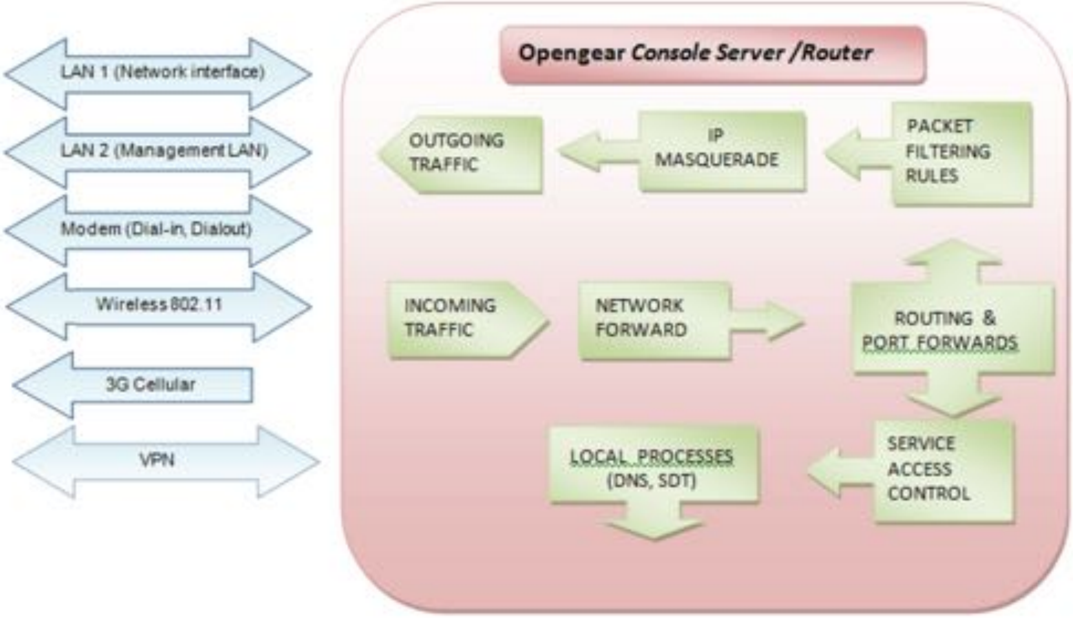
Permitted Calling Number
A complete phone number or regular expression to match against the calling number.

Dynamic DNS

Dynamic DNS None - DDNS disabled
Update a DNS server when IP address is changed.

DDNS server
The DDNS server to push updates to.

IP Masquerading is used to allow all the devices on your local private network to hide behind and share the one public IP address when connecting to a public network. This type of translation is only used for connections originating within the private network destined for the outside public network, and each outbound connection is maintained by using a different source IP port number.



When using IP Masquerading, devices on the external network cannot initiate connections to devices on the internal network. Port Forwards allows external users to connect to a specific port on the external interface of the console server and be redirected to a specified internal address for a device on the internal network.

With Firewall Rules, packet filtering inspects each packet passing through the firewall and accepts or rejects it based on user-defined rules.

Then Service Access Rules can be set for connecting to the console server/router itself.

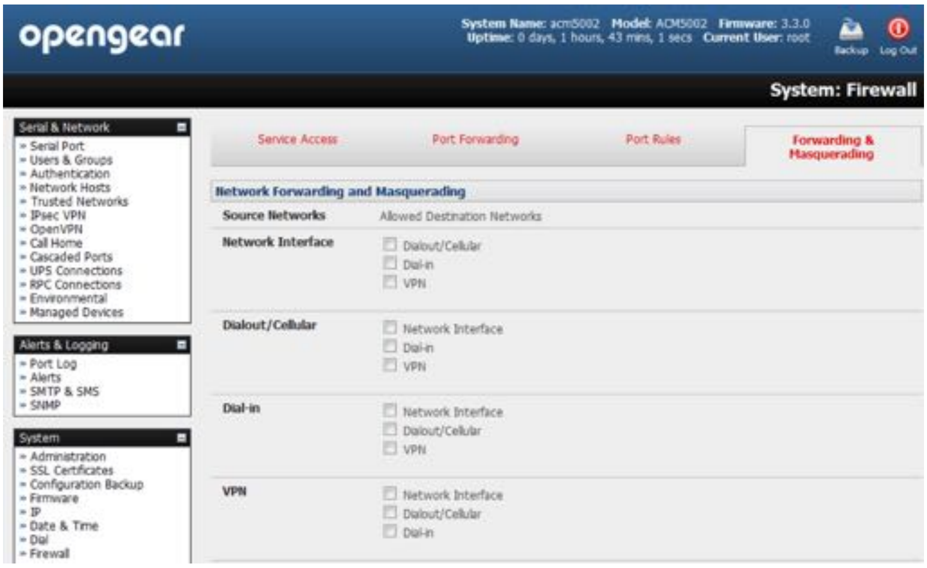
4.8.1. Configuring network forwarding & IP masquerading

To use a *console server* as an Internet or external network gateway requires establishing an external network connection (for example, for the ACM5004-G it means setting up the 3G cellular link as detailed in chapter 4) and then setting up forwarding and masquerading.

By default, all *console server* models are configured so that they will not route traffic between networks. To use the *console server* as an Internet or external network gateway, forwarding must be enabled so that traffic can be routed from the internal network to the Internet or an external network.

Note: Network forwarding allows the network packets on one network interface (for example, LAN1/eth0) to be forwarded to another network interface (for example LAN2/eth1 or dial-out/cellular). Locally networked devices can IP-connect through the **console server** *to devices on a remote network. IP masquerading is used to allow all the devices on your local private network to hide behind and share the one public IP address when connecting to a public network. This type of translation is only used for connections originating within the private network destined for the outside public network, and each outbound connection is maintained by using a different source IP port number.*

- Navigate to **System > Firewall**.
- Select the **Forwarding & Masquerading** tab.



System Name: acm5002 Model: ACM5002 Firmware: 3.3.0
Uptime: 0 days, 1 hours, 43 mins, 1 secs Current User: root

System: Firewall

Network Forwarding and Masquerading

Source Networks	Allowed Destination Networks
Network Interface	□ Dialout/Cellular □ Dial-in □ VPN
Dialout/Cellular	□ Network Interface □ Dial-in □ VPN
Dial-in	□ Network Interface □ Dialout/Cellular □ VPN
VPN	□ Network Interface □ Dialout/Cellular □ Dial-in

- Find the *Source Network* to be routed and tick the relevant *Destination Network*.

  For example, to configure a single-Ethernet device such as the ACM5004-G as a cellular router set:

  the *Source Network* to *Network Interface*
  the Destination Network to *Dialout/Cellular*.

IP Masquerading is generally required if the *console server* will be routing to the Internet, or if the external network being routed to does not have routing information about the internal network behind the *console server*.

IP Masquerading performs Source Network Address Translation (SNAT) on outgoing packets, to make them appear like they've come from the *console server* rather than devices on the internal network.

When response packets come back devices on the external network, the *console server* translates the packet address back to the internal IP, so that it is routed correctly. This allows the console server to provide full outgoing connectivity for internal devices using a single IP Address on the external network.

By default IP Masquerading is disabled for all networks. To enable masquerading:

- navigate to **System > Firewall**.
- select the **Forwarding & Masquerading** tab.
- check *Enable IP Masquerading (SNAT)* on the network interface where masquerading is to be enabled.

4.8.2. Configuring client devices

Client devices on the local network must be configured with Gateway and DNS settings. This can be done statically on each device, or, in IM- and ACM-series devices, using DHCP.

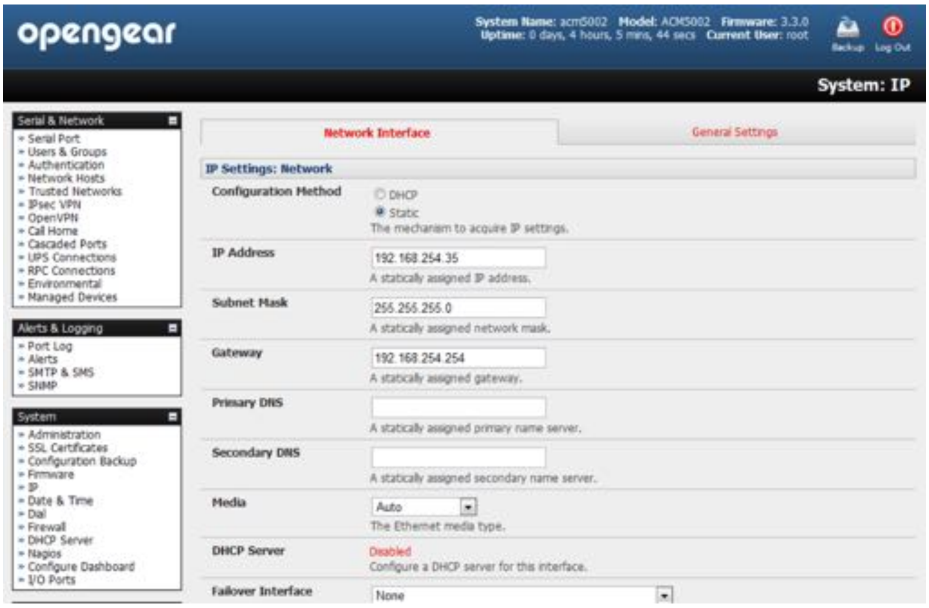
Manual configuration

Manually set a static gateway address (being the address of the *console server*) and set the DNS server address to be the same as used on the external network. That is, if the *console server* is acting as an internet gateway or a cellular router, use the ISP-provided DNS server address.

DHCP configuration

Note: DHCP configuration is only available on IM- and ACM-series devices.

- Navigate to **System > IP**.
- Click the tab of the interface connected to the internal network.



System Name: acm5002 **Model:** ACM5002 **Firmware:** 3.3.0
Uptime: 0 days, 4 hours, 5 mins, 44 secs **Current User:** root

System: IP

IP Settings: Network

Configuration Method ○ DHCP ● Static
The mechanism to acquire IP settings.

IP Address 192.168.254.35
A statically assigned IP address.

Subnet Mask 255.255.255.0
A statically assigned network mask.

Gateway 192.168.254.254
A statically assigned gateway.

Primary DNS
A statically assigned primary name server.

Secondary DNS
A statically assigned secondary name server.

Media Auto
The Ethernet media type.

DHCP Server Disabled
Configure a DHCP server for this interface.

Failover Interface None

- To use DHCP, a static address must be set: check that the *IP Address* and *Subnet Mask* fields have specific and static values entered.

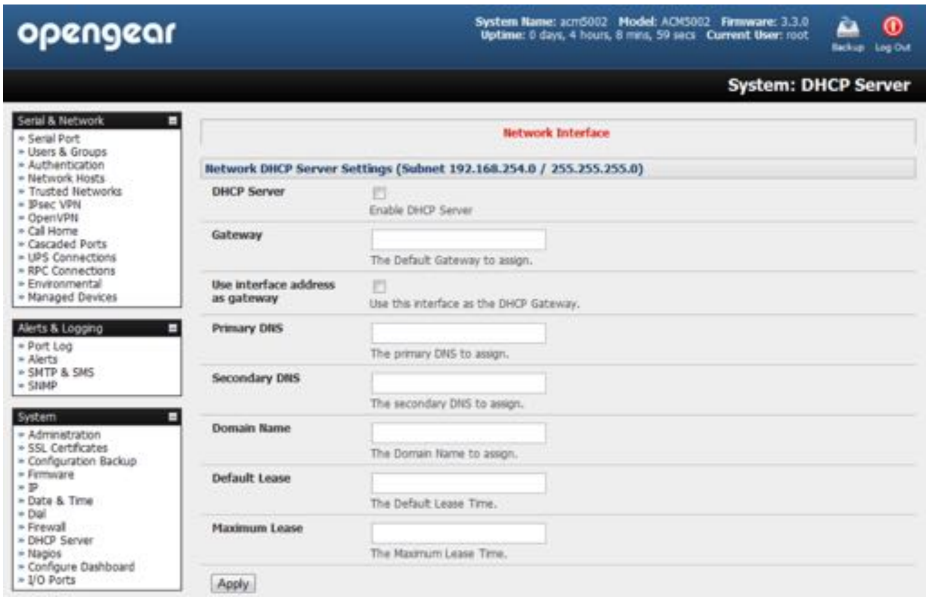
- Click the *Disabled* link adjacent the *DHCP Server* entry.

  System > DHCP Server will load.

- Check the *DHCP Server* checkbox.
- Check the *Use interface address as gateway* checkbox.
- Set the *Primary DNS* and *Secondary DNS* addresses to the same addresses as are used on the external network.

  That is, if the *console server* is acting as an internal gateway or a cellular router, use the ISP-provided DNS server addresses.

- Enter the *Default Lease* time in seconds.
- Enter the *Maximum Lease* time in seconds.



System Name: acm5002 Model: ACM5002 Firmware: 3.3.0
Uptime: 0 days, 4 hours, 8 mins, 59 secs Current User: root

System: DHCP Server

Network Interface

Network DHCP Server Settings (Subnet 192.168.254.0 / 255.255.255.0)

DHCP Server ☐ Enable DHCP Server

Gateway: The Default Gateway to assign.

Use interface address as gateway ☐ Use this interface as the DHCP Gateway.

Primary DNS: The primary DNS to assign.

Secondary DNS: The secondary DNS to assign.

Domain Name: The Domain Name to assign.

Default Lease: The Default Lease Time.

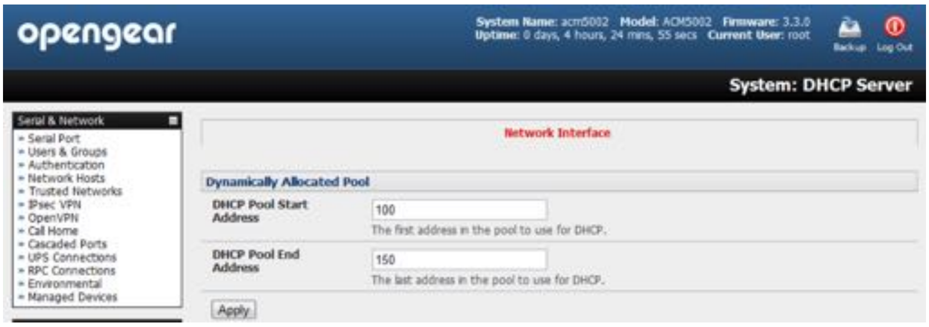
Maximum Lease: The Maximum Lease Time.

Least times are the number of seconds a dynamically assigned IP address is valid before the client must request it again.

- click **Apply**.

The DHCP server issue IP addresses sequentially from a specified address pool or pools.

- Click **Add** in the *Dynamic Address Allocation Pool* section.



System Name: acm5002 Model: ACM5002 Firmware: 3.3.0
Uptime: 0 days, 4 hours, 24 mins, 55 secs Current User: root

System: DHCP Server

Network Interface

Dynamically Allocated Pool

DHCP Pool Start Address: 100 — The first address in the pool to use for DHCP.

DHCP Pool End Address: 150 — The last address in the pool to use for DHCP.

- Enter the *DHCP Pool Start Address*.
- Enter the *DHCP Pool End Address*.
- click **Apply**.

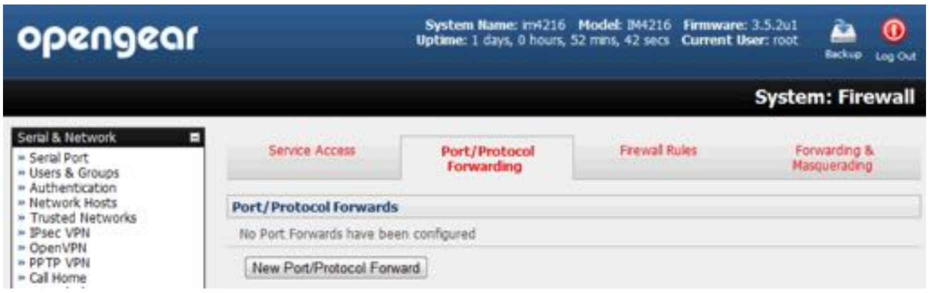
4.8.3. Port & protocol forwarding

When using IP Masquerading, devices on the external network cannot initiate connections to devices on the internal network.

To work around this, Port Forwards can be set up to allow external users to connect to a specific port, or range of ports on the external interface of the *console server* or cellular router. Port forwarding also allows the *console server* or cellular router to redirect data to a specified internal address and port range.

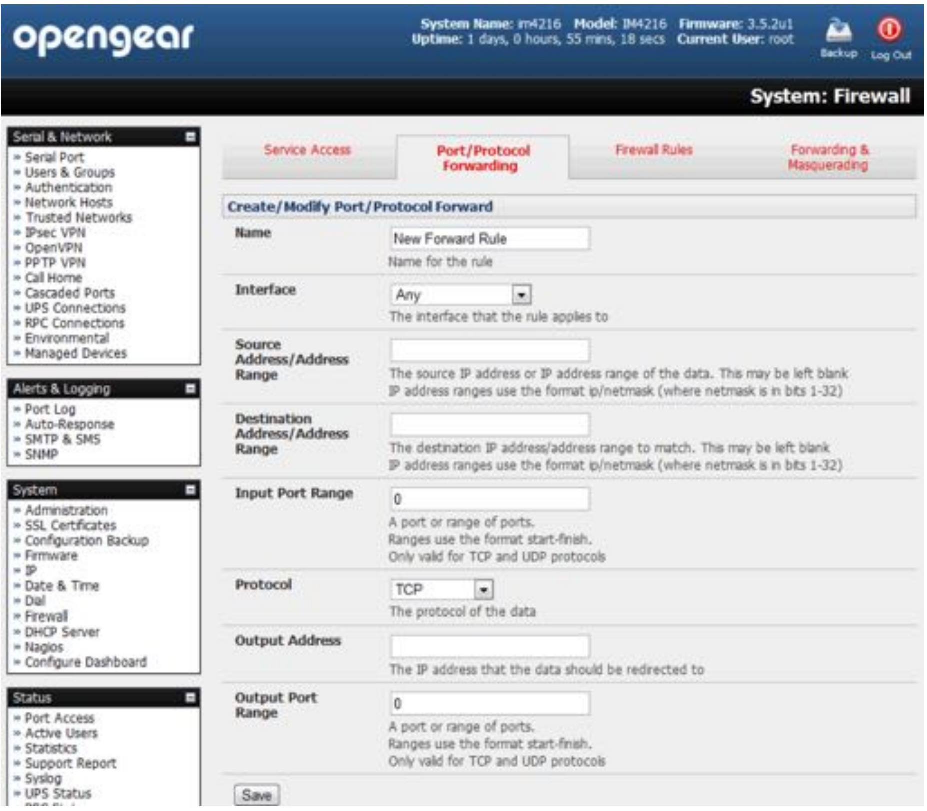
To setup a port and protocal forward:

- navigate to **System > Firewall**.



No Port Forwards have been configured

- click the **Port/Protocol Forwarding** tab.
- Click **New Port/Protocol Forward**.



Create/Modify Port/Protocol Forward

Name: New Forward Rule
Name for the rule

Interface: Any
The interface that the rule applies to

Source Address/Address Range:
The source IP address or IP address range of the data. This may be left blank
IP address ranges use the format ip/netmask (where netmask is in bits 1-32)

Destination Address/Address Range:
The destination IP address/address range to match. This may be left blank
IP address ranges use the format ip/netmask (where netmask is in bits 1-32)

Input Port Range: 0
A port or range of ports.
Ranges use the format start-finish.
Only valid for TCP and UDP protocols

Protocol: TCP
The protocol of the data

Output Address:
The IP address that the data should be redirected to

Output Port Range: 0
A port or range of ports.
Ranges use the format start-finish.
Only valid for TCP and UDP protocols

- Fill in the following fields.

field	purpose
Name	Name for the port forward. This should describe the target and the service that the port forward is used to access.
Input Interface	This allows the user to only forward the port from a specific interface. In most cases, this should be left as *Any*.
Source Address/Address Range	This allows the user to restrict access to a port forward to a specific source IP address or IP address range of the data. This may be left blank. IP address ranges use the format ip/netmask (where netmask is in bits 1-32).
Destination Address/Address Range	The destination IP address/address range to match. This may be left blank. IP address ranges use the format ip/ netmask (where netmask is in bits 1-32)
Input Port Range	The range of ports to forward to the destination IP. These will be the port(s) specified when accessing the port forward. These ports need not be the same as the output port range.
Protocol	The protocol of the data being forwarded. The options are *TCP*, *UDP*, *TCP and UDP*, *ICMP*, *ESP*, *GRE*, or *Any*.
Output Address	The target of the port forward. This is an address on the internal network where packets sent to the Input Interface on the input port range are sent.
Output Port Range	The port or range of ports that the packets will be redirected to on the Output Address. Ranges use the format start-finish. Only valid for TCP and UDP protocols.

For example, to forward port 8443 to an internal HTTPS server on 192.168.10.2, use the following settings:

field	value
Name	*Administrator's choice.*
Input Interface	Any
Source Address/Address Range	*Leave blank.*
Destination Address/Address Range	*Leave blank.*
Input Port Range	8443
Protocol	TCP
Output Address	192.168.10.2
Output Port Range	443

4.8.4. Firewall rules

Firewall rules can be used to block or allow traffic through an interface based on port number, the source IP address, the destination IP address or range, the direction (ingress or egress), the protocol or any combination of these. This can be used to allow custom on-box services, or block traffic based on policy.

To setup a firewall rule:

- navigate to **System > Firewall**.
- click the **Firewall Rules** tab.

Note: prior to firmware v3.4 this tab was labeled **Port Rules** *and fewer firewall rules could be configured.*

- Click **New Firewall Rule**.
- Fill in the following fields.

field	purpose
Name	Name the rule. This name should describe the policy the firewall rule is being used to implement (for example, *Block FTP* or *Allow Tony*).
Interface	Select the interface that the firewall rule will be applied to. Choices include *Any*, *Dialout/Cellular*, *VPN*, *Network Interface*, and *Dial-in*.
Port Range	Specify the Port or range of Ports (for example 1000 – 1500) that the rule will apply to. This may be left blank for *Any*.
Source MAC Address	Specify the source MAC address to be matched. This may be left blank for *Any*. MAC addresses use the format XX:XX:XX:XX:XX:XX, where XX are hex digits.
Source Address Range	Specify the source IP address (or address range) to match. IP address ranges use the format ip/netmask (where netmask is in bits 1-32). This may be left blank for *Any*.
Destination Range	Specify the destination IP address/address range to match. IP address ranges use the format ip/netmask (where netmask is in bits 1-32). This may be left blank.
Protocol	Select if the firewall rule will apply to *TCP*, *UDP*, *TCP and UDP*, *ICMP*, *ESP*, *GRE*, or *Any*.
Direction	Select the traffic direction that the firewall rule will apply to: *Ingress* = incoming; *Egress* = outgoing.
Action	Select the action (*Accept* or *Block*) to be applied to the packets detected that match the Interface + Port Range + Source Address + Destination Range+ Protocol+ Direction.

For example, to block all SSH traffic from leaving Dialout Interface, use the following settings:

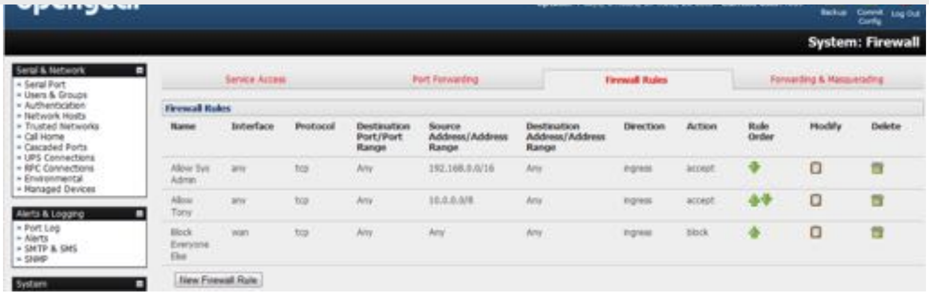
field	value
Name	*Administrator's choice.*
Interface	Dialout/Cellular
Port Range	*22*

Source MAC Address	*Left blank.*
Source Address Range	*Left blank (Any).*
Destination Range	*Left blank.*
Protocol	TCP
Direction	Egress
Action	Block

Firewall rules are processed in a set order, from top to bottom. So rule placement is important.

For example with the following rules, all traffic coming in over the Network Interface is blocked except when it comes from two nominated IP addresses (SysAdmin and Tony):

field	allow SysAdmin	allow Tony	Block Everyone Else
Interface	Any	Any	Network Interface
Port Range	Any	Any	Any
Source MAC Address	Any	Any	Any
Source Address Range	SysAdmin's IP address	Tony's IP address	Any
Destination Range	Any	Any	Any
Protocol	TCP	TCP	TCP
Direction	Ingress	Ingress	Ingress
Action	Accept	Accept	Block



Firewall Rules

Name	Interface	Protocol	Destination Port/Port Range	Source Address/Address Range	Destination Address/Address Range	Direction	Action	Rule Order	Modify	Delete
Allow Sys Admin	any	tcp	Any	192.168.0.0/16	Any	ingress	accept	↓	□	🗑
Allow Tony	any	tcp	Any	10.0.0.0/8	Any	ingress	accept	↑↓	□	🗑
Block Everyone Else	wan	tcp	Any	Any	Any	ingress	block	↑	□	🗑

If the *Rule Order* is changed so the *Block Everyone Else* rule was second on the list, Tony's traffic — coming in over the *Network Interface* — would be blocked.

4.8.5. Packet state matching in firewall rules

As of firmware 4.0.0, Firewall rules can include packet state matching.

This is implemented using an iptables extension module and can be set as follows:

- Navigate to **System > Firewall > Firewall Rules**.
- In either the IPv4 or IPv6 section, click the *New Firewall Rule* button.
- Enter a **Name** for the new rule in the *Name field.*
- Select the *Interface* the new rule will be applied against from the *Interface* pop-up menu.

Note: the available interfaces vary depending on the exact hardware available on the **console**

Note: **server** *but, by default, new firewall rules are applied against* **Any** *(ie, all) available interface.*

- If the selected interface operates the TCP or UDP protocol, enter a port or port range of the rule's destination.
- If the firewall rule is to apply against a particular MAC address, enter this value in the *Source MAC address* field.

  MAC addresses must be entered in standard *xx:xx:xx:xx:xx:xx* format (where each *xx* is a hexadecimal value).
- If the firewall rule is to apply against a particular source address or range of source addresses, enter this address or address range in the *Source Address/Address Range* field.

  Address ranges can be entered using the *ip-address/netmask* syntax.
- If the firewall rule is to apply to a particular destination address or address range, enter this address or address range in the *Destination Address/Address Range* field.

  As with the *Source Address/Address Range* field, address ranges can be entered using the *ip-address/netmask* syntax.
- Set the data protocol against which the firewall rule will apply.

  By default, new firewall rules apply against the *TCP* protocol.
- Set the direction of data travel against which the firewall rule will apply.

  This setting can take one of two values: *Ingress* or *Egress*. The default is *Ingress*.

  Ingress means data arriving at an interface from elsewhere. *Egress* means data leaving an interface and going to elsewhere.
- Select the desired packet state to match against from the *Connection State* pop-up menu.

  Available options are *New*, *Established/Related*, and *Any*.

  The default option is *Any*.

Note: the default option leaves packet state matching inactive. With this option no extra specifications are added to the firewall rule.

- Select the desired action to be taken regarding packets of the chosen state from the *Action* pop-up menu.

  The two available options are *Block* and *Accept*.

  The default action is *Block*.
- Click the **Save** button.

Using the Connection State pop-up menu in **System > Firewall > Firewall Rules > IPv4 > New Firewall Rule** to set packet state matching to *New* or *Established/Related* is equivalent to running one of the following at a shell-prompt:

```
# iptables -m state --state NEW
```

```
# iptables -m state --state ESTABLISHED,RELATED
```

For example:

```
# iptables -I INPUT -p tcp --dport 23 -m state --state \
  ESTABLISHED,RELATED -j ACCEPT
```

This tells the firewall to accept incoming Telnet traffic for previously established Telnet sessions.

If the rule is created in *IPv6 > New Firewall Rule*, it is the equivalent of running one of the following at a shell-prompt:

```
# ip6tables -m state --state NEW
```

```
# ip6tables -m state --state ESTABLISHED,RELATED
```

For example:

```
# ip6tables -I INPUT -p tcp --dport 23 -m state --state \
  ESTABLISHED,RELATED -j ACCEPT
```

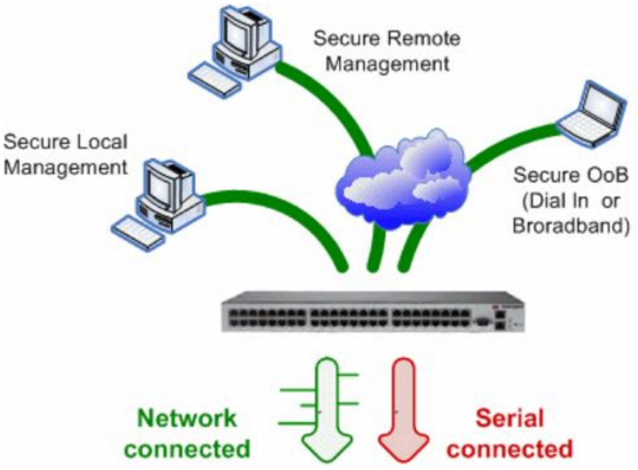
As with the `iptables` example, this tells the firewall to accept incoming Telnet traffic for previously established Telnet sessions.

For more on `iptables`, `ip6tables` and `iptables-extensions`, see the respective man pages: iptables, ip6tables and iptables-extensions.

5.SSH tunnels & SDT connector

Each Opengear *console server* has an embedded SSH server and uses SSH tunneling so remote users can securely connect through the console server to Managed Devices using text-based console tools (such as SSH, telnet, SoL) or graphical tools (such VNC, RDP, HTTPS, HTTP, X11, VMware, DRAC, iLO).

The Managed Devices being accessed can be located on the same local network as the console server or they can be attached to the console server via a serial port. The remote User/Administrator connects to the *console server* thru an SSH tunnel via dial-up, wireless or ISDN modem; a broadband Internet connection; the enterprise VPN network or the local network:



To set up the secure SSH tunnel from the Client PC to the console server, you must install (if necessary) and launch SSH client software on the *User's* or *Administrator's* PC.

Opengear recommends you use the SDT Connector client software that is supplied with the *console server* for this. SDT Connector is simple to install and auto-configure and it will provides all your users with point-and-click access to all the systems and devices in the secure network.

With one click, SDT Connector sets up a secure SSH tunnel from the client to the selected console server, then establishes a port forward connection to the target network connected host or serial connected device, then executes the client application that will be used in communicating with the host.

This chapter details the basic SDT Connector operations:

- Configuring the console server for SSH tunneled access to network attached hosts and setting up permitted Services and user access.
- Setting up the SDT Connector client with gateway, host, service and client application details and making connections between the Client PC and hosts connected to the console server.
- Using SDT Connector to browser access the Management Console.
- Using SDT Connector to Telnet or SSH connect to devices that are serially attached to the console server.

The chapter then covers more advanced SDT Connector and SSH tunneling topics:

- Using SDT Connector for out of band access.
- Automatic importing and exporting of configurations.
- Configuring Public Key Authentication.
- Setting up a SDT Secure Tunnel for Remote Desktop.
- Setting up a SDT Secure Tunnel for VNC.
- Using SDT to IP connect to hosts that are serially attached to the console server.

5.1. Configuring for SSH tunnelling to hosts

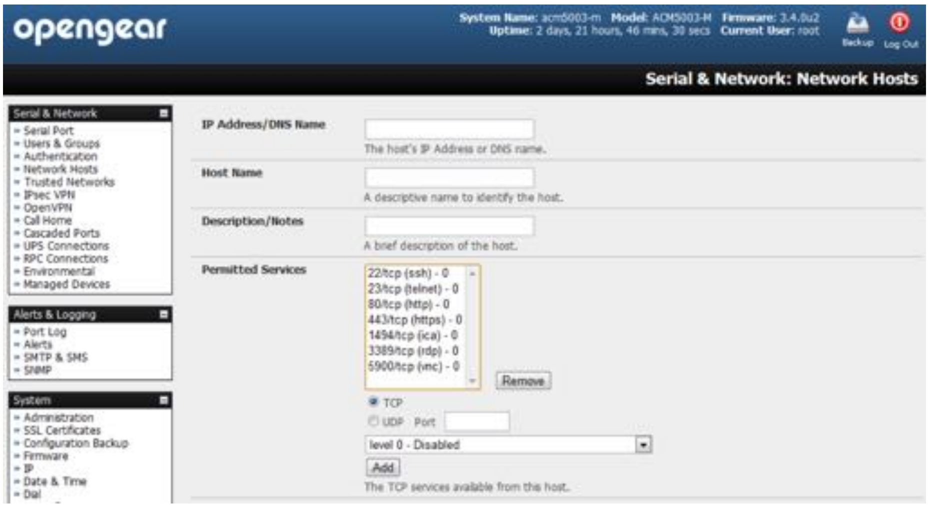
To set up the *console server* for SSH tunneled access a network attached *host*:

- Add the new host and the permitted services using the **Serial & Network > Network Hosts** menu as detailed in Network Hosts (chapter 3.4). Only these permitted services will be forwarded through by SSH to the host. All other services (TCP/UDP ports) will be blocked.
- following are some of the TCP Ports used by SDT in the *console server*:

port	application	notes
22	SSH	All SDT tunneled connections.
23	Telnet	On local LAN. Forwarded inside tunnel.
80	HTTP	On local LAN. Forwarded inside tunnel.
3389	RDP	On local LAN. Forwarded inside tunnel.

5900	VNC	On local LAN. Forwarded inside tunnel.
73*xx*	RDP over serial	From local LAN. *xx* is the serial port # (eg 7301–7348 on a 48-port *console server*.
79*xx*	VNC over serial	From local LAN. *xx* is the serial port # (eg 7301–7348 on a 48-port *console server*.

- Add the new Users using **Serial & Network > Users & Groups** menu as detailed in Network Hosts (chapter 3.4). Users can be authorized to access the *console server* ports and specified network-attached hosts.



Serial & Network: Network Hosts

IP Address/DNS Name
The host's IP Address or DNS name.

Host Name
A descriptive name to identify the host.

Description/Notes
A brief description of the host.

Permitted Services
22/tcp (ssh) - 0
23/tcp (telnet) - 0
80/tcp (http) - 0
443/tcp (https) - 0
1494/tcp (ica) - 0
3389/tcp (rdp) - 0
5900/tcp (vnc) - 0

● TCP
○ UDP Port
level 0 - Disabled
The TCP services available from this host.

To simplify configuration, the *Administrator* can first set up Groups with group access permissions, then *Users* can be classified as members of particular Groups.

5.2. SDT connector client configuration

The *SDT Connector* client works with all Opengear *console servers*. Each remote *console servers* has an embedded OpenSSH based server which can be configured to port forward connections from the *SDT Connector* client to hosts on their local network (see chapter 4).

The *SDT Connector* can also be pre-configured with the access tools and applications that will be available to be run when access to a particular host has been established.

SDT Connector can connect to the console server using an alternate OOB access. It can also access the *console server* itself and devices connected to the *console server's* serial ports.

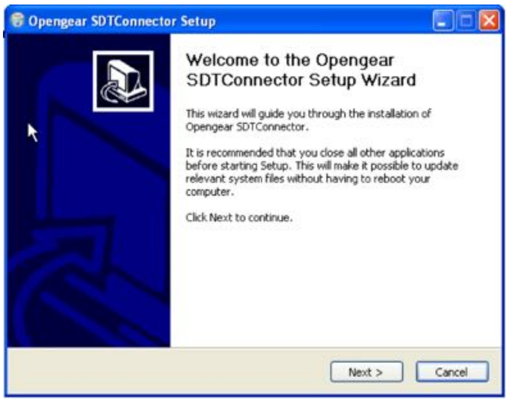
5.2.1. SDT connector client installation

SDT Connector's set up tool, `SDTConnector Setup-1.n.exe` or `sdtcon-1.n.tar.gz`, is on the CD supplied with your *console server*. It can also be had from Opengear's website.

To install, run the set-up program.

On Windows, `SDTConnectorSetup-1.n.exe` installs `SDT Connector 1.n.exe` and the config file `defaults.xml`. If `defaults.xml` exists, it is not overwritten. To remove earlier config files, run `regedit`, search for *SDT Connector* and remove the directory with this name.

For Linux and other Unix clients, `SDTConnector.tar.gz` will install the `sdtcon-1.n.jar` and the config file `defaults.xml`.



Welcome to the Opengear SDTConnector Setup Wizard

This wizard will guide you through the installation of Opengear SDTConnector.

It is recommended that you close all other applications before starting Setup. This will make it possible to update relevant system files without having to reboot your computer.

Click Next to continue.

Once complete you will have *SDT Connector* on your machine and an icon on your desktop.

To launch the *SDT Connector* client, double-click this icon.

Note: **SDT Connector** *is a Java application. It must have a Java Runtime Environment (JRE) installed. It will install on Windows 2000 and later and on most Linux platforms. Solaris platforms are also supported however they must have Firefox installed.* **SDT Connector** *can run on any system with Java 1.4.2 and above installed, but it assumes the web browser is Firefox, and that* `xterm -e telnet` *opens a telnet window.*

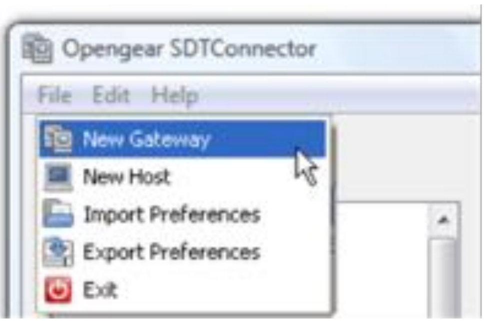
To operate *SDT Connector*, you first add new gateways to the client software by entering the access details for each *console server* (see chapter 5.2.2) then let the client auto-configure with all host and serial port connections from each *console server* (see section 5.2.3) then point-and-click to connect to the Hosts and serial devices (see chapter 5.2.4).

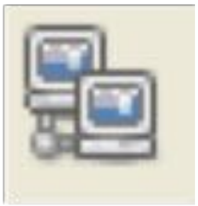
Alternately you can manually add network connected hosts (see chapter 5.2.5) and manually configure new services to be used in accessing the *console server* and the hosts (see chapter 5.2.6) then manually configuring clients to run on the PC that will use the service to connect to the hosts and serial port devices (see chapter 5.2.7). SDT Connector can also be set up to make an out-of-band connection to the console server.

5.2.2. Configuring a new gateway in the SDT connector client

To create a secure SSH tunnel to a new *console server*:

- select **File > New Gateway** or click the **New Gateway** icon.





- enter the IP address or hostname of the *console server*.
- enter the SSH port (typically port 22).

If *SDT Connector* is connecting to a remote console server through the public Internet or a routed network you will need to:

- determine the public IP address of the *console server* or the public IP address of the router or firewall that connects the *console server* to the Internet.

  One way to find the public IP address is to access / or / from a computer on the same network as the console server and note the reported IP address.

- Setup port-forwarding for TCP port 22 on any firewall, router or NAT service located between *SDT Connector* and the *console server*.

  http://www.portforward.com/ has port-forwarding instructions for a range of routers. The Open Port Check tool from http://www.canyouseeme.org/ can be used to check if port-forwarding through a firewall, router or NAT service has been properly configured.

- enter the *Username* and *Password* of a user on the gateway who has been enabled to connect via SSH.
- optionally, enter a *Descriptive Name* to display instead of the IP address or hostname.
- optionally enter desired information in the *Description/Notes* field.

  For example: the *console server's* site location; the *console server's* running firmware version; or details on the site's network configuration.

- click **OK**.

  The new gateway will appear in the *SDT Connector* home page.

Note: *For an* **SDT Connector** *user to access a* **console server** *and then access specific hosts or serial devices connected to that* **console server**, *that user must first be setup on the* **console server**, *and must be authorized to access the specific ports on the specific hosts (see chapter 4). Only these permitted services will be forwarded through by SSH to the Host. All other services (TCP/UDP ports) are blocked.*

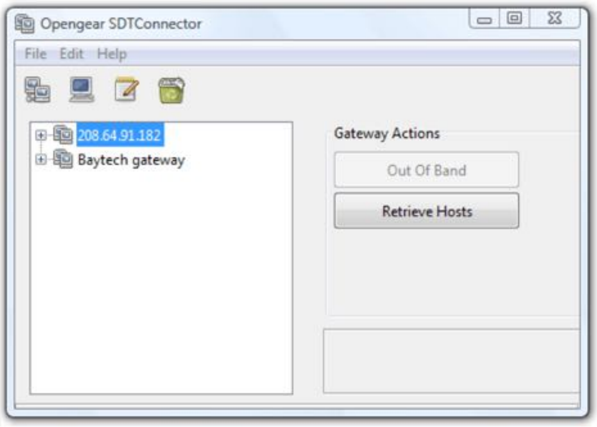
5.2.3. Auto-configure SDT connector client with the user's access privileges

Each user on the *console server* has an access profile which has been configured with those specific connected hosts and serial port devices the user has authority to access, and a specific set of the enabled services for each of these. This configuration can be auto-uploaded into the SDT Connector client.

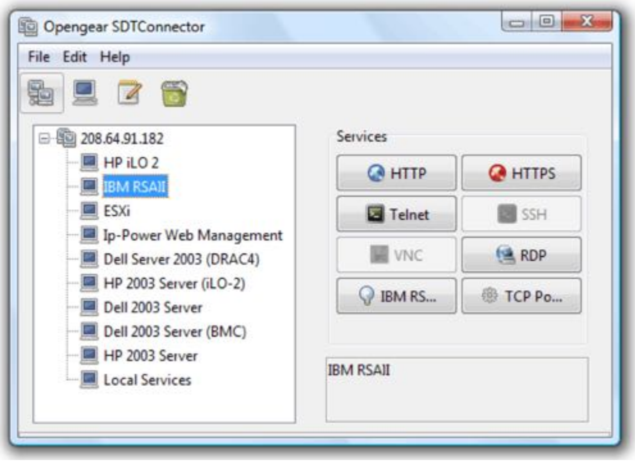
- Select **File > New Gateway** (or click the **New Gateway** icon).
- Click **Retrieve Hosts**.

SDT Connector will:

- configure access to network connected Hosts that the user is authorized to access and will, for each of these Hosts, set up the services (for example, HTTPS, IPMI2.0) and the related IP ports being redirected.



- configure access to the *console server* itself. This is shown as a Local Services host.
- configure access with the enabled services for the serial port devices connected to the *console server*.



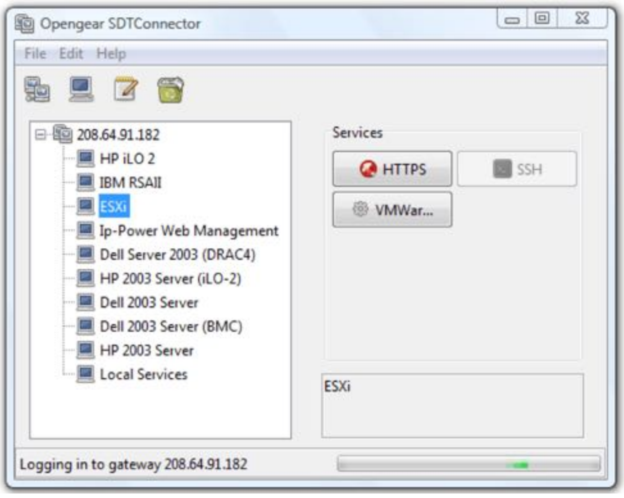
Note: **Retrieve Hosts** *auto-configures all classes of user whether they are members of user, admin, some other group, or no group. SDT Connector will not, however, auto-configure the root. Further, it is recommended that root only be used for initial config and for adding an initial admin account to the* **console server.**

5.2.4. Make an SDT connection through the gateway to a host

- Select the **host** to be accessed.
- Click the **Service** to be used in accessing that host.

  The SSH tunnel to the gateway is established, the appropriate ports redirected through to the host, and the appropriate local client application is launched pointing at the local endpoint of the redirection.

The SDT Connector client can be configured with an unlimited number of gateways and each gateway can be configured to port forward to an unlimited number of locally networked Hosts. Similarly there is no limit on the number of SDT Connector clients who can be configured to access the one Gateway. Nor are there limits on the number of Host connections that an SDT Connector client can concurrently have open through the one Gateway tunnel.

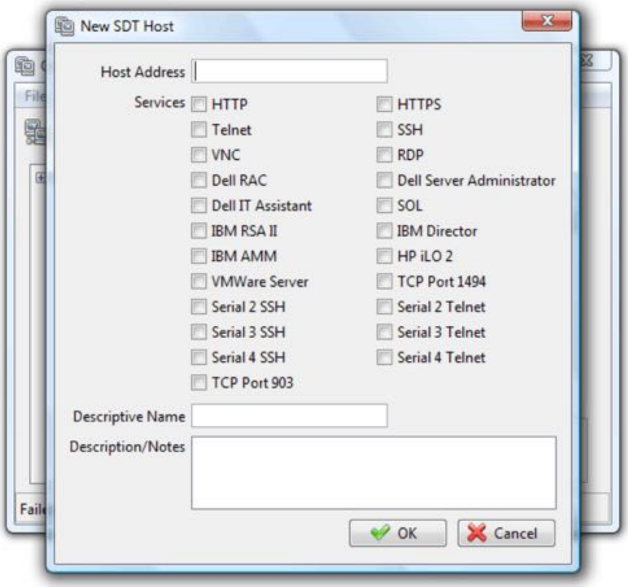


However there is a limit to the number of SDT Connector SSH tunnels that can be open at the one time on a particular Gateway. IM4200, ACM5000 and ACM5500 models each support at least 50 such concurrent connections. So for a site with a IM4200 gateway you can have, at any time up to 50 users securely controlling an unlimited number of network attached computers and appliances (servers, routers, etc.) at that site. ACM7000, IM7200 and CM7100 support many hundreds of simultaneous client tunnels.

5.2.5. Manually adding a host to the SDT connector gateway

For each gateway, you can manually specify the network connected hosts that will be accessed through that console server; and for each host, specify the services that will used in communicating with the host.

- Select **File > New Host** (or select a gateway and click the **Host** icon).



- Enter the IP address or hostname of the host.

Note: a hostname must be resolvable by the gateway.

- Select which **Services** are to be used in accessing the new host.

  A range of service options are pre-configured in the default SDT Connector client (RDP, VNC, HTTP, HTTPS, Dell RAC, VMware etc). If you wish to add services beyond the pre-configured range, proceed to the next section then return here.

- Optionally, enter a *Descriptive Name* to display instead of the IP address or hostname.

- Optionally enter desired information in the *Description/Notes* field.

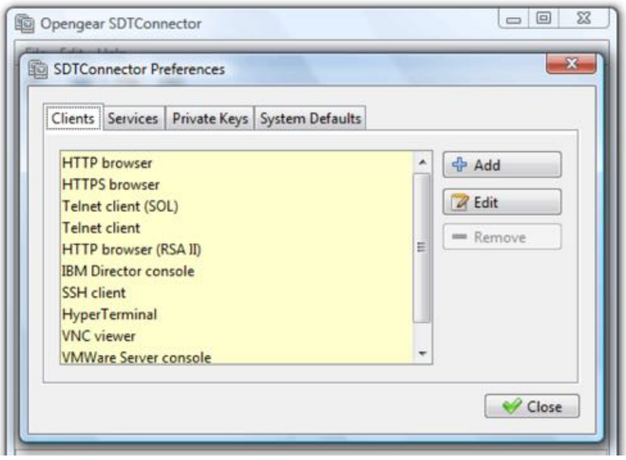
  For example: the *console server's* site location; the *console server's* running firmware version; or details on the site's network configuration.

- Click **OK**.

5.2.6. Manually adding new services to the new hosts

To extend the range of services that can be used when accessing hosts with *SDT Connector*:

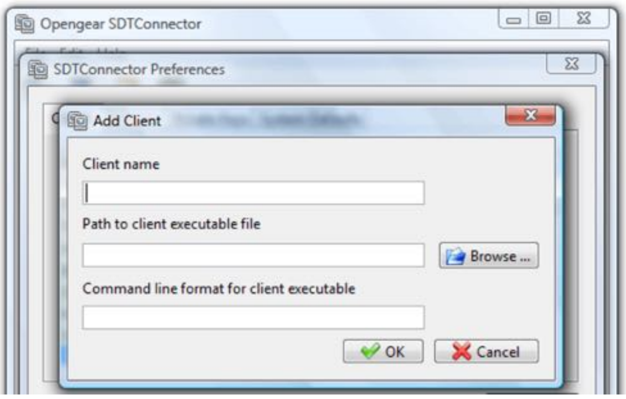
- select **Edit > Preferences**.



HTTP browser
HTTPS browser
Telnet client (SOL)
Telnet client
HTTP browser (RSA II)
IBM Director console
SSH client
HyperTerminal
VNC viewer
VMWare Server console

- click the **Services** tab.
- Click **Add**.
- enter a *Service Name*.
- click **Add**.
- under the **General** tab, enter the TCP Port that this service runs on (for example, port 80 for HTTP).
- optionally, select the client to use to access the local endpoint of the redirection.
- select which client application is associated with the new service.

  A range of client application options are pre-configured in the default SDT Connector (RDP client, VNC client, HTTP browser, HTTPS browser, Telnet client etc). However if you wish to add new client applications to this range proceed to the next section then return here.



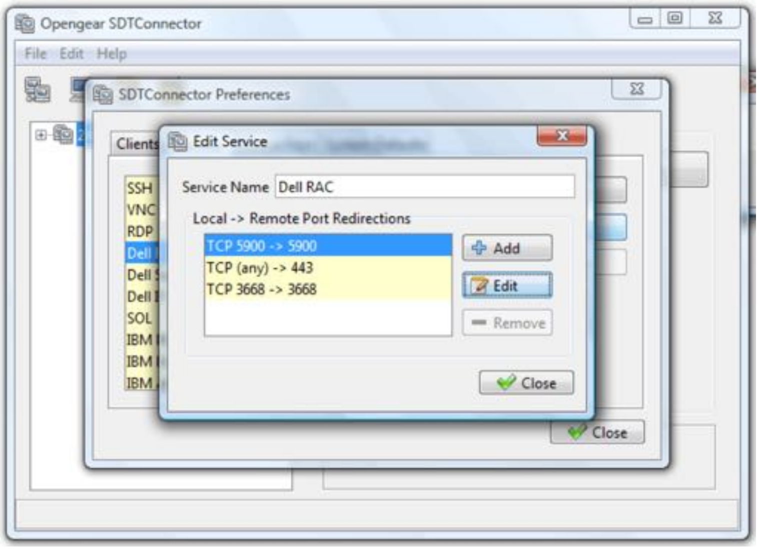
- Click **OK**.
- Click **Close**.

A service typically consists of a single SSH port redirection and a local client to access it. However it may consist of several redirections; some or all of which may have clients associated with them.

An example is the Dell RAC service. The first redirection is for the HTTPS connection to the RAC server. It has a client associated with it (web browser) that is launched immediately upon clicking the button for this service.

The second redirection is for the VNC service that the user may choose to later launch from the RAC web console. It automatically loads in a Java client served through the web browser, so it does not need a local client associated with it.

On the Add Service screen you can click **Add** as many times as needed to add multiple new port redirections and associated clients.



Service Name Dell RAC

TCP 5900 -> 5900
TCP (any) -> 443
TCP 3668 -> 3668

You may also specify Advanced port redirection options:

- enter the local address to bind to when creating the local endpoint of the redirection.

  It is not usually necessary to change this from *localhost*.

- enter a local TCP port to bind to when creating the local endpoint of the redirection.

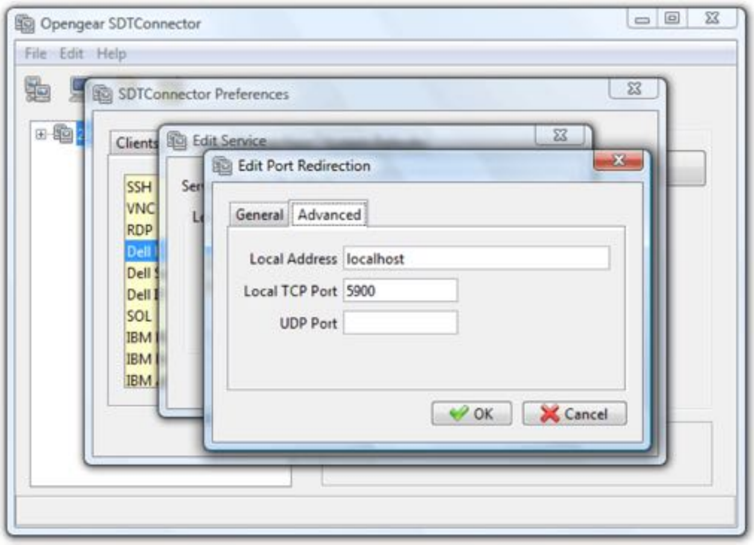
  If this is left blank, a random port will be selected.

Note: SDT Connector can also tunnel UDP services. SDT Connector tunnels the UDP traffic through the TCP SSH redirection, so in effect it is a tunnel within a tunnel. Enter the UDP port on which the service is running on the host. This will also be the local UDP port that SDT Connector binds as the local endpoint of the tunnel. For UDP services, you still need to specify a TCP port under General. This will be an arbitrary TCP port that is not in use on the gateway. An example of this is the SOL Proxy service. It redirects local UDP port 623 to remote UDP port 623 over the arbitrary TCP port 6667.

5.2.7. Adding a client program to be started for the new service

Clients are local applications that may be launched when a related service is clicked. To add to the pool of client programs:

- select **Edit > Preferences**.



Local Address localhost

Local TCP Port 5900

UDP Port

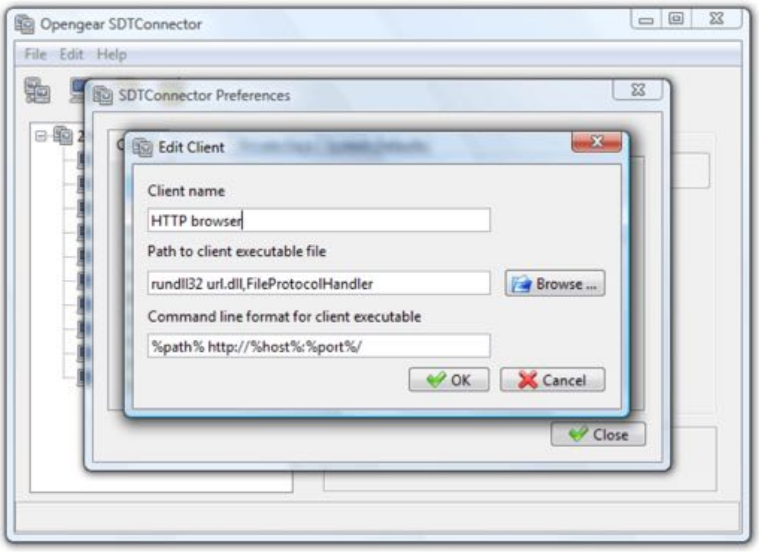
- click the **Client** tab.
- click **Add**.
- enter a *Client name***.**
- enter the *Path to the client executable file* or click **Browse** to locate the client application.
- enter a *Command line format for client executable* associated with launching the client.

  SDT Connector typically launches a client using command line arguments to point it at the local endpoint of the redirection. Three keywords specify the command line format. When launching the client, *SDT Connector* substitutes these keywords with appropriate values.

keyword	description
%path%	The path to the executable file. Takes the previous field value: *Path to the client executable file*.

%host%	The local address to which the local endpoint of the redirection is bound. That is, the Local Address field for the Service redirection Advanced options.
%port%	The local port to which the local endpoint of the redirection is bound. That is the Local TCP Port field for the Service redirection Advanced options. If *port* is unspecified (*Any*) an appropriate randomly selected port is substituted.

For example, *SDT Connector* is preconfigured for Windows with an HTTP client that connects to the Windows user's default browser. If there is no default browser Firefox is used.



Client name: HTTP browser

Path to client executable file: rundll32 url.dll,FileProtocolHandler

Command line format for client executable: %path% http://%host%:%port%/

Some clients are launched in a command line or terminal window. The Telnet client for example. In this case, *Path to client executable file* is `telnet` and the *Command line format for client executable* is `cmd /c start %path% %host% %port%`.

- Click **OK**.

5.2.8. Dial-in configuration

If the client is dialing into the *console server*'s Local/Console port, setup a dial-in PPP link.

- Configure the *console server* for dial-in access, following the steps in chapter 4.1.
- Set up the PPP client software on the remote computer, following the steps in chapter 4.

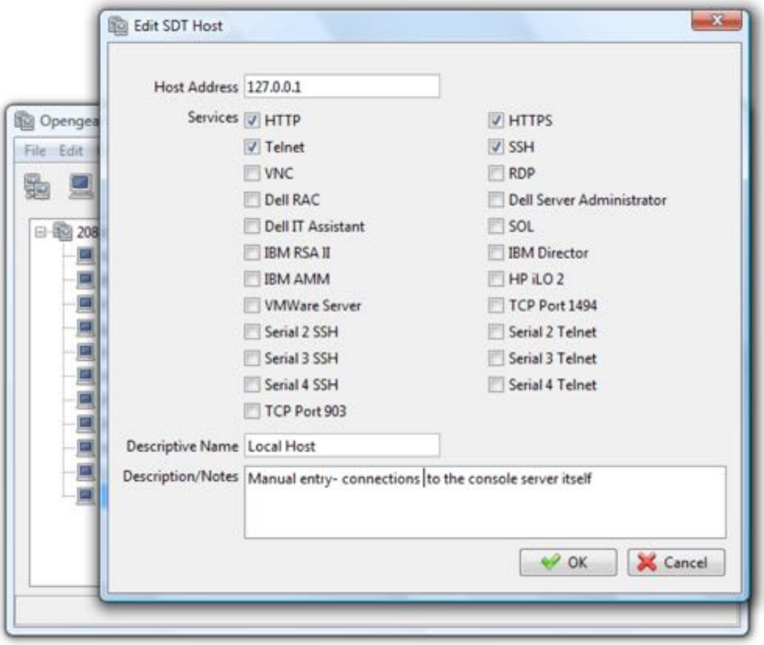
Once you have a dial-in PPP connection established, set up the secure SSH tunnel from the remote computer to the *console server*.

5.3. SDT connector to management console

SDT Connector can also be configured for browser access to the gateway's Management Console and for Telnet or SSH access to the gateway's shell. For these connections to the gateway itself, you must configure *SDT Connector* to access the gateway by setting the *console server* up as a host, and then configuring the appropriate services.

- Launch *SDT Connector* on your PC.

- Assuming you have already set up the *console server* as a Gateway in your *SDT Connector* client (with username, password etc) select this newly added Gateway and click the *Host* icon to create a host.
- Alternatively, select **File > New Host**.
- Enter 127.0.0.1 as the *Host Address*.
- Optionally add details in the *Descriptive Name* and *Description/Notes* fields.



Edit SDT Host

Host Address: 127.0.0.1

Services:

☑ HTTP	☑ HTTPS
☑ Telnet	☑ SSH
☐ VNC	☐ RDP
☐ Dell RAC	☐ Dell Server Administrator
☐ Dell IT Assistant	☐ SOL
☐ IBM RSA II	☐ IBM Director
☐ IBM AMM	☐ HP iLO 2
☐ VMWare Server	☐ TCP Port 1494
☐ Serial 2 SSH	☐ Serial 2 Telnet
☐ Serial 3 SSH	☐ Serial 3 Telnet
☐ Serial 4 SSH	☐ Serial 4 Telnet
☐ TCP Port 903	

Descriptive Name: Local Host

Description/Notes: Manual entry- connections to the console server itself

- Click **OK**.
- Click the *HTTP* or *HTTPS* services icon to access the gateway's Management Console.
- Click *SSH* or *Telnet* to access the gateway's command line console.

To enable SDT access to the gateway console, you must configure the console server to allow port forwarded network access to itself.

As of firmware v3.3, this can be done using the *console server's* Management Console.

- Navigate to **System > Firewall**.
- Click the **Service Access** tab.
- Enable *SSH Command Shell* access on the *Network Interface* and on any *Out-of-band Interfaces*.

With firmware versions prior to v3.3, do the following.

- Navigate to **Serial & Network > Network Hosts**.
- Click **Add Host**.
- In the *IP Address/DNS Name* field enter *127.0.0.1*.

This is the loopback address.

- Enter *Loopback* in the *Description* field.
- Remove all entries under *Permitted Services* except for those that will be used in accessing the Management Console (80/http or 443/https) or the command line (22/ssh or 23/telnet).
- click **Apply**.

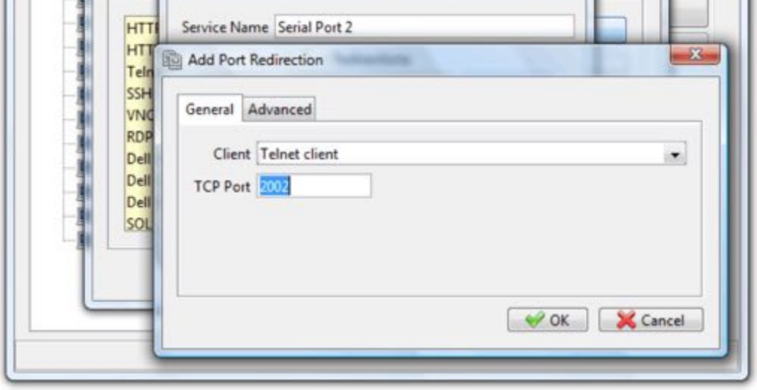
By default, *Administrators* have gateway access privileges. For *Users* to access the gateway Management Console, however, the required access privileges must be granted.

- Navigate to **Serial & Network > Users & Groups**.
- Click **Add User**.
- Enter a *Username*, *Description* and *Password*.
- Select 127.0.0.1 from the *Accessible Host(s)* pop-up menu.
- click **Apply**.

5.4. SDT connector: telnet or SSH connect to serially-attached devices

SDT Connector can also be used to access text consoles on devices that are attached to the *console server's* serial ports. For these connections, configure the *SDT Connector* client software with a Service that will access the target gateway serial port, and then set the gateway up as a host.

- Launch *SDT Connector* on your PC.
- Select **Edit > Preferences**.
- Click **Add**.
- Enter *Serial Port 2* as the *Service Name*.
- Click **Add**.
- Select *Telnet* as the *Client*.
- Enter *2002* as the *TCP Port*.
- Click **OK**.
- Close the **Add Service** window.
- Close the **SDTConnector Preferences** window.
- Assuming you have already set up the *console server* as a Gateway in your *SDT Connector* client (with username, password etc) select this newly added Gateway and click the *Host* icon to create a host.
- Alternatively, select **File > New Host**.
- Enter 127.0.0.1 as the *Host Address*.
- Optionally add details in the *Descriptive Name* and *Description/Notes* fields.



Service Name: Serial Port 2

Client: Telnet client

TCP Port: 2002

- Click **OK**.
- Click the **Serial Port 2** icon for Telnet access to the serial console on the device attached to serial port #2 on the gateway.

To enable *SDT Connector* to access to devices connected to the gateway's serial ports, configure the *console server* to allow port forwarded network access to itself, and enable access to the nominated serial port.

- Navigate to **Serial & Network > Serial Port**.
- Click *Edit* next to the selected Port.

  For example, click *Edit* next to *Port 2* if the target device is attached to the second serial port.
- Ensure the port's serial configuration is appropriate for the attached device.
- Set the *Console Server Setting* to *Console Server Mode*.
- click **Apply**.
- Navigate to **Serial & Network > Network Hosts**.
- click **Add Host**.
- In the *IP Address/DNS Name* field enter *127.0.0.1*.

  This is the loopback address.
- Enter *Loopback* in the *Description* field.
- Remove all entries under *Permitted Services*.
- Select *TCP*.
- *Enter 200n* in the *Port* field.

Note: 'n' corresponds to the Serial Port selected in the step above. For **Serial Port 2**, *for example, enter* **2002.**

- Click **Add**.
- Click **Apply**.

By default, *Administrators* have gateway and serial port access privileges. For *Users* to access the gateway Management Console and the serial port, however, the required access privileges must be granted.

- Navigate to **Serial & Network > Users & Groups**.
- Click **Add User**.
- Enter a *Username*, *Description* and *Password*.

- Select 127.0.0.1 from the *Accessible Host(s)* pop-up menu.
- Select *Port 2* from the *Accessible Port(s)* pop-up menu.
- click **Apply**.

5.5. Using SDT connector for out-of-band connection to the gateway

SDT Connector can also be set up to connect to the *console server* out-of-band (OOB). OOB access uses an alternate path for connecting to the *console server* to that used for regular data traffic. OOB access is useful for when the primary link into the *console server* is unavailable or unreliable.

Typically a *console server's* primary link is a broadband Internet connection or Internet connection via a LAN or VPN, and the secondary out-of-band connectivity is provided by a dial-up or wireless modem directly attached to the *console server*.

So out-of-band access enables you to access the hosts and serial devices on the network, diagnose any connectivity issues, and restore the *console server's* primary link.

In *SDT Connector*, OOB access is configured by providing the secondary IP address of the gateway, and telling *SDT Connector* how to start and stop the OOB connection. Starting an OOB connection may be achieved by initiating a dial up connection, or adding an alternate route to the *console server*. *SDT Connector* allows for maximum flexibility is this regard, by allowing you to provide your own scripts or commands for starting and stopping the OOB connection.

To configure *SDT Connector* for OOB access:

- Choose **File > New Gateway**.
- Click the **Out Of Band** tab.
- Enter the *console server's* Out of Band IP address in the *Secondary Address* field.

  The *console server's* Out of Band IP address is the address the *console server* is accessbile from when using the Out of Band access route.
- Change the *Port* value if the *console server* is using a port other than the default 22 for SSH access.
- Enter the command or path to a script to start the OOB connection in the *Start Command* field.
- To initiate a pre-configured dial-up connection under Windows, use the following *Start Command* string:

  ```
  cmd /c start "Starting Out of Band Connection" /wait /min rasdial
  network_connection login password
  ```

  where `network_connection` is the name of the network connection as displayed in **Control Panel > Network Connections**, `login` is the *console server's* dial-in username, and `password` is the *console server's* dial-in password.
- To initiate a pre-configured dial-up connection under Linux, use the following *Start Command* string:

```
pon network_connection
```

where `network_connection` is the name of the connection.

- Enter the command or path to a script to stop the OOB connection in the *Stop Command* field.
- To stop a pre-configured dial-up connection under Windows, use the following *Stop Command* string:

  ```
  cmd /c start "Stopping Out of Band Connection" /wait /min rasdial
  network_connection /disconnect
  ```

  where `network_connection` is the name of the network connection as displayed in **Control Panel > Network Connections**.
- To stop a pre-configured dial-up connection under Linux, use the following *Stop Command* string:

  ```
  poff network_connection
  ```

To make the OOB connection using *SDT Connector*:

- Select the *console server* to connect to.
- Click the **Out Of Band** button.

  The status bar changes color to indicate this *console server* is being accessed using the OOB link rather than the primary link.

When you connect to a service on a host behind the *console server*, or to the *console server* itself, *SDT Connector* will initiate the OOB connection using the provided *Start Command*. The OOB connection isn't stopped (using the provided *Stop Command*) until **Out Of Band** under **Gateway Actions** is clicked off, at which point the status bar will return to its normal color.

5.6. Importing and exporting preferences

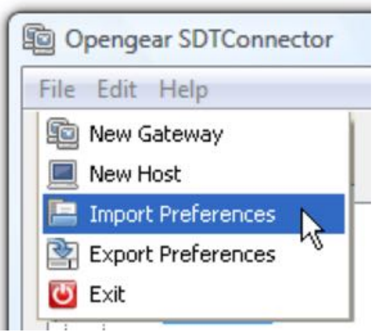
To enable the distribution of pre-configured client config files, *SDT Connector* has an Import and Export facility:

To save a configuration `.xml` file for backup or for importing into other SDT Connector clients):

- select **File > Export Preferences**.
- select the location to save the configuration file.

To import a configuration:

- select **File > Import Preferences**.



- select the `.xml` configuration file to be installed.

5.7. SDT connector public key authentication

SDT Connector can authenticate against an SSH gateway using your SSH key pair rather than requiring you to enter your password. This is known as public key authentication.

To use public key authentication with *SDT Connector*, first you must add the public part of your SSH key pair to your SSH gateway.

- Ensure the SSH gateway allows public key authentication.

  This is typically the default behavior.

- If you do not already have a public/private key pair for your client PC (the one running *SDT Connector*) generate them now using `ssh-keygen`, *PuTTYgen* or a similar tool.

  See chapter 14.6 for details on generating and installing public/private key pairs.

Note: You can use RSA or DSA. In this case, however, leave the passphrase field blank.

- Upload the public part of your SSH key pair (typically named `id_rsa.pub` or `id_dsa.pub`) to the SSH gateway, or otherwise add to `.ssh/authorized` keys in your home directory on the SSH gateway.
- Add the private SSH key (typically named `id_rsa` or `id_dsa`) to *SDT Connector*.
- Click **Edit > Preferences**.
- Select **Private Keys**.
- click **Add**.
- navigate to and select the private key file.
- Click **OK**.

You do not have to add the public SSH key: it is calculated using the private key.

SDT Connector will now use public key authentication when connecting through the SSH *console server*.

Note: you may have to restart **SDT Connector** *to shut down existing SSH tunnels established using password authentication.*

If you have a host behind the *console server* that you connect to by clicking the SSH button in *SDT Connector* you may wish to configure access to it for public key authentication as well.

This configuration is entirely independent of *SDT Connector* and the SSH *console server*. You must configure the SSH client that *SDT Connector* launches (for example Putty or OpenSSH) and the host's SSH server for public key authentication. Essentially what you are using is SSH over SSH, and the two SSH connections are entirely separate.

5.8. Setting up SDT for remote desktop access

Microsoft's Remote Desktop Protocol (RDP) enables the system manager to:

- securely access and manages remote Windows computers

- to reconfigure applications and user profiles on Windows computers
- to upgrade a Windows server operating system.
- reboot the machine and more.

Opengear's Secure Tunneling uses SSH tunneling, so this RDP traffic is securely transferred through an authenticated and encrypted tunnel.

SDT with RDP also allows remote Users to connect to Windows XP and later computers and to Windows 2000 Terminal Servers; and to have access to all of the applications, files, and network resources (with full graphical interface just as though they were in front of the computer screen at work).

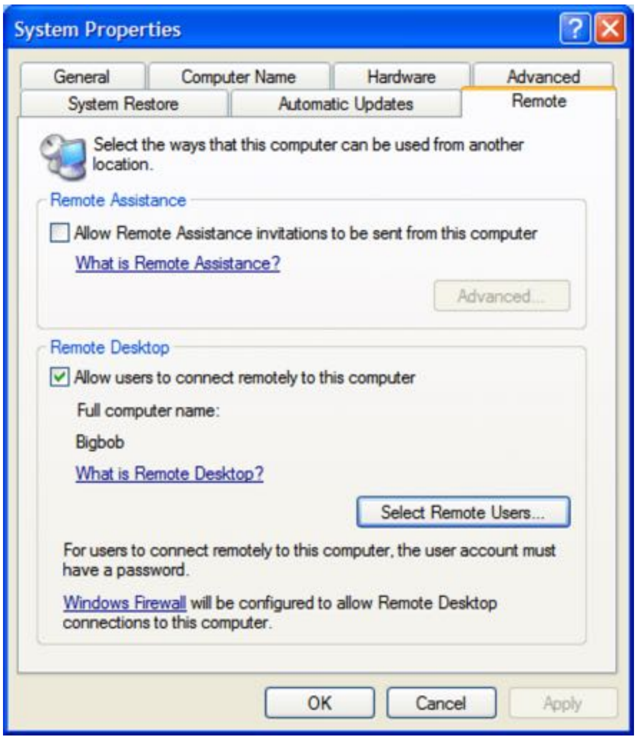
To set up a secure Remote Desktop connection you must enable Remote Desktop on the target Windows computer that is to be accessed and configure the RPD client software on the client PC.

5.8.1. Enable Remote Desktop on the target Windows computer to be accessed

Note: Windows XP Professional and Windows Vista only support one Remote Desktop session and it connects directly to the Windows root console. Windows Server 2003 supports three sessions: the console session and two other general sessions. Windows Server 2008 supports multiple sessions.

To enable Remote Desktop on the Windows computer being accessed:

- navigate to **Start Menu > Control Panel**.
- double-click the **System** icon.
- click the **Remote** tab.



Select the ways that this computer can be used from another location.

Remote Assistance

□ Allow Remote Assistance invitations to be sent from this computer

What is Remote Assistance?

Remote Desktop

☑ Allow users to connect remotely to this computer

Full computer name:

Bigbob

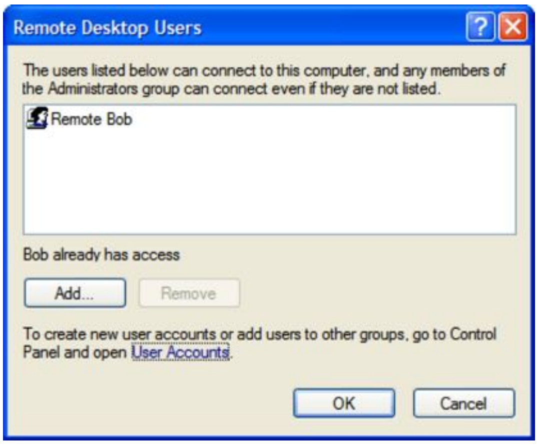
What is Remote Desktop?

For users to connect remotely to this computer, the user account must have a password.

Windows Firewall will be configured to allow Remote Desktop connections to this computer.

- check the *Allow users to connect remotely to this computer* checkbox.
- click the **Select Remote Users...** button.

  The **Remote Desktop Users** window opens.



Remote Desktop Users

The users listed below can connect to this computer, and any members of the Administrators group can connect even if they are not listed.

Remote Bob

Bob already has access

To create new user accounts or add users to other groups, go to Control Panel and open User Accounts.

- Click the **Add...** button to add users to the list of those allowed to remotely access the system using the RDP protocol.
- Click **OK** to close the **Remote Desktop Users** window.
- Click **OK** to close the **System Properties** window.

Windows generates the available user list from local accounts on the target Windows computer. To setup new users to then add them to the **Remote Desktop Users** list:

- navigate to **Start Menu** > **Control Panel**.
- double-click the **User Accounts** icon.
- create new users as required.

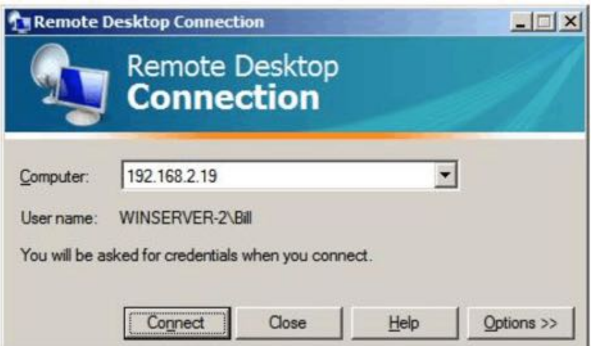
Note: when a remote user connects to the accessed computer via the root console, Remote Desktop automatically locks that computer (so no other user can access the applications and files). When you come back to your computer, you can unlock it by typing CTRL+ALT+DEL.

5.8.2. Configure the Remote Desktop connection client

Once the Client computer is securely connected to the *console server* (either locally, or remotely through an enterprise VPN, a secure SSH internet tunnel or a dial-in SSH tunnel) you can establish the Remote Desktop connection from the Client. To do this enable the Remote Desktop Connection on the remote client PC then point it to the SDT Secure Tunnel port in the console server.

On a Windows client

- Navigate to **Start Menu** > **Programs** > **Accessories** > **Communications**.
- Click **Remote Desktop Connection**.



Computer: 192.168.2.19

User name: WINSERVER-2\Bill

You will be asked for credentials when you connect.

- Enter the appropriate IP address and port number in *Computer*.

  Where there is a local connection or enterprise VPN connection, enter the IP Address of the *console server*, and the port number of the SDT Secure Tunnel for the *console server* serial port that is attached to the Windows computer to be controlled.

  For example, if the Windows computer is connected to serial Port 3 on a *console server* located at 192.168.0.50 enter *192.168.0.50:7303*.

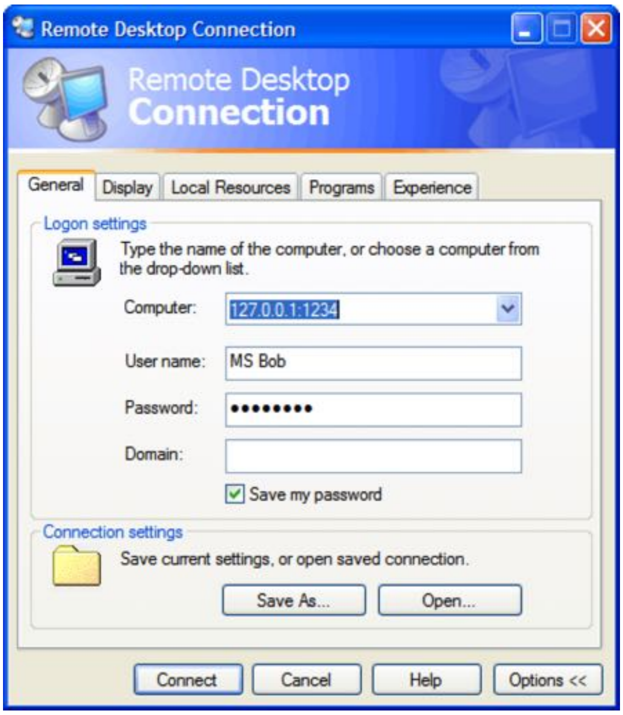
  Where there is an SSH tunnel over a dial up PPP connection or over a public internet connection or private network connection, enter localhost as the IP address (that is, 127.0.0.1). For Port Number, enter the source port you created when setting up SSH tunneling/port forwarding (see chapter 5.1).

- Click **Option**.

- Specify an appropriate color depth in the **Display** section.

  For example, for a connection running over a modem, don't set the color depth to greater than 256 colors (8-bit).

- In **Local Resources** specify the peripherals and ports on the remote Windows computer that are available to be controlled (for example, a directly connected printer or the serial port on the Windows PC).



Type the name of the computer, or choose a computer from the drop-down list.

Computer: 127.0.0.1:1234

User name: MS Bob

Password: ••••••••

Domain:

☑ Save my password

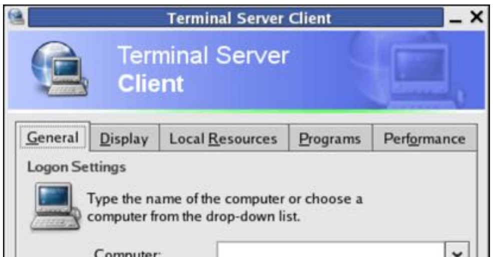
Save current settings, or open saved connection.

- Click **Connect**.

On a Linux or UNIX client

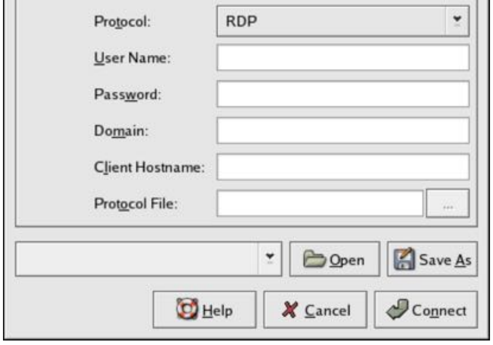
- Launch the open source `rdesktop` client from a shell. For example:

```
rdesktop -u windows-user-id -p windows-password -g 1200x950 ms-
windows-terminal-server-host-name
```



Type the name of the computer or choose a computer from the drop-down list.

Computer:



rdesktop option	description
-a	Color depth. Valid values are 8, 16, and 24.
-r	Device redirection. Redirects remote machine sound to the local device.
-g	Display geometry. Either *widthxheight* in pixels, or % of local screen.
-p	Sets rdesktop to receive a password prompt form the remote machine.

You can use GUI front end tools such as the GNOME Terminal Services Client `tsclient` to configure and launch the `rdesktop` client.

`tsclient` also allows for multiple `rdesktop` configurations for connection to many servers.

On an OS X client

- Download Microsoft's free Remote Desktop Connection (RDC) client from https://microsoft.com/en-us/download/details.aspx?id=18140.

Note: Microsoft RDC Client for OS X is not supported for use with OS X v10.7 (Lion) or later.

5.9. SDT SSH tunnel for VNC

Alternately, with SDT and Virtual Network Computing (VNC), *Users* and *Administrators* can securely access and control computers running Windows, Linux, macOS, Solaris and UNIX.

To set up a secure VNC connection you must

- install (if necessary) and configure VNC Server software on the computer to be accessed.
- install (if necessary) and configure VNC Viewer software on the Viewer PC.

5.9.1. Install & configure the VNC server on the computer to be accessed

Virtual Network Computing (VNC) software enables users to remotely access computers running Linux, macOS, Solaris, UNIX, all versions of Windows and most other operating systems.

VNC Servers

RealVNC Connect, https://realvnc.com/, is a multi-platform VNC server that runs on Windows, macOS, Linux, Solaris, HP-UX, AIX, and Raspberry Pi. RealVNC also offers a VNC client, *RealVNC Viewer*, which runs on these platforms as well as iOS, Android, and Chrome.

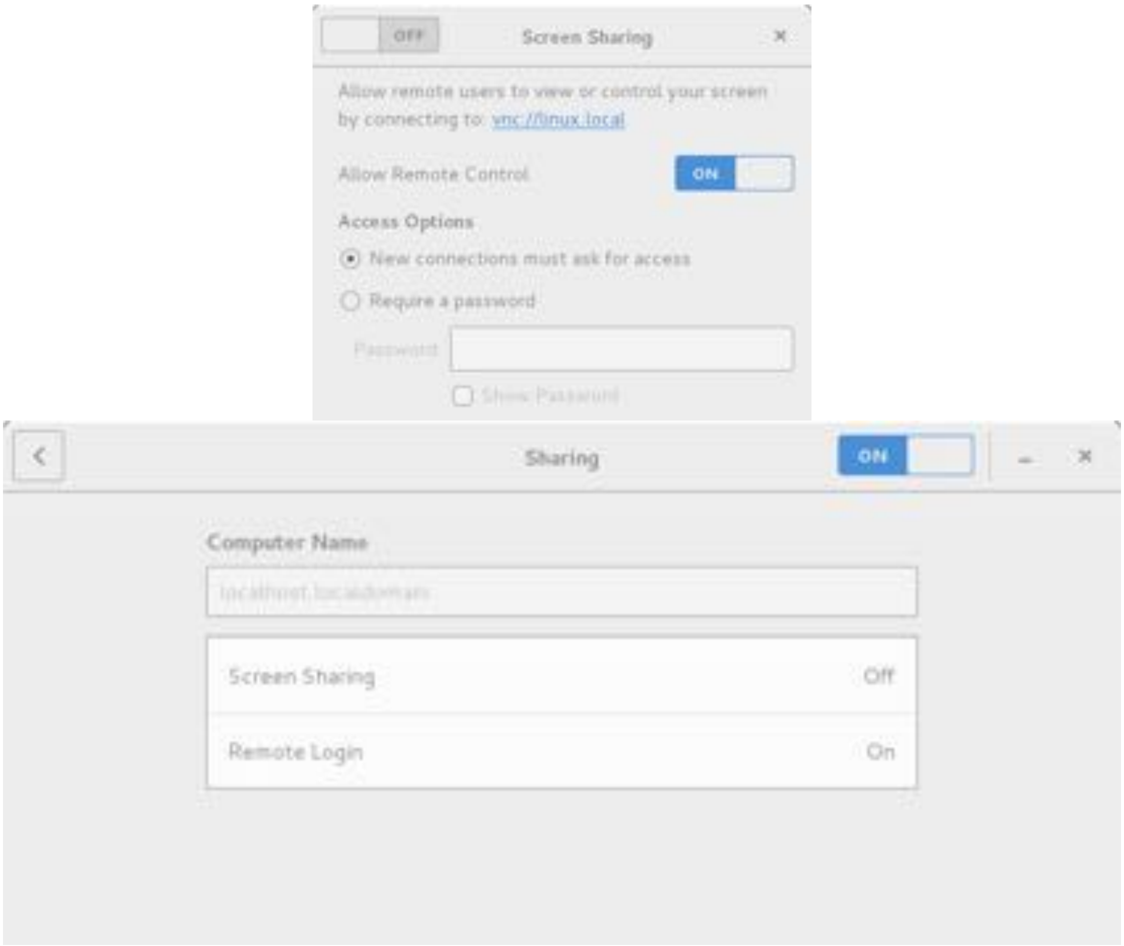
TightVNC, https://tightvnc.com/, is a dual-licensed (GPL and commercial) VNC server for Windows. TightVNC also offer a Java-based VNC viewer. It works on any system with Java SE version 1.6 or later installed.

UltraVNC, http://uvnc.com/, is a VNC server and viewer for Windows.

Most Linux distributions ship with VNC servers and viewers. If a Linux instance does not have VNC software installed, it will likely be available for install via the distro's software repository.

For example, to turn the VNC server on in Centos 7:

- Navigate to **Applications > System Tools > Settings**.
- Click **Sharing**.
- Click **Screen Sharing**.
- Click the **On-Off** control to start the VNC server.



Screen Sharing
OFF
Allow remote users to view or control your screen by connecting to: vnc://linux.local
Allow Remote Control: ON
Access Options
● New connections must ask for access
○ Require a password
Password
□ Show Password

Sharing
ON
Computer Name: localhost.localdomain
Screen Sharing: Off
Remote Login: On

Below the *Screen Sharing* title bar is the vnc-protocol URL the computer is accessible via.

- Click the *Require a password* radio button.
- Create and Enter the *Password* remote clients must enter to view the Centos screen.
- Click the **Close** box in the top right-hand corner of the *Screen Sharing* window.
- Click the **Close** box in the top right-hand corner of the *Sharing* window.

macOS also ships with a VNC server. To turn this server on:

- Choose **Apple Menu > System Preferences**.
- Click the **Sharing icon** (or choose **View > Sharing**).
- Check the *Screen Sharing* checkbox.

  The built-in VNC server is now running. Immediately below the text *Screen Sharing: On* is the vnc-protocol URL the computer is accessible via.

- Click the **Computer Settings...** button.
- Check the *VNC viewers may control screen with password* checkbox.
- Create and enter the password said VNC viewer applications will need to supply.
- Click **OK**.

5.9.2. Install, configure & connect the VNC viewer

VNC is platform-independent.: a viewer on one OS can connect to a server on any other OS.

There are also Java viewers available so that any desktop can be viewed with any Java-capable browser. http://en.wikipedia.org/wiki/VNC lists many VNC viewers sources.

To make VNC faster, when you set up the VNC viewer:

- if you have a fast enough CPU, set encoding to *ZRLE*.
- decrease the color level (for example, 64-bit).
- disable the background transmission on the server, or use a plain wallpaper.

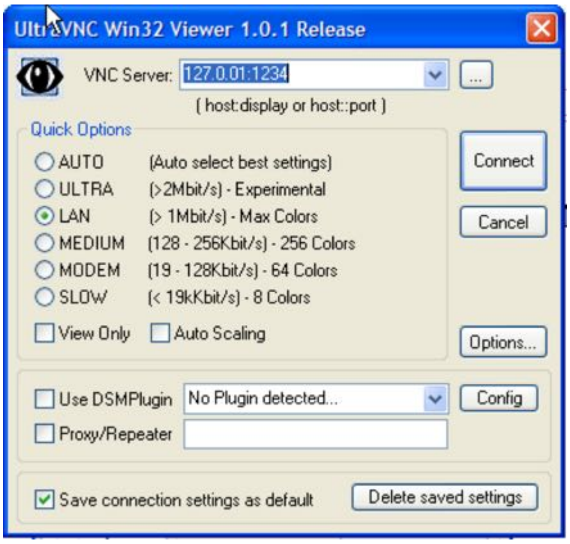
See http://doc.uvnc.com/ for detailed configuration instructions.

To establish a VNC connection:

- enter the VNC server IP address and port.

  When the viewer is connected via an SSH tunnel, whether over the Internet, a dial-in connection, or a private network, use *localhost* or *127.0.0.1* as the VNC server's IP address.

  The port number is the number entered when setting up SSH tunneling/port forwarding in section 5.2.6. For example: 1234.



UltraVNC Win32 Viewer 1.0.1 Release

VNC Server: 127.0.01:1234

(host:display or host::port)

Quick Options

○ AUTO (Auto select best settings)
○ ULTRA (>2Mbit/s) - Experimental
● LAN (> 1Mbit/s) - Max Colors
○ MEDIUM (128 - 256Kbit/s) - 256 Colors
○ MODEM (19 - 128Kbit/s) - 64 Colors
○ SLOW (< 19kKbit/s) - 8 Colors

□ View Only □ Auto Scaling

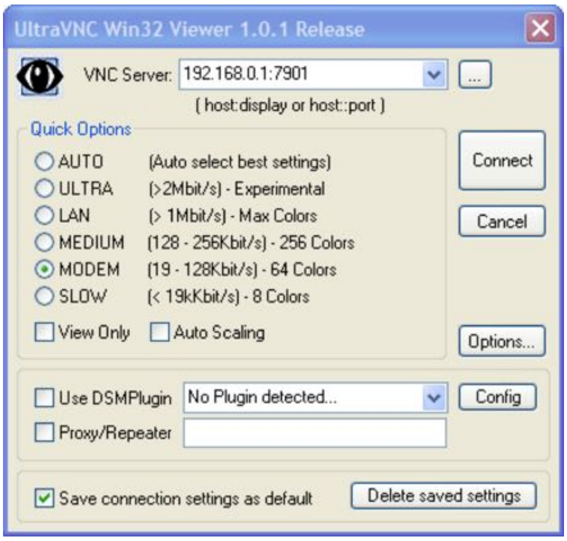
□ Use DSMPlugin No Plugin detected...

□ Proxy/Repeater

☑ Save connection settings as default

When the VNC viewer is connected directly to the *console server* (that is locally or remotely through a VPN or dial in connection) and the VNC server is serially connected to the *console server*, enter the IP address of the *console server* unit with the TCP port that the SDT tunnel will use.

The TCP port will be 7900 plus the physical serial port number (that is 7901 to 7948). All traffic directed to port 79xx on the *console server* is tunneled thru to port 5900 on the PPP connection on serial Port xx.



UltraVNC Win32 Viewer 1.0.1 Release

VNC Server: 192.168.0.1:7901

(host:display or host::port)

Quick Options

○ AUTO (Auto select best settings)
○ ULTRA (>2Mbit/s) - Experimental
○ LAN (> 1Mbit/s) - Max Colors
○ MEDIUM (128 - 256Kbit/s) - 256 Colors
● MODEM (19 - 128Kbit/s) - 64 Colors
○ SLOW (< 19kKbit/s) - 8 Colors

□ View Only □ Auto Scaling

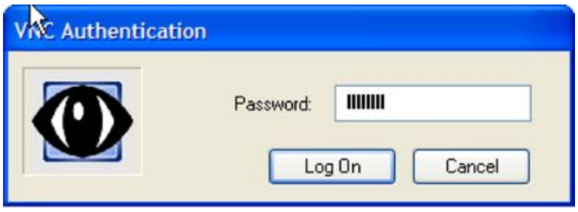
□ Use DSMPlugin No Plugin detected...

□ Proxy/Repeater

☑ Save connection settings as default

For example, for a Windows computer using UltraVNC as the viewer connecting to a VNC server which is attached to Port 1 on a *console server* located 192.168.0.1:

- establish the VNC connection by activating the VNC viewer and entering the *Password*.



VNC Authentication

Password: ||||||||

For background reading on Remote Desktop and VNC access we recommend the following:

The Microsoft Remote Desktop How-To: http://www.microsoft.com/windowsxp/using/mobility/getstarted/remoteintro.mspx.

The Illustrated Network Remote Desktop help page: http://theillustratednetwork.mvps.org/RemoteDesktop/RemoteDesktopSetupandTroubleshooting.html.

What is Remote Desktop in Windows XP and Windows Server 2003? by Daniel Petri: http://www.petri.co.il/what's_remote_desktop.htm.

Frequently Asked Questions about Remote Desktop: http://www.microsoft.com/windowsxp/using/mobility/rdfaq.mspx.

Secure remote access of a home network using SSH, Remote Desktop and VNC for the home user: http://theillustratednetwork.mvps.org/RemoteDesktop/SSH-RDP-VNC/RemoteDesktopVNCandSSH.html.

Wikipedia's general background article on VNC: http://en.wikipedia.org/wiki/VNC.

5.10. Using SDT to IP connect to hosts that are serially-attached to the gateway

Network (IP) protocols like RDP, VNC and HTTP can also be used for connecting to host devices that are serially connected through their COM port to the console server. To do this you must:

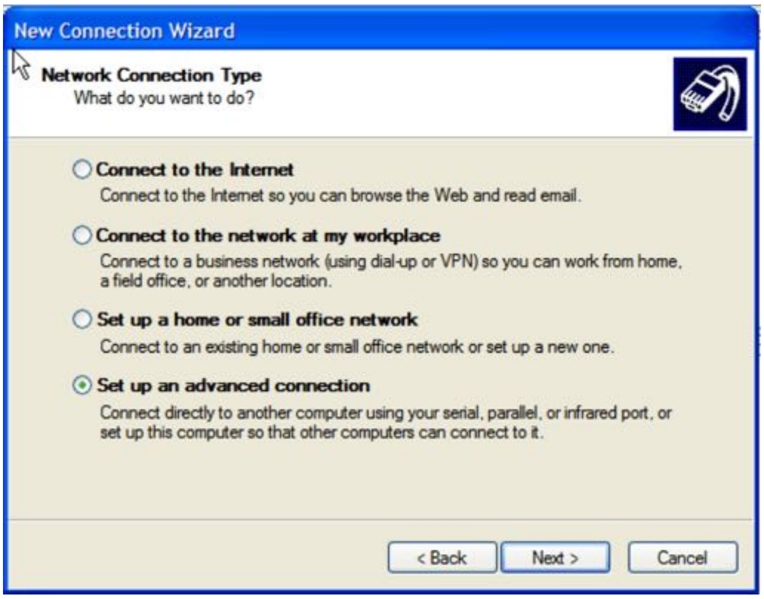
- establish a PPP connection between the host and the gateway. See chapter 5.10.1.
- set up Secure Tunneling Ports on the *console server*. See chapter 5.10.2.
- configure SDT Connector to use the appropriate network protocol to access IP consoles on the host devices that are attached to the *console server* serial ports. See chapter 5.10.3.

5.10.1. Establish a PPP connection between the host COM port & console server

- (This step is only necessary for serially-connected computers.) Physically connect the COM port on the host computer that is to be accessed, to the serial port on the *console server*.
- On computers running Linux, UNIX, Solaris and other Unix-like operating systems, establish a PPP connection over the serial port.

  The online tutorial at http://yolinux.com/TUTORIALS/LinuxTutorialPPP.html presents a selection of methods for establishing a PPP connection using a computer running Linux.
- On computers running Windows, follow the procedure below to set up an advanced network connection between the Windows computer's COM port and the *console server*.

  Windows allows for the creation of a simple dial-in service which can be used for a Remote Desktop or VNX or HTTP/X connection to the *console server*.
- Navigate to **Start Menu > Control Panel**.
- Double-click the **Network Connections** icon.
- Click the **New Connection Wizard**.



New Connection Wizard

Network Connection Type
What do you want to do?

○ **Connect to the Internet**
Connect to the Internet so you can browse the Web and read email.

○ **Connect to the network at my workplace**
Connect to a business network (using dial-up or VPN) so you can work from home, a field office, or another location.

○ **Set up a home or small office network**
Connect to an existing home or small office network or set up a new one.

● **Set up an advanced connection**
Connect directly to another computer using your serial, parallel, or infrared port, or set up this computer so that other computers can connect to it.

- Select the *Set up an advanced connection* radio button.
- Select *Accept Incoming Connections* in the **Advanced Connection Options** window.

- click **Next**.
- Select *COM1* as the *Connection Device* (that is, the COM port on the computer that is connected to the *console server's* serial port).
- Set the COM port to its maximum baud rate.
- Click **Next**.
- Select *Do not allow virtual private connections* in the **Incoming VPN Connection Options** window.
- Click **Next**.
- Select which users will be allowed to use this connection.

  This should be the same users given Remote Desktop access privileges in the earlier step.
- Click **Next**.
- Select *TCP/IP* in the **Network Connections** window.
- Click **Properties**.
- Select *Specify TCP/IP addresses* in the **Incoming TCP/IP Properties** window.
- Enter IP addresses in the *From* and *To* fields.

  Choose any TCP/IP addresses so long as they are addresses which are not used anywhere else on your network.

  The *From* address will be assigned to the computer running Windows. The *To* address will be used by the *console server*. For simplicity use the IP address shown in the illustration above:

From	169.134.13.1
To	169.134.13.2

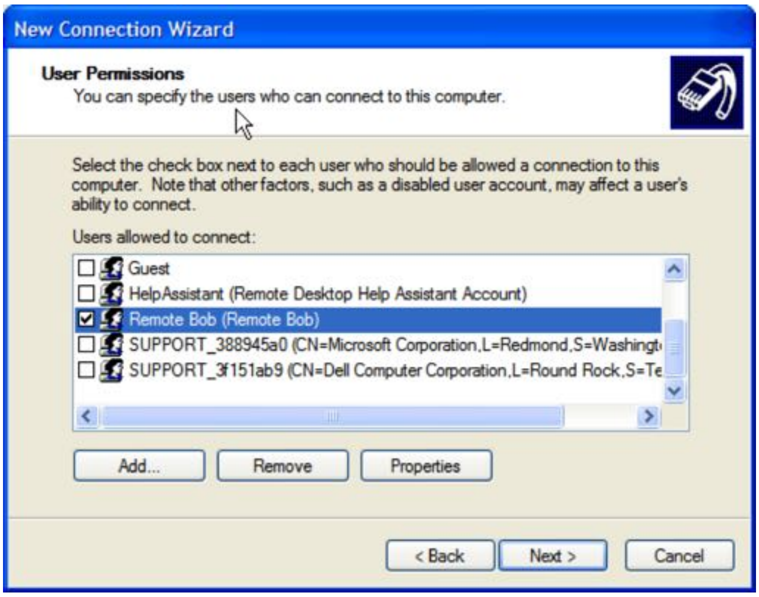
  Alternatively, set the advanced connection and access on the computer running Windows to use the *console server* defaults:

  From 10.233.111.254
  Allow calling computer to specify its own IP address checked.
- Click **OK**.

Another option is to use the *console server's* default username and password to setup the Remote Desktop user and give this user permission to use the advanced connectiuon to access the computer running Windows.

- The *console server*'s default *Username* is *portXX* where *XX* is the serial port number on the *console server*.
- The *console server*'s default *Password* is *portXX* where *XX* is the serial port number on the *console server*.

  For example, for an RDP connection to serial port 2 on the *console server*, setup a Windows user named *port02* with appropriate permissions.



New Connection Wizard

User Permissions

You can specify the users who can connect to this computer.

Select the check box next to each user who should be allowed a connection to this computer. Note that other factors, such as a disabled user account, may affect a user's ability to connect.

Users allowed to connect:

- □ Guest
- □ HelpAssistant (Remote Desktop Help Assistant Account)
- ☑ Remote Bob (Remote Bob)
- □ SUPPORT_388945a0 (CN=Microsoft Corporation,L=Redmond,S=Washingt
- □ SUPPORT_3f151ab9 (CN=Dell Computer Corporation,L=Round Rock,S=Te

When the PPP connection has been set up, a network icon appears in the Windows task bar.

The above notes describe setting up an incoming connection for Windows XP. The steps are similar for later versions of Windows although the set up screens present slightly differently.

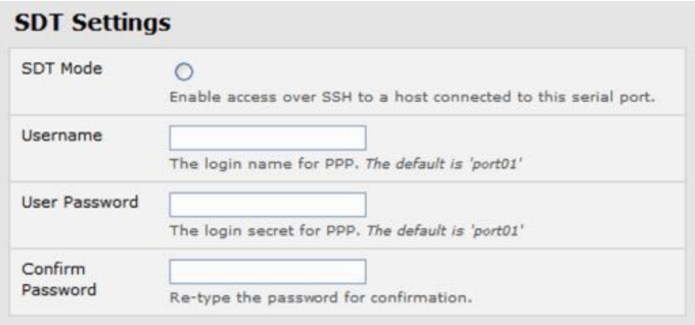
If an **Incoming Connections Properties** window presents, check the *Always allow directly connected devices such as palmtop computers to connect without providing a password* checkbox.

Also the option to **Set up an advanced connection** is not available in Windows 2003 if RRAS is configured. If RRAS has been configured, enable the null modem connection for the dial-in configuration.

5.10.2. Set up SDT serial ports on console server

To set up RDP (and VNC) forwarding on the *console server* Serial Port that is connected to the Windows computer COM port:

- Navigate to **Serial & Network > Serial Port**.
- click *Edit* for the particular *Serial Port* connected to the Windows computer's COM port.
- Select *SDT Mode* in the **SDT Settings** section.



SDT Settings

SDT Mode	○ Enable access over SSH to a host connected to this serial port.
Username	The login name for PPP. *The default is 'port01'*
User Password	The login secret for PPP. *The default is 'port01'*
Confirm Password	Re-type the password for confirmation.

This will enable port forwarding and SSH tunneling.

Note: Enabling SDT overrides all other configuration protocols on this port.

- enter a *Username* and *User Password*.

If you leave the *Username* and *User Password* fields blank, they both default to portXX where XX is the serial port number. For example, the default username and password for Secure RDP over Port 2 is *port02*.

- Set the *console server's* serial port *Common Settings* (Baud Rate and Flow Control) to the same values as were set up on the Windows computer' COM port.
- click **Apply**.

RDP and VNC forwarding over serial ports is enabled on a per-Port basis. You can add Users who can have access to these ports (or reconfigure User profiles) by navigating to **Serial & Network > User & Groups** as documented in chapter 3.

5.10.3. Set up SDT connector to SSH port forward over the console server serial port

In the *SDT Connector* software running on your remote computer, specify the gateway IP address of your *console server* and specify a username and password for a user you have setup on the *console server* that has access to the desired port.

Next add a New SDT Host.

In the Host address put *portxx* where *xx* is the port you are connecting to.

For example, for port 3 enter a Host Address of *port03* and then check the RDP Service check box.

5.11. SSH tunnelling using other SSH clients (for example, PuTTY)

SDT Connector, which is supplied with *console servers* is Opengear's recommended SSH client. There are, however, other SSH client programs that can provide secure SSH connections to *console servers* and connected devices, including:

ssh client	source	description
PuTTY	http://putty.org/	An open-source SSH implementation for Windows.
SSHTerm	http://sourceforge.net/projects/sshtools	A Java-based open-source SSH communiations suite.
Tectia SSH	https://ssh.com/products/tectia-ssh/	A commercial SSH client and server.
Reflection for Secure IT	https://www.microfocus.com/products/reflection-secure-it	A commercial SSH client and server.

This section documents the use of the PuTTY client to establish an SSH-tunneled connection to a network-connected device.

- Launch **PuTTY**.

  The **PuTTY Configuration** window opens.
- Click *Session* in the **Category** section.
- Enter the IP address of the *console server* to connect to in the *Host Name or IP address* field.

  For dial-in connections, this IP address will be the Local Address that you assigned to the *console server* when you set it up as the Dial-In PPP Server.

For Internet or local/VPN connections this will be the public IP address of the *console server*.

- Leave the port number as *22* (unless you've configured the *console server* to run SSH on a port other than the default value of 22).
- Click the *SSH* radio button under *Connection type*.
- Click *Tunnels* in the **Category** section (in the disclosure tree this is in **Connection > SSH**).
- Enter any high, unused port number (for example: 55555) in the *Source port* field under *Add new forwarded port*.
- Enter the *Destination* IP address and port.

If your destination device is network connected to the *console server* and you are connecting using RDP, set the Destination as

managed-device-ipaddress-or-hostname:3389

For example, if, when setting up the Managed Device as Network Host on the *console server* its IP address was sets to

192.168.253.1

or its hostname was set to

accounts.myco.intranet.com

then set the *Destination* to

192.168.523.1:3389

or

accounts.myco.intranet.com:3389

Note: only devices which have been configured as networked Hosts can be accessed using SSH tunneling (except by the root user who can tunnel to any IP address the console server can route to).

If your destination computer is serially-connected to the *console server*, set the *Destination* as

port-label:3389

For example, if the *Label* you specified on the serial port on the *console server* is *win2k3*, then specify the remote host as

win2k3:3389

Alternatively, set the *Destination* as

portXX:3389

where *XX* is the SDT-enabled serial port number.

For exmaple, if port 4 on the console server carries the RDP traffic then set the *Destination* *to*

port04:3389

- Select the *Local* radio button.
- Click **Add**.
- Click **Open**.

  A shell prompt window will open prompting you to `login as:`

- Enter a username and press **Return**.

  The shell will return a `password` prompt.

- Enter the user's password. and press **Return**.

  If you are connecting as a *user* in the `users` group you can only SSH tunnel to hosts and serial ports where you have specific access permissions.

  If you are connecting as an *administrator* (that is, a user in the `admin` group) then you can connect to any configured host or serial port which has SDT enabled.

To set up the secure SSH tunnel for a HTTP browser connection to the managed device, specify port 80 (rather than port 3389, used for RDP) in the *Destination IP* field.

To set up the secure SSH tunnel from the Client PC to the *console server* for VNC, configure the VNC port redirection by specifying port 5900 in the *Destination IP* field.

5.12. VNC security

How secure is VNC? VNC access generally allows access to your whole computer, so security is very important. VNC uses a random challenge-response system to provide the basic authentication that allows you to connect to a VNC server. This is reasonably secure and the password is not sent over the network.

However, once connected, all subsequent VNC traffic is unencrypted. So a malicious user could snoop your VNC session. Also there are VNC scanning programs available, which will scan a subnet looking for PCs which are listening on one of the ports which VNC uses.

Tunneling VNC over a SSH connection ensures all traffic is strongly encrypted. Also no VNC port is ever open to the internet, so anyone scanning for open VNC ports will not be able to find your computers. When tunneling VNC over a SSH connection, the only port which you are opening on your console server is the SDT port (port 22).

It may be prudent to tunnel VNC through SSH even when the Viewer PC and the console server are both on the same local network.

6. Alerts, auto-response & logging

This chapter describes the automated response, alert generation and logging features of the *console server*.

The Auto-Response facility extends on the basic Alert facility available in earlier (pre V3.5) firmware revisions. With Auto-Response the console server monitors selected serial ports, logins, the power status and environmental monitors and probes for Check Condition triggers. The *console server* will then initiate a sequence of actions in response to these triggers. To configure Auto-Response you:

- set the general parameters.
- select and configure the *Check Conditions* (the conditions that trigger the response).
- specify the *Trigger Actions* (the action sequence initiated in event of the trigger condition).
- specify the *Resolve Actions* (the actions performed when trigger conditions are resolved).

Also all *console server* models can maintain log records of all access and communications with the console server and with the attached serial devices. A log of all system activity is also maintained as is a history of the status of any attached environmental monitors.

Some models can also log access and communications with network attached hosts and maintain a history of the UPS and PDU power status.

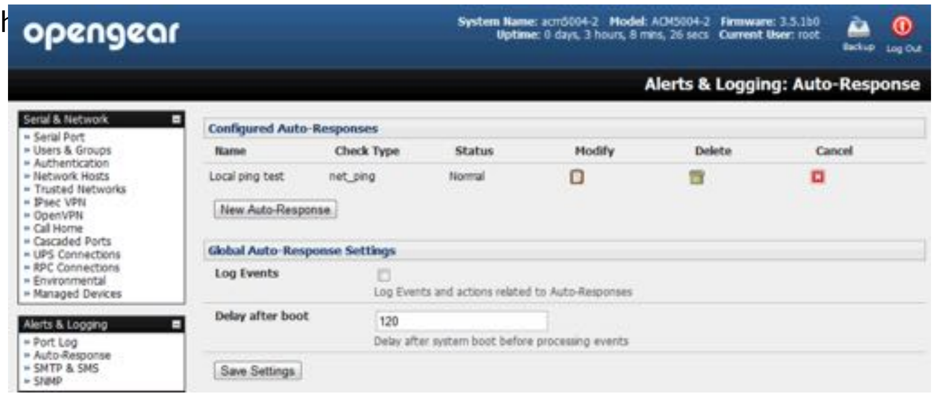
If port logs are to be maintained on a remote server, then the access path to this location need to be configured Then you need to activate and set the desired levels of logging for each serial and network port and for power and environment UPS (see chapter 7).

6.1. Configure auto-response

With the Auto-Response facility, a sequence of Trigger Actions is initiated in the event of a specified trigger condition (the *Check Condition*). Subsequent *Resolve Actions* can also be performed when the trigger condition has been resolved.

First set the general parameters that will be applied to all Auto-Responses.

- Navigate to **Alerts & Logging > Auto-Response**.
- Check th



System Name: acm5004-2 Model: ACM5004-2 Firmware: 3.5.1b0
Uptime: 0 days, 3 hours, 8 mins, 26 secs Current User: root

Alerts & Logging: Auto-Response

Configured Auto-Responses

Name	Check Type	Status	Modify	Delete	Cancel
Local ping test	net_ping	Normal	□	🗑	☒

Global Auto-Response Settings

Log Events □
Log Events and actions related to Auto-Responses

Delay after boot 120
Delay after system boot before processing events

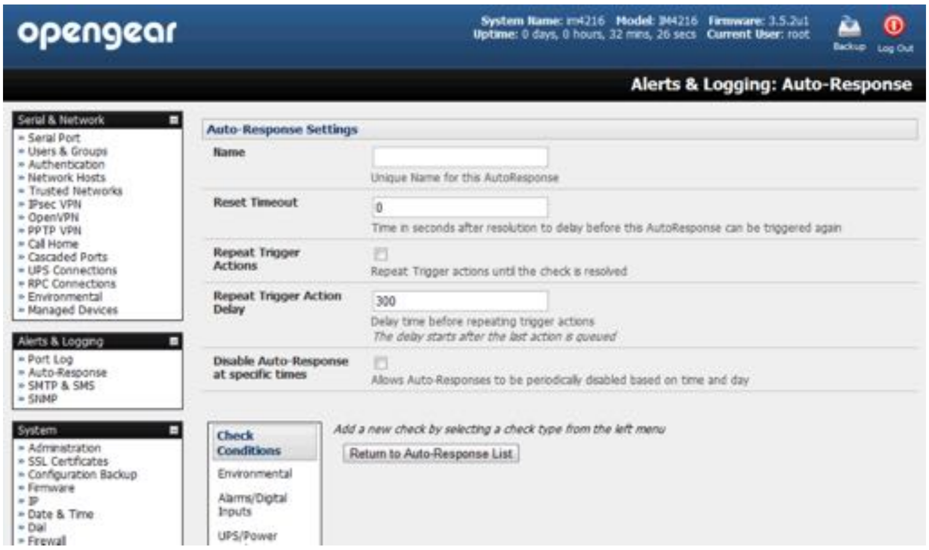
This enables logging of all Auto-Response activities.

- Set the *Delay after boot* time (in seconds) to establish the delay between a *console server* booting and the same *console server* processing events.

To configure a new Auto-Response:

- Select **New Auto-Response** in the **Configured Auto-Response** field.

  A new **Auto-Response Settings** page presents.



System Name: im4216 Model: IM4216 Firmware: 3.5.2u1
Uptime: 0 days, 0 hours, 32 mins, 26 secs Current User: root

Alerts & Logging: Auto-Response

Auto-Response Settings

Name
Unique Name for this AutoResponse

Reset Timeout 0
Time in seconds after resolution to delay before this AutoResponse can be triggered again

Repeat Trigger Actions □
Repeat Trigger actions until the check is resolved

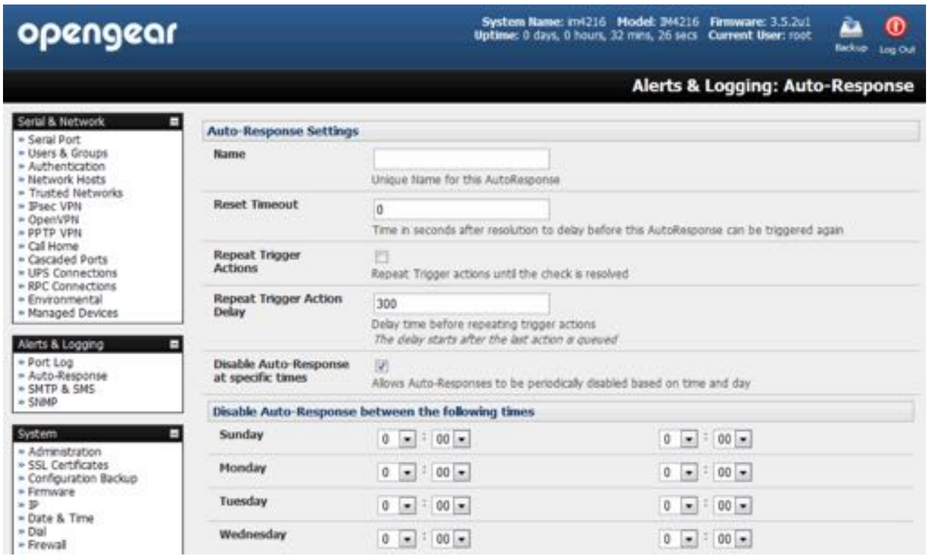
Repeat Trigger Action Delay 300
Delay time before repeating trigger actions
The delay starts after the last action is queued

Disable Auto-Response at specific times □
Allows Auto-Responses to be periodically disabled based on time and day

Add a new check by selecting a check type from the left menu

- Enter a unique **Name** for the new Auto-Response.
- Specify the **Reset Timeout** for the time in seconds after resolution to delay before this Auto-Response can be triggered again.
- Check **Repeat Trigger Actions** to repeat trigger actions until the check is resolved.

- Enter any required delay time before repeating trigger actions in **Repeat Trigger Action Delay**. This delay starts after the last action is queued.



System Name: im4216 Model: IM4216 Firmware: 3.5.2u1
Uptime: 0 days, 0 hours, 32 mins, 26 secs Current User: root

Alerts & Logging: Auto-Response

Auto-Response Settings

Name:
Unique Name for this AutoResponse

Reset Timeout: 0
Time in seconds after resolution to delay before this AutoResponse can be triggered again

Repeat Trigger Actions: □
Repeat Trigger actions until the check is resolved

Repeat Trigger Action Delay: 300
Delay time before repeating trigger actions
The delay starts after the last action is queued

Disable Auto-Response at specific times: ☑
Allows Auto-Responses to be periodically disabled based on time and day

Disable Auto-Response between the following times

Sunday	0 : 00	0 : 00
Monday	0 : 00	0 : 00
Tuesday	0 : 00	0 : 00
Wednesday	0 : 00	0 : 00

- Check **Disable Auto-Response at specific times** and you will be able to periodically disable auto-Responses between specified times of day.

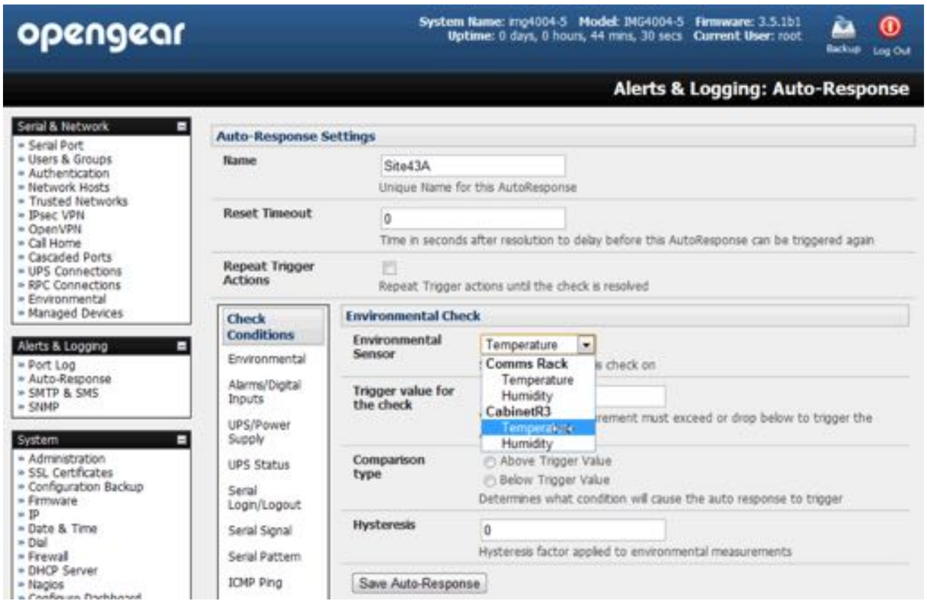
6.2. Check conditions

To configure the condition that will trigger the Auto-Response:

- Click on the *Check Condition* type (for example, *Environmental*, *UPS Status* or *ICMP ping*) to be configured as the trigger for this Auto-Response in the **Auto-Response Settings** menu.

6.2.1. Environmental

To configure Humidity or Temperature levels as the trigger event:



System Name: img4004-5 Model: IMG4004-5 Firmware: 3.5.1b1
Uptime: 0 days, 0 hours, 44 mins, 30 secs Current User: root

Alerts & Logging: Auto-Response

Auto-Response Settings

Name: Site43A
Unique Name for this AutoResponse

Reset Timeout: 0
Time in seconds after resolution to delay before this AutoResponse can be triggered again

Repeat Trigger Actions: □
Repeat Trigger actions until the check is resolved

Environmental Check

Environmental Sensor: Temperature
s check on

Trigger value for the check:
rement must exceed or drop below to trigger the

Comparison type: ○ Above Trigger Value ○ Below Trigger Value
Determines what condition will cause the auto response to trigger

Hysteresis: 0
Hysteresis factor applied to environmental measurements

- Click on *Environmental* as the **Check Condition**.
- In the *Environmental Check* menu, select the specific environmental sensor to be checked for the trigger
- Specify the Trigger value (in °C or °F for temperature and % for humidity) that the check measurement must exceed or drop below to trigger the AutoResponse.
- Select Comparison type as being *Above Trigger Value* or *Below Trigger* Value to trigger
- Specify any *Hysteresis* factor that is to be applied to environmental measurements. For example, if an Auto-Response was set up with a trigger event of a temp reading above 49°C with a *Hysteresis* of 4, then the trigger condition would not be seen as having been resolved till the temperature reading was below 45°C.
- Check **Save Auto-Response**.

Note: before configuring **Environmental Checks** *as the trigger in Auto-Response you will need first to configure the Temperature sensores, the Humidity sensors or both on your ACM5000 or attached EMD.*

6.2.2. Alarms & digital inputs

To set the status of any attached Smoke or Water sensors or digital inputs as the trigger event:

- Click on *Alarms/Digital Inputs* as the **Check Condition**.
- In the *Alarms/Digital Inputs Check* menu, select the specific *Alarm/Digital IO Pin* that will trigger the Auto-Response.
- Select *Trigger on Change* to trigger when alarm signal changes, or select to trigger when the alarm signal state changes to either a *Trigger Value* of Open (0) or Closed (1).
- Check **Save Auto-Response**.

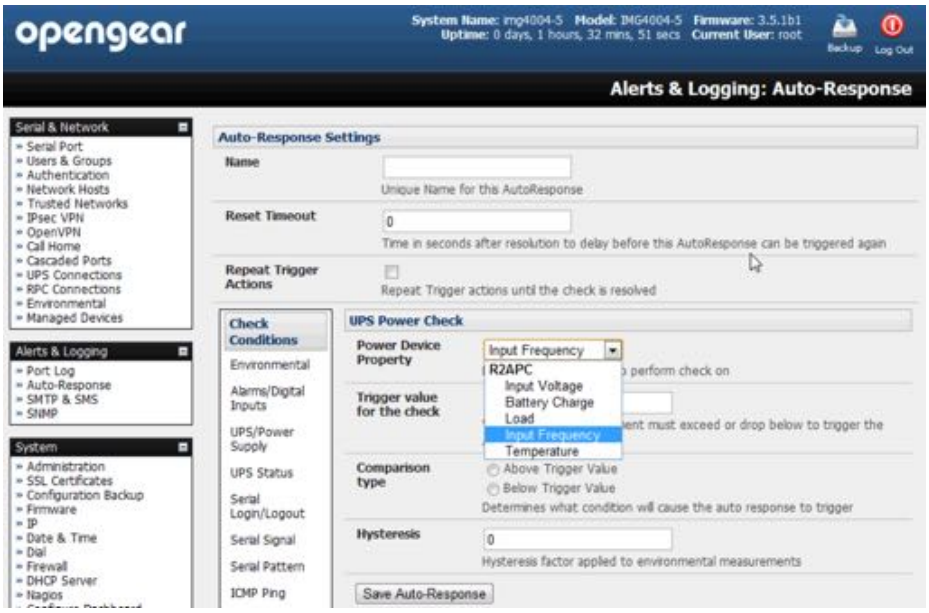
Note: before configuring **Alarms/Digital Inputs** *checks in Auto-Response you first must configure the sensor/DIO that is to be attached to your EMD or ACM5000.*

6.2.3. UPS & power supply

To use the properties of any attached UPS as the trigger event:

- select *UPS/Power Supply* as the **Check Condition**.
- Select the UPS *Power Device Property* (Input Voltage, Battery Charge %, Load %, Input Frequency Hz or Temperature in °C) to be checked for the trigger.
- specify the *Trigger value that the check* measurement must exceed or drop below to trigger the AutoResponse.
- select the *Comparison type* as being *Above Trigger Value* or *Below Trigger Value* to trigger.
- specify any *Hysteresis* factor to be applied to environmental measurements.

  For example, if an Auto-Response is set up with a trigger event of a battery charge below 20% with a Hysteresis of 5 then the trigger condition will not be set to resolved until the battery charge is above 25%.



System Name: img4004-5 Model: IMG4004-5 Firmware: 3.5.1b1
Uptime: 0 days, 1 hours, 32 mins, 51 secs Current User: root

Alerts & Logging: Auto-Response

Auto-Response Settings

Name:
Unique Name for this AutoResponse

Reset Timeout: 0
Time in seconds after resolution to delay before this AutoResponse can be triggered again

Repeat Trigger Actions: ☐
Repeat Trigger actions until the check is resolved

UPS Power Check

Power Device Property: Input Frequency
…o perform check on

Trigger value for the check:
…ent must exceed or drop below to trigger the

Comparison type: ○ Above Trigger Value ○ Below Trigger Value
Determines what condition will cause the auto response to trigger

Hysteresis: 0
Hysteresis factor applied to environmental measurements

- Check **Save Auto-Response**.

Note: before configuring UPS checks in Auto-Response you first must configure the attached UPS

6.2.4. UPS status

To use the alert state of any attached UPS as the Auto-Response trigger event:

- click on *UPS Status* as the **Check Condition**.
- select the reported *UPS State* to trigger the *Auto-Response* (either On Battery or Low Battery).

  The Auto-Response will resolve when the UPS state returns to the *Online* state.
- select which connected UPS Device to monitor.
- Click **Save Auto-Response**.

Note: before configuring UPS state checks in Auto-Response the attached UPS must be configured.

6.2.5. Serial log-in, signal or pattern

To monitor serial ports and check for login/logout or pattern matches for Auto-Response triggers events:

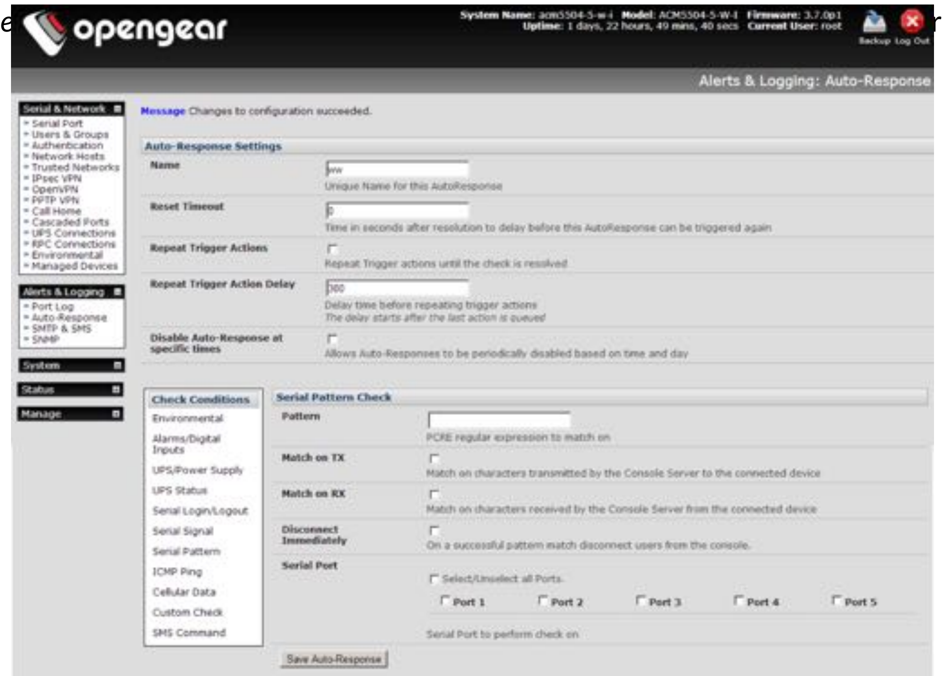
- click on *Serial Login/Logout* as the **Check Condition**.
- in the *Serial Login/Logout Check* menu select *Trigger on Login* (to trigger when any user logs into the serial port) or *Trigger on Logout*.
- specify *Serial Port* to perform check on.
- click on *Serial Signal* as the *Check Condition*.

The above two options can be set individually or together.

- in the *Serial Signal Check* menu select the Signal (CTS, DCD, DSR) to trigger the condition (either on *serial signal change*, or *check level*).
- specify *Serial Port* to perform check on.
- click on *Serial Pattern* as the *Check Condition*.

The above two options can be set individually or together.

- in the *Se* rial line



System Name: acm5504-5-w-i Model: ACM5504-5-W-I Firmware: 3.7.0p1
Uptime: 1 days, 22 hours, 49 mins, 40 secs Current User: root

Alerts & Logging: Auto-Response

Message Changes to configuration succeeded.

Auto-Response Settings

Name: ww
Unique Name for this AutoResponse

Reset Timeout: 0
Time in seconds after resolution to delay before this AutoResponse can be triggered again

Repeat Trigger Actions: □
Repeat Trigger actions until the check is resolved

Repeat Trigger Action Delay: 300
Delay time before repeating trigger actions
The delay starts after the last action is queued

Disable Auto-Response at specific times: □
Allows Auto-Responses to be periodically disabled based on time and day

Serial Pattern Check

Pattern:
PCRE regular expression to match on

Match on TX: □
Match on characters transmitted by the Console Server to the connected device

Match on RX: □
Match on characters received by the Console Server from the connected device

Disconnect Immediately: □
On a successful pattern match disconnect users from the console.

Serial Port: □ Select/Unselect all Ports.
□ Port 1 □ Port 2 □ Port 3 □ Port 4 □ Port 5
Serial Port to perform check on

(TX or RX) and *Serial Port* to pattern check on.

Note: *With* **Serial Pattern** *checks you can nominate to* **Disconnect Immediately** *all users from the serial port being monitored in the event of a successful pattern match.*

Note: *for devices with an inbuilt cellular modem with GPS enabled, the GPS will be displayed as an additional port and it can be monitored for trigger events. For example, with an ACM5504-5-G-I with 4 serial ports, the GPS will be shown as Port 5.*

- Click **Save Auto-Response**.

Note: *before configuring serial port checks in Auto-Response the affected serial port must be configured in Console server mode. Also, most serial port checks are not resolvable so resolve actions will not run.*

6.2.6. USB console status

Note: *USB port labels in the Web interface match the USB port labels printed on a console server with two exceptions. Some console servers include discrete pairs of USB ports which do not have printed labels. In this case, the Web interface denotes them as either Upper or Lower. That is, the Web interface lists them by their physical relationship to each other. Also, some console servers ship with an array of four USB ports. A limited number of these console servers have labels A – D printed by these ports even though the Web interface will denote* *them as USB ports 1 – 4.*

To monitor USB ports:

- Select USB *Console Status* as the **Check Condition**.
- Check the *Trigger on Connect* checkbox, the *Trigger on Disconnect* checkbox, or both checkboxes to set which actions trigger the Auto-Response.
- Check each USB port to be monitored (or click the *Select/Unselect all Ports* checkbox to select or deselect all USB ports).
- Click the **Save Auto-Response** button.
- Select an option from the *Add Trigger Action* list.
- Enter a unique *Action Name* for the trigger action being created.
- Set an *Action Delay Time*.

  By default, this is 0 seconds.
- Enter the specific details of the selected action. For example, the *Send Email* action requires a *Recipient Email Address* and allows for a *Subject* and *Email Text*.
- Click the **Save New Action** button.

Note: USB console status checks are not resolvable. Trigger actions run but Resolve actions do not.

6.2.7. ICMP ping

To use a `ping` result as the Auto-Response trigger event:

- select *ICMP Ping* as the **Check Condition**.
- specify which *Address to Ping* (that is, the IP address or DNS name to send ICMP `pings` to).
- specify which Interface to send ICMP `pings` from (for example, the Management LAN or Wireless network).
- set the *Check Frequency*.

  This is the time in seconds between checks.
- set the Number of ICMP Ping packets to send.
- check **Save Auto-Response**.

6.2.8. Cellular data

This check monitors the aggregate data traffic inbound and outbound through the cellular modem as an Auto-Response trigger event.

- Select *Cellular Data* as the **Check Condition**.

Note: before configuring cellular data checks in Auto-Response, the internal cellular modem must be configured and detected by the console server.

6.2.9. Custom check

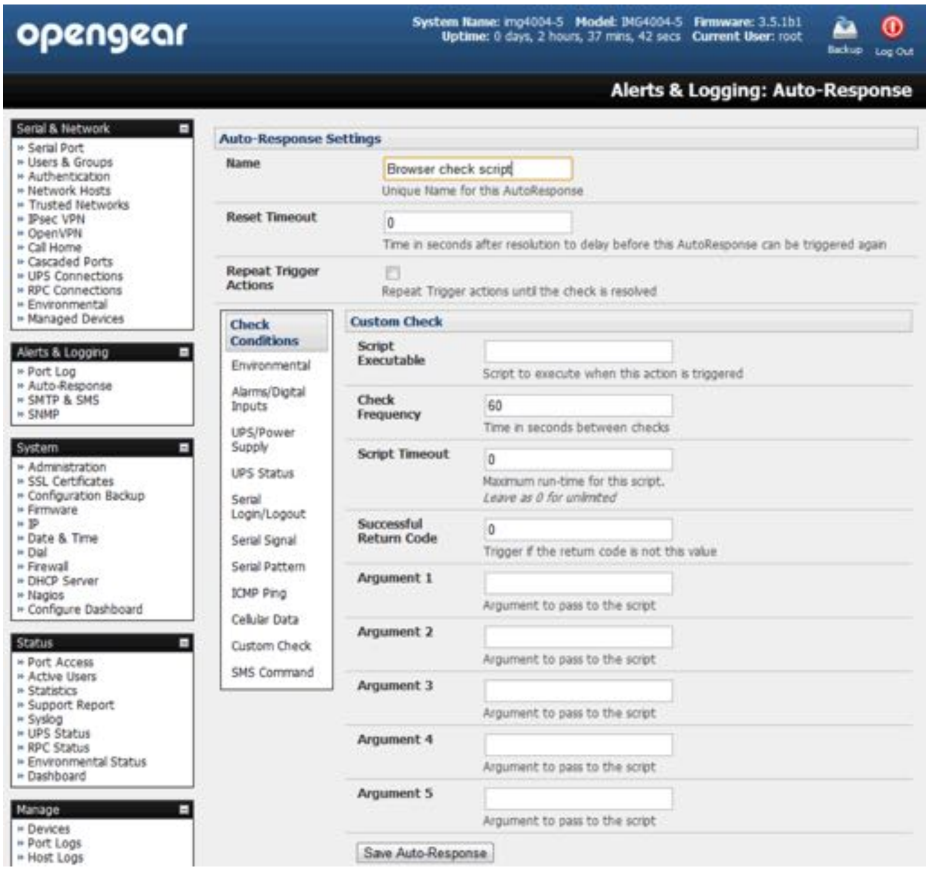
This check allows users to run a nominated custom script with nominated arguments whose return value is used as an Auto-Response trigger event:

- Click on *Custom Check* as the **Check Condition**.
- Create an executable trigger check script file.

  For example `/etc/config/test.sh`

  ```
  #!/bin/sh
  logger "A test script"
  logger Argument1 = $1
  logger Argument2 = $2
  logger Argument3 = $3
  logger Argument4 = $4

  if [ -f /etc/config/customscript.0 ]; then
      rm /etc/config/customscript.0
      exit 7
  fi

  touch /etc/config/customscript.0
  exit 1
  ```

Note: refer to the Opengear FAQ for a sample web page html check and other script file templates.



Auto-Response Settings

Name: Browser check script
Unique Name for this AutoResponse

Reset Timeout: 0
Time in seconds after resolution to delay before this AutoResponse can be triggered again

Repeat Trigger Actions: □
Repeat Trigger actions until the check is resolved

Custom Check

Script Executable:
Script to execute when this action is triggered

Check Frequency: 60
Time in seconds between checks

Script Timeout: 0
Maximum run-time for this script.
Leave as 0 for unlimited

Successful Return Code: 0
Trigger if the return code is not this value

Argument 1:
Argument to pass to the script

Argument 2:
Argument to pass to the script

Argument 3:
Argument to pass to the script

Argument 4:
Argument to pass to the script

Argument 5:
Argument to pass to the script

- Enter the *Script Executable* file name.

For example `/etc/config/test.sh`.

- Set the *Check Frequency*.

  This is the time, in seconds, between re-running the script.

- Set the *Script Timeout*.

  This is the maximum run-time for the script.

- Specify the *Successful Return Code*.

  An Auto-Response is triggered if the return code from the script is not this value.

- Enter Arguments that are to be passed to the script.

  For example, with a web page html check script, these Arguments might specify the web page address/DNS and user logins.

Check **Save Auto-Response**.

6.2.10. CLI session event

When the **Check Condition** is set to *CLI Session Event*, the triggers that cause the Auto-Response to run can be any or all of the following:

- *Trigger on Login*
- *Trigger on Logout*
- *Trigger on Authentication Error*

Checking the *Trigger on Login* checkbox sets the Auto-Response to run when the console's shell is logged in to.

Checking the *Trigger on Logout* checkbox sets the Auto-Response to run when the console's shell is logged out of.

And checking the *Trigger on Authentication Error* checkbox sets the Auto-Response to run when the console's shell returns an authentication error.

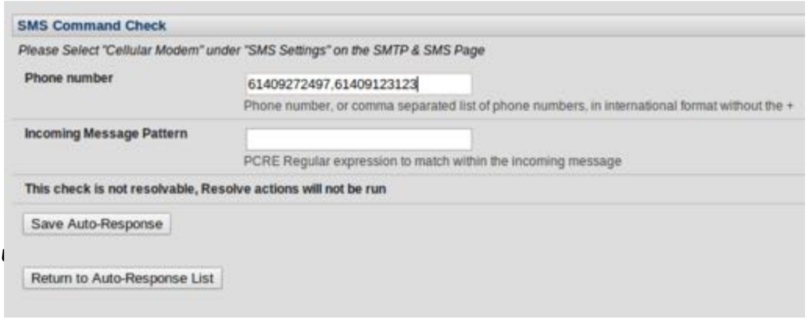
An Auto-Response can be set to trigger on one, two or all three of these events. After selecting the desired CLI session events to respond to:

- Click **Save Auto-Response**.

6.2.11. SMS command

An incoming SMS command from a nominated caller can trigger an Auto-Response:

- Select *SMS Command* as the **Check Condition**.



SMS Command Check

Please Select "Cellular Modem" under "SMS Settings" on the SMTP & SMS Page

Phone number: 61409272497,61409123123

Phone number, or comma separated list of phone numbers, in international format without the +

Incoming Message Pattern:

PCRE Regular expression to match within the incoming message

This check is not resolvable, Resolve actions will not be run

- Set the *Phone number*. For multiple SMS sources comma-separate the numbers.

Note: enter the phone number in international format without the plus-sign (+) prefix.

- Set the *Incoming Message Pattern* to match to create trigger event.

  This pattern is a PCRE regular expression.

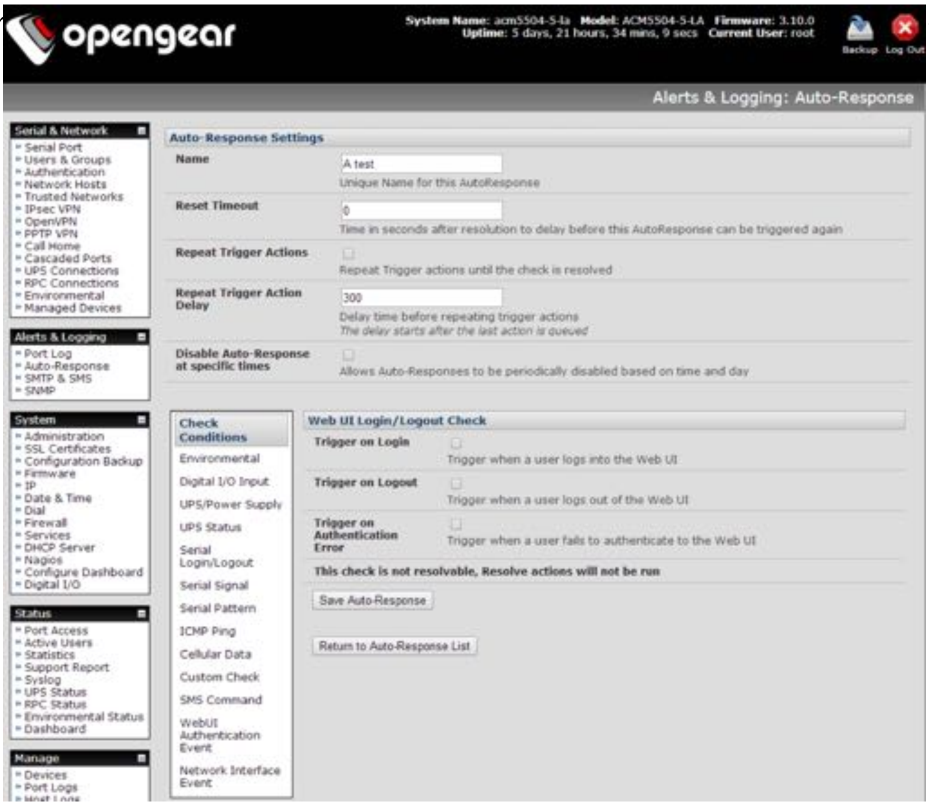
Note: the SMS command trigger condition can only be set if an internal cellular modem detected.

- Click **Save Auto-Response**.

6.2.12. Log-in & log-out check

To configure Web Log In/Out as the trigger event:

- select *Web UI Authentication* as the **Check Condition**.
- check *Tr* e Web UI.



System Name: acm5504-5-la **Model:** ACM5504-5-LA **Firmware:** 3.10.0
Uptime: 5 days, 21 hours, 34 mins, 9 secs **Current User:** root

Alerts & Logging: Auto-Response

Auto-Response Settings

Name A test
Unique Name for this AutoResponse

Reset Timeout 0
Time in seconds after resolution to delay before this AutoResponse can be triggered again

Repeat Trigger Actions □
Repeat Trigger actions until the check is resolved

Repeat Trigger Action Delay 300
Delay time before repeating trigger actions
The delay starts after the last action is queued

Disable Auto-Response at specific times □
Allows Auto-Responses to be periodically disabled based on time and day

Web UI Login/Logout Check

Trigger on Login □
Trigger when a user logs into the Web UI

Trigger on Logout □
Trigger when a user logs out of the Web UI

Trigger on Authentication Error □
Trigger when a user fails to authenticate to the Web UI

This check is not resolvable, Resolve actions will not be run

- Check *Trigger on Authentication Error* to trigger when Web UI user authentication fails.

Note: this check is not resolvable. Resolve actions will not, as a consequence, run.

- Click **Save Auto-Response**.

6.2.13. Network interface event

You may wish to configure a change in the network status as the trigger event (e.g. to send an alert or restart a VPN tunnel connection):

- select *Network Interface* as the **Check Condition**.

- select the *Interface* to monitor.
- check the interface *Event* to trigger on.

Note: this check is not resolvable. Resolve actions will not, as a consequence, run.

- Click **Save Auto-Response**.

6.2.14. Routed data usage check

This check monitors the specified input interface for data usage that is being routed through the Opengear and out another interface such as the Internal Cellular Modem.

It is particularly useful in IP Passthrough mode, to detect when the downstream router has failed over and is now routing via the Opengear's modem as a backup connection.

This check may be configured with these parameters:

- the Opengear's incoming *Interface* to monitor.
- an optional *Source MAC address* or *source IP Address*, to monitor traffic from a specific host (for example, the downstream router).
- a *Data Limit* threshold and specified *Time Period*.

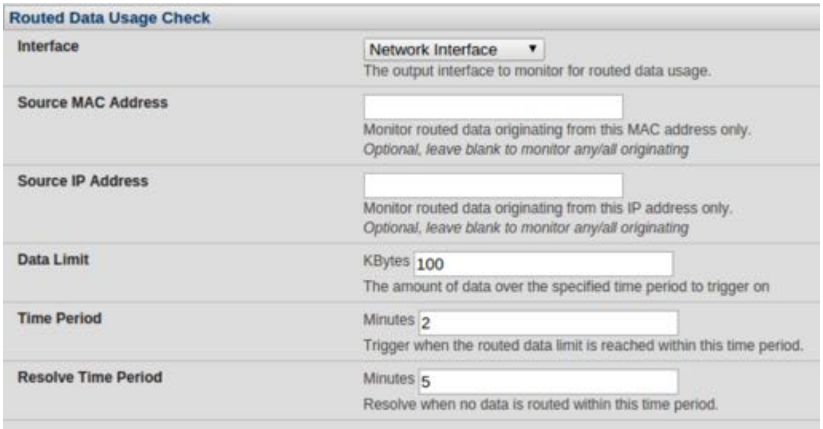
  The Auto-Response will trigger when the limit is hit in the specified time.

The Auto-Response will resolve if no matching data is routed for the *Resolve Period*.

6.3. Trigger actions

To configure the sequence of actions that is to be taken in the event of the trigger condition:

- for a nominated Auto-Response with a defined *Check Condition*, select an **Add Trigger Action** (for example, *Send Email* or *Run Custom Script*).



Routed Data Usage Check

Interface	Network Interface ▾ The output interface to monitor for routed data usage.
Source MAC Address	 Monitor routed data originating from this MAC address only. *Optional, leave blank to monitor any/all originating*
Source IP Address	 Monitor routed data originating from this IP address only. *Optional, leave blank to monitor any/all originating*
Data Limit	KBytes 100 The amount of data over the specified time period to trigger on
Time Period	Minutes 2 Trigger when the routed data limit is reached within this time period.
Resolve Time Period	Minutes 5 Resolve when no data is routed within this time period.

  This selects the action type to be taken.

- configure the selected action (as detailed in the sections following).

Each action is configured with a nominated *Action Delay Time* which specifies how long (in seconds) after the Auto-Response trigger event to wait before performing the action.

Note: you can add follow-on actions to create a sequence of actions that will be taken in the event of the one trigger condition.

To edit or delete an existing action:

- click the *Modify* or *Delete* icon in the **Scheduled Trigger Action** table.

A message text can be sent with Email, SMS and Nagios actions. This configurable message can include selected values:

value	description
$AR_TRIGGER_VAL	The trigger value for the check. For example the UPS Status trigger value can be either *onbatt* or *battlow*.
$AR_VAL	The value returned by the check. For example the ups status value can be *online*, *onbatt*, or *battlow*.
$AR_CHECK_DEV	The name of the device being checked. For example, for Alarm, the alarm name.
$TIMESTAMP	The current timestamp.
$HOSTNAME	The hostname of the *console server*.

The default message text is:

> *$TIMESTAMP*: This action was run — Check details: value *$AR_VAL* vs trigger value *$AR_TRIGGER_VAL*.

6.3.1. Send e-mail

- Select *Send Email* as the **Add Trigger Action**.
- Enter a unique *Action Name*.
- Set the *Action Delay Time*.
- Specify the *Recipient Email Address* to send this email to

  For multiple recipients enter comma-separated addresses.
- Enter a *Subject* for the email.
- Edit the *Email Text* message to send.
- click **Save New Action**.

Note: an SMS alert can also be sent via an SMTP (email) gateway. You will need to specify the Recipient Email Address in the format specified by the gateway provider. For example, for T-Mobile it is **phonenumber@tmomail.net**.

6.3.2. Send SMS

- Select *Send SMS* as the **Add Trigger Action**.
- Enter a unique *Action Name*.
- Set the *Action Delay Time*.
- Specify the Phone number that the SMS will be sent to.

This must be in international format bit without the leading plus (+) sign.

- Edit the Message Text to send
- click **Save New Action**.

Note: the SMS alert can be sent if there is an internal cellular modem attached. Alternatively an SMS alert can also be sent via a SMTP SMS gateway as documented in chapter 6.5.2.

6.3.3. Perform RPC action

- Select *Perform RPC Acrtion* as the **Add Trigger Action**.
- Enter a unique *Action Name*.
- Set the *Action Delay Time*.
- Select a power *Outlet*.
- Specify the *Action* (*Power On*, *Power Off*, or *Cycle*) to be performed.
- click **Save New Action**.

6.3.4. Run custom script

- Select *Run Custom Script* as the **Add Trigger Action**.
- Enter a unique *Action Name*.
- Set the *Action Delay Time*.
- Create a script file to execute when this action is triggered.
- Enter the *Script Executable's* file name.

  For example `/etc/config/action.sh`.
- Set the *Script Timeout*.

  This is the maximum run-time for the script. Set this at 0 for unlimited time.
- Enter any *Arguments* that are to be passed to the script.
- click **Save New Action**.

6.3.5. Send SNMP trap

- Select *Send SNMP Trap* as the **Add Trigger Action**.
- Enter a unique *Action Name*.
- Set the *Action Delay Time*.

Note: the SNMP Trap actions are valid for Serial, Environmental, UPS and Cellular data triggers.

- click **Save New Action**.

6.3.6. Send Nagios event

- Select *Send Nagios Event* as the **Add Trigger Action**.
- Enter a unique *Action Name*.
- Set the *Action Delay Time*.
- Edit the *Nagios Event Message* text to display on the Nagios status screen for the service.
- Specify the *Nagios Event State* (*OK*, *Warning*, *Critical*, or *Unknown*) to return to Nagios for this service.
- click **Save New Action**.

Note: to notify the central Nagios server of Alerts, NSCA must be enabled under **System > Nagios** *and Nagios must be enabled for each applicable host or port.*

6.3.7. Perform interface action

- Select *Perform Interface Action* as the **Add Trigger Action**.
- Enter a unique *Action Name*.
- Set the *Action Delay Time*.
- Select the *Interface* (*Modem* or *VPN Service*).
- Select the *Action* (*Start Interface* or *Stop Interface*) to be taken.

  For example, you may wish to start an IPsec VPN service in response to an incoming SMS message, or set up an OpenVPN tunnel whenever your *console server* fails over to use the cellular connection.
- click **Save New Action**.

Note: If any IPsec service or OpenVPN tunnel is to be controlled by the **Network Interface Event Action**, *the* **Control by Auto-Response** *checkbox must be checked when configuring that service. Also, if selected, the default state for the VPN tunnel or service will be* **Down**.

6.4. Resolve actions

Actions can also be scheduled to be taken a trigger condition has been resolved.

- For a nominated Auto-Response with a defined trigger Check Condition, click *Add Resolve Action* (for example, *Send Email* or *Run Custom Script*) to select the action type to be taken.

Note: **Resolve Actions** *are configured the same way as* **Trigger Actions** *except the designated* **Resolve Actions** *are all executed on resolution of the trigger condition and there are no* **Action Delay Times** *to set.*

6.5. Configure SMTP, SMS, SNMP & Nagios service for alert notifications

The Auto-Response facility enables remote alerts to be sent as Trigger and Resolve Actions. Before such alert notifications can be sent, you must configure the nominated alert service.

6.5.1. Send e-mail alerts

The *console server* uses SMTP (Simple Mail Transfer Protocol) for sending the email alert notifications. To use SMTP, the *Administrator* must configure a valid SMTP server for sending the email.

- Navigate to **Alerts & Logging > SMTP & SMS > SMTP Server**.
- Enter the IP address of the outgoing mail Server in the *Server* field.
- If this mail server uses a *Secure Connection*, select its type.
- Specify the IP port to use.

  The default SMTP Port is 25.
- Optionally enter a *Sender* email address.

  This will appear as the *From* address in all email notifications sent from this *console server*.

Note: many SMTP servers check the sender's email address with the host domain name to verify the address as authentic. So it may be useful to assign an email address for the console server such as consoleserver2@mydomian.com.

- If the SMTP server requires authentication, enter the required *Username* and *Password*.
- Optionally, enter a Subject Line that will be sent with all email notifications.

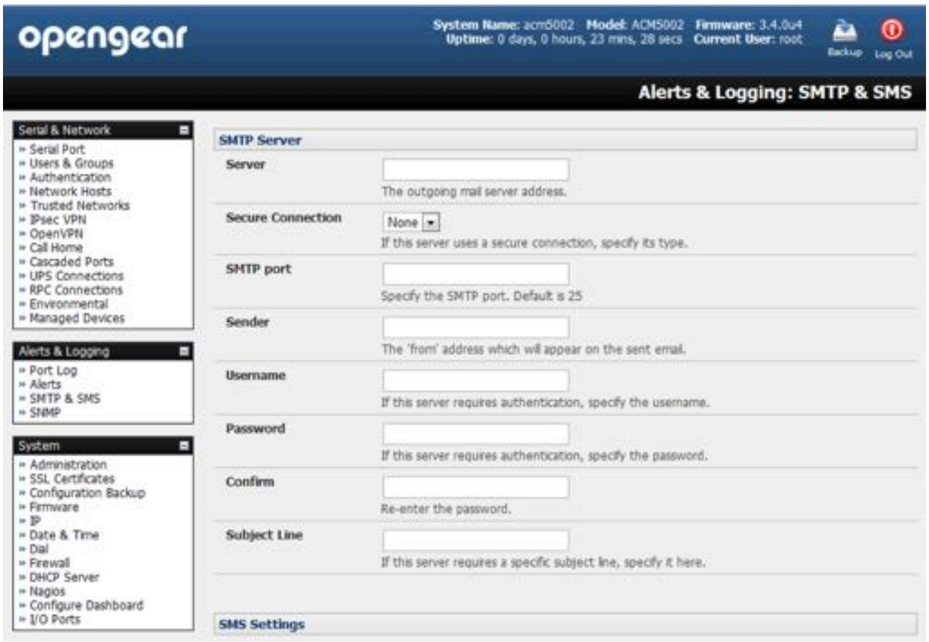
Note: some SMTP servers require a non-blank Subject field.

- Click **Apply**.

  SMTP is activated.

6.5.2. Send SMS alerts

With any model *console server* you can use email-to-SMS services to send SMS alert notifications to mobile devices. Almost all mobile phone carriers provide an SMS gateway service that forwards email to mobile phones on their networks. There's also a wide selection



System Name: acm5002 Model: ACM5002 Firmware: 3.4.0u4
Uptime: 0 days, 0 hours, 23 mins, 28 secs Current User: root

Alerts & Logging: SMTP & SMS

SMTP Server

Server
The outgoing mail server address.

Secure Connection: None
If this server uses a secure connection, specify its type.

SMTP port
Specify the SMTP port. Default is 25

Sender
The 'from' address which will appear on the sent email.

Username
If this server requires authentication, specify the username.

Password
If this server requires authentication, specify the password.

Confirm
Re-enter the password.

Subject Line
If this server requires a specific subject line, specify it here.

SMS Settings

of SMS gateway aggregators which provide email to SMS forwarding to phones on any carriers.

Alternately if your *console server* has an embedded or externally attached cellular modem you will be given the option to send the SMS directly over the carrier connection.

SMS via e-mail gateway

To use SMTP SMS the Administrator must configure a valid SMTP server for sending the email.

- Navigate to **Alerts & Logging > SMTP & SMS**.
- Select the *SMS Gateway* radio button in the **SMS Settings** section.

  An **SMS via Email Gateway** section will appear.
- Enter the IP address of the outgoing SMS gateway *Server*.
- Select a *Secure Connection* (if applicable).
- specify the SMTP port to be used.

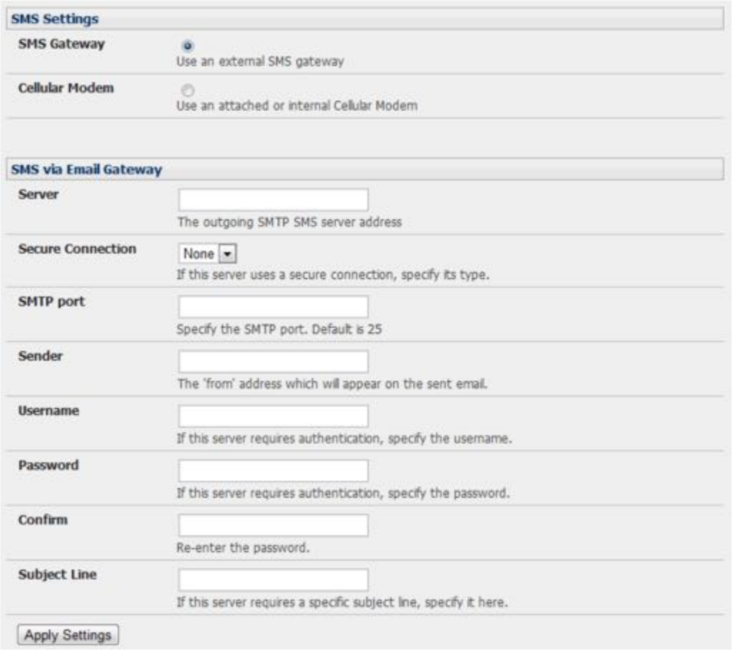
  The default SMTP Port is 25.
- Optionally enter a *Sender* email address.

This will appear as the *From* address in all email notifications sent from this console server.

Note: some SMS gateway service providers only forward email to SMS when the email has been received from authorized senders. So you may need to assign a specific authorized email address for the **console server**.

- If the SMTP server requires authentication, enter the required *Username* and *Password*.
- Optionally, enter a *Subject Line* that will be sent with all notifications.

Note: generally the email subject will contain a truncated version of the alert notification message



SMS Settings

SMS Gateway	● Use an external SMS gateway
Cellular Modem	○ Use an attached or internal Cellular Modem

SMS via Email Gateway

Server	The outgoing SMTP SMS server address
Secure Connection	None ▾ If this server uses a secure connection, specify its type.
SMTP port	Specify the SMTP port. Default is 25
Sender	The 'from' address which will appear on the sent email.
Username	If this server requires authentication, specify the username.
Password	If this server requires authentication, specify the password.
Confirm	Re-enter the password.
Subject Line	If this server requires a specific subject line, specify it here.

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(which is contained in full in the body of the email). However some SMS gateway service providers require blank subjects or require specific authentication headers to be included in the subject line.

- Click **Apply Settings**.

  The SMS-SMTP connection is activated.

SMS via cellular modem

To use an attached or internal cellular modem for SMS the *Administrator* must enable SMS.

- Navigate to **Alerts & Logging > SMTP & SMS**.
- Select the *Cellular Modem* radio button in the **SMS Settings** section.
- Check *Receive Messages* to enable incoming SMS messages to be received.

  A custom script will be called on receipt of incoming SMS messages.

- You may need to enter the phone number of the carrier's SMS Message Centre

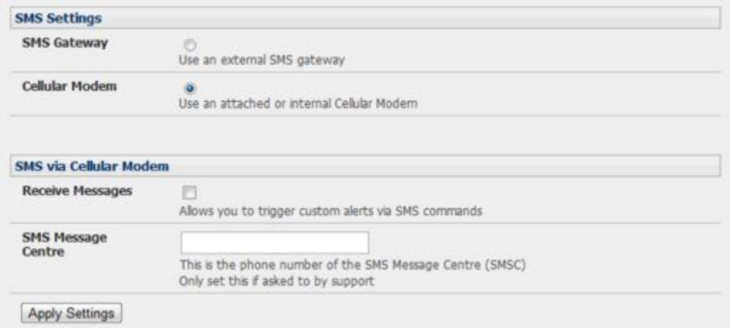
  Only enter this if advised by your carrier or by Opengear support.

- Click **Apply Settings**.

  The SMS-SMTP connection is activated.

Note: the option to directly send SMS alerts via the cellular modem was included in the Management GUI as of firmware v3.4. Advanced **console servers** *have had the gateway software (SMS Server Tools 3) embedded since firmware v3.1 however you this could only be accessed from the command line to send SMS messages. see the Opengear FAQ for more.*

6.5.3. Sends SNMP trap alerts



SMS Settings

SMS Gateway ○
Use an external SMS gateway

Cellular Modem ●
Use an attached or internal Cellular Modem

SMS via Cellular Modem

Receive Messages □
Allows you to trigger custom alerts via SMS commands

SMS Message Centre
This is the phone number of the SMS Message Centre (SMSC)
Only set this if asked to by support

The *Administrator* can configure the Simple Network Management Protocol (SNMP) agent that resides on the *console server* to send SNMP trap alerts to an NMS management application.

- Navigate to **Alerts & Logging > SNMP**.
- Click the **Primary SNMP Manager** tab.

  The **Primary SNMP Manager** and **Secondary SNMP Manager** tabs are used to configure where and how outgoing SNMP alerts and notifications are sent.

If you require your console server to send alerts via SNMP a Primary SNMP Manager must be configured.

Optionally, a second SNMP Network Manager, with its own SNMP settings, can be specified on the **Secondary SNMP Manager** tab.

Note: **console servers** *can also be configured to provide status information on demand using* `snmpd`*. This SNMP agent is configured using the* **SNMP Service Detail** *at* **Alerts & Logging > SNMP**. *See chapter 14 for more.*

- Select the *Manager Protocol*.

  SNMP is generally a UDP-based protocol though infrequently it uses TCP instead.

- Enter the host address of the SNMP Network Manager in the *Manager Address* field.
- Enter the TCP/IP port number into the *Manager Trap Port* field

  By default this port number is 162.

- Select the *Version* to be used.

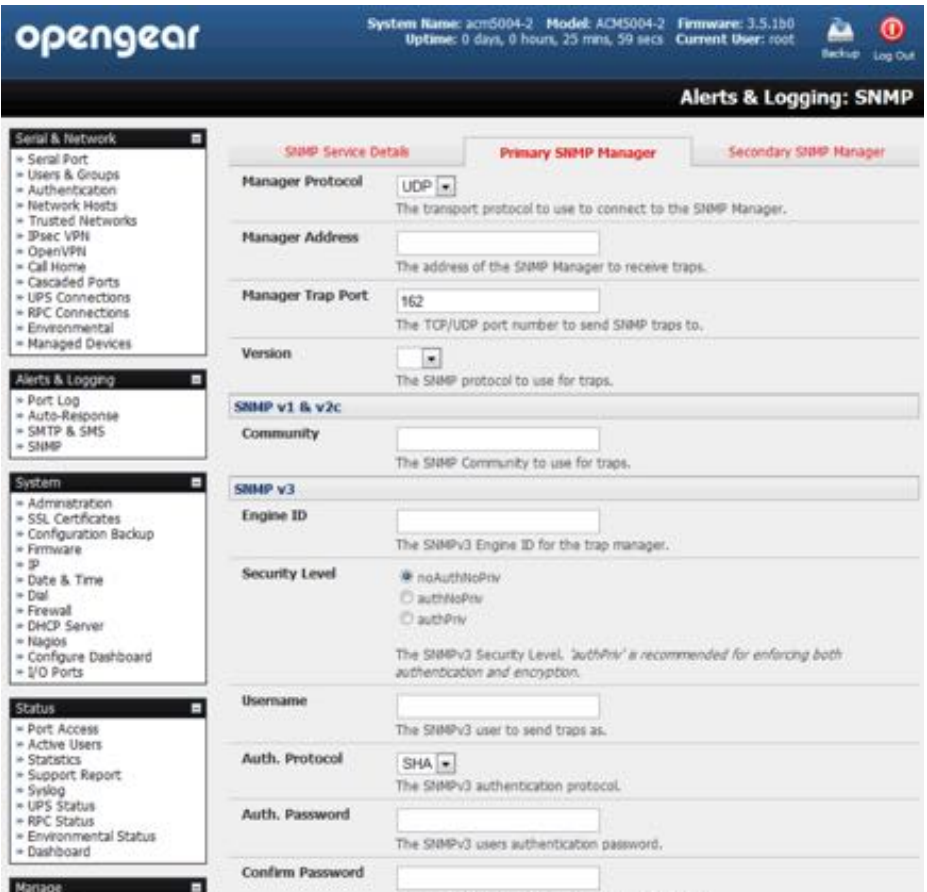
  The console server SNMP agent supports SNMP v1, v2 and v3.

- Enter the *Community* name for SNMP v1 or SNMP v2c.

  At a minimum, a community needs to be set for either SNMP v1 or v2c traps to work. An SNMP community is the group to which devices and management stations running SNMP belong. It helps define where information is sent. SNMP default communities are private for Write and public for Read.

- If required, configure *SNMP v3*.

  For SNMP v3 messages, the user's details and security level must match what the receiving SNMP Network Manager is expecting. SNMP v3 mandates that the message will be rejected unless the SNMPv3 user sending the trap already exists in the user database on



System Name: acm5004-2 Model: ACM5004-2 Firmware: 3.5.1b0
Uptime: 0 days, 0 hours, 25 mins, 59 secs Current User: root

Alerts & Logging: SNMP

SNMP Service Details | Primary SNMP Manager | Secondary SNMP Manager

Manager Protocol: UDP
The transport protocol to use to connect to the SNMP Manager.

Manager Address:
The address of the SNMP Manager to receive traps.

Manager Trap Port: 162
The TCP/UDP port number to send SNMP traps to.

Version:
The SNMP protocol to use for traps.

SNMP v1 & v2c

Community:
The SNMP Community to use for traps.

SNMP v3

Engine ID:
The SNMPv3 Engine ID for the trap manager.

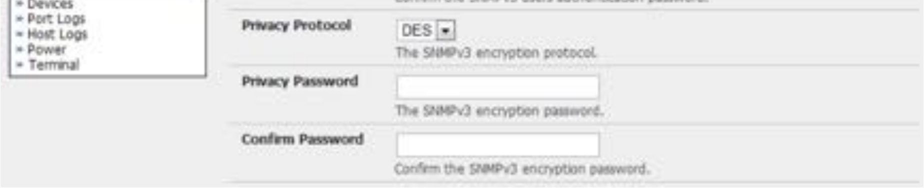
Security Level:
● noAuthNoPriv
○ authNoPriv
○ authPriv
The SNMPv3 Security Level. *'authPriv' is recommended for enforcing both authentication and encryption.*

Username:
The SNMPv3 user to send traps as.

Auth. Protocol: SHA
The SNMPv3 authentication protocol.

Auth. Password:
The SNMPv3 users authentication password.

Confirm Password:



Privacy Protocol: DES
The SNMPv3 encryption protocol.

Privacy Password:
The SNMPv3 encryption password.

Confirm Password:
Confirm the SNMPv3 encryption password.

the SNMP Manager. The user database in a SNMP v3 application is actually referenced by a combination of the Username and the Engine ID for the given SNMP application you are talking to.

- Enter the *Engine ID* for the user sending messages.

  This is a hex number. For example: *0x8000000001020304*.

- Specify the *Security Level*.

  The security level has to be compatible with the settings of the remote SNMP Network Manager.

security level	meaning
noAuthNoPriv	No authentication or encryption
authNoPriv	Authentication only. An authentication protocol (SHA or MD5) and password are required.
authPriv	Authentication and encryption. Requires an encryption protocol (DES or AES) and an authentication protocol password.

- Complete the *Username*.

  This is the Security Name of the SNMPv3 user sending the message. This field is mandatory and must be completed when configuring the *console server* for SNMPv3.

- If the required *Security Level* is authNoPriv or authPrive, select an *Authentication Protocol* (either SHA or MD5) and an *Authentication Password*.

  The password must contain at least 8 characters.

- If the required *Security Level* is authPriv, select a *Privacy Protocol* (DES or AES).

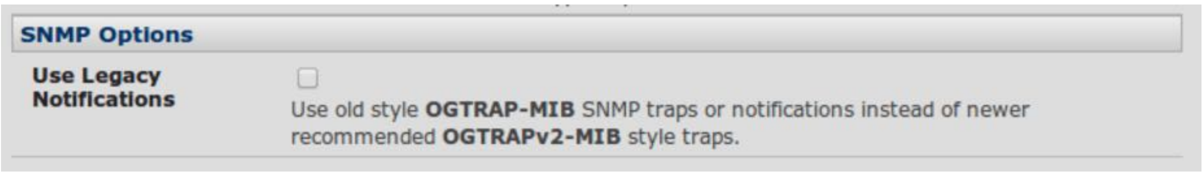
  AES is recommended. A password of at least 8 characters must be provided for encryption to work.

- Click **Apply**.

Note: **Console servers** *with firmware v3.0 and later also embed the* `net-snmpd` *dæmon. This dæmon can accept SNMP requests from remote SNMP management servers and provides information on alert status, serial port status and device status (see chapter 14.5 for more details).* **Console servers** *with firmware earlier than v3.3 can only configure a Primary SNMP server from the Management Console. See chapter 14.5 for details on configuring the snmptrap daemon to send traps/notifications to multiple remote SNMP servers.*

As of firmware v3.10.2, new SNMP status and trap MIBS were created to provide more and better structured SNMP status and traps from console servers.

There is an option in **Alerts & Logging > SNMP** to *Use Legacy Notifications* for the SNMP traps.



SNMP Options

Use Legacy Notifications □
Use old style **OGTRAP-MIB** SNMP traps or notifications instead of newer recommended **OGTRAPv2-MIB** style traps.

Setting this option sets the *console server* to SNMP traps that are compatible with those sent in older firmware before the new MIBS were added. Setting this option ensures a firmware upgrade to v3.10.2 or later does not break existing SNMP management.

When upgrading from firmware which does not support the newer SNMP MIBs/traps (that firmware versions before 3.10.2) to firmware that does support the new MIBs/traps:

If the SNMP service was enabled and an SNMP manager was configured before upgrading the firmware, the *console server* will be configured to use the legacy traps after upgrading

If the SNMP service was not enabled or no SNMP manger was configured before the upgrade, the console server will be configured to use the new SNMP traps after the upgrade. This won't have any effect until the SNMP service is turned on and an SNMP manager is configured.

6.5.4. Send Nagios event alerts

To notify the central Nagios server of Alerts, NSCA must be enabled under **System > Nagios** and Nagios must be enabled for each applicable host or port under **Serial & Network > Network Hosts** or **Serial & Network > Serial Ports** (see chapter 9).

Note: in a Lighthouse CMS centrally managed environment you can check the Nagios alert option. On the trigger condition (for matched patterns, logins, power events and signal changes) an NSCA check warning result will be sent to the central Nagios server. This condition is displayed on the Nagios status screen and triggers a notification, which can then cause the Nagios central server itself to send out an email or an SMS, page, etc.

6.6. Logging

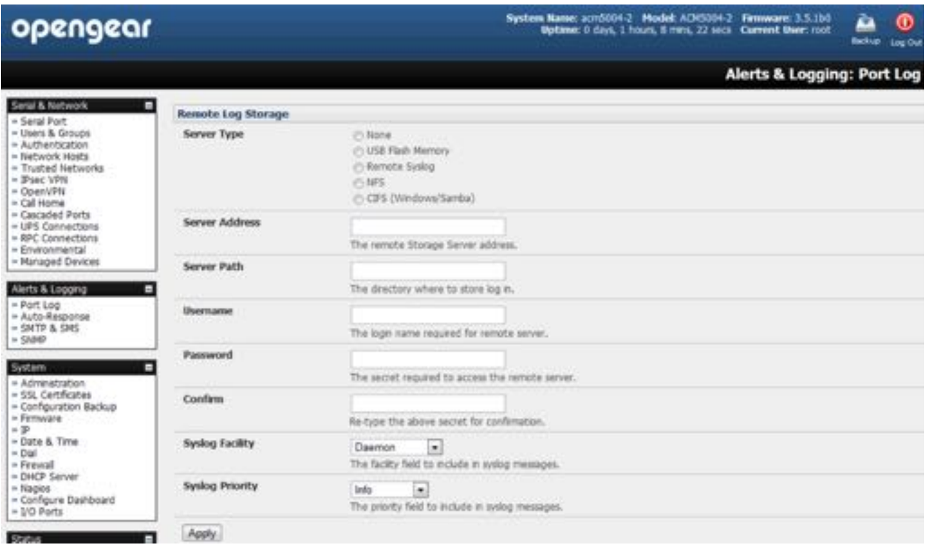
The *console server* can maintain log records of auto-response events. It can also log records of all access and communications events with both the *console server* and with attached serial, network and power devices.

A log of all system activity is also maintained by default, as is a history of the status of any attached environmental monitors.

6.6.1. Log storage

Before activating any Event, Serial, Network or UPS logging, you must specify where those logs are to be saved. These records are stored off-server or in the ACM/IM gateway USB flash memory.

- Navigate to **Alerts & Logging > Port Log**.



System Name: acm5004-2 Model: ACM5004-2 Firmware: 3.5.1b0
Uptime: 0 days, 1 hours, 8 mins, 22 secs Current User: root

Alerts & Logging: Port Log

Remote Log Storage

Server Type
○ None
○ USB Flash Memory
○ Remote Syslog
○ NFS
○ CIFS (Windows/Samba)

Server Address
The remote Storage Server address.

Server Path
The directory where to store log in.

Username
The login name required for remote server.

Password
The secret required to access the remote server.

Confirm
Re-type the above secret for confirmation.

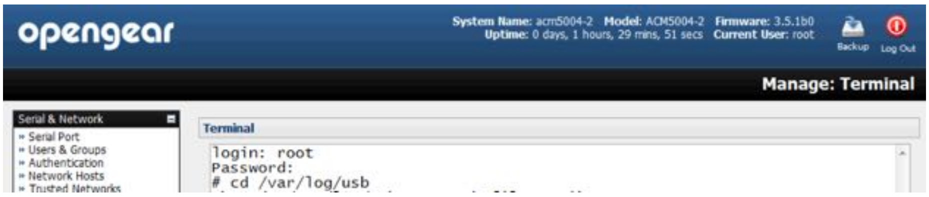
Syslog Facility: Daemon
The facility field to include in syslog messages.

Syslog Priority: Info
The priority field to include in syslog messages.

- Specify the *Server Type* to be used.
- add the required server details to enable log server access.

The *Administrator* can view serial, network, and power device logs stored in the console reserve memory (or on a USB-connected flash device) in **Manage > Devices**.

A *User* will only see logs for the Managed Devices they (or their Group) have been given access privileges for (see chapter 12).



System Name: acm5004-2 Model: ACM5004-2 Firmware: 3.5.1b0
Uptime: 0 days, 1 hours, 29 mins, 51 secs Current User: root

```
login: root
Password:
# cd /var/log/usb
```

View USB event logs in a web terminal or by `ssh` or `telnet` to the *console server*.

6.6.2. Serial port logging

In *Console Server* mode, activity logs can be maintained of all serial port activity. To specify which serial ports are to have activities recorded and to what level data is to be logged:

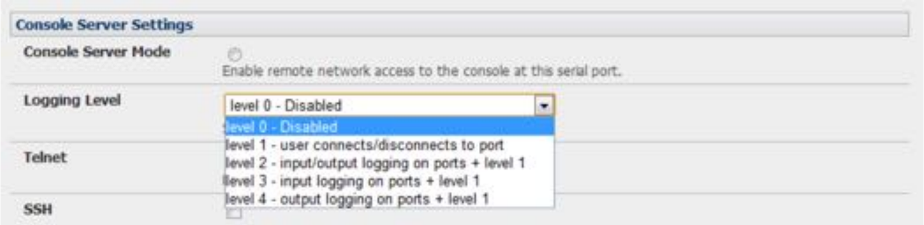
- navigate to **Serial & Network > Serial Port**.
- click *Edit* for the port to be logged.
- Specify the *Logging Level* for each port.

level	user connection events	data transferred to the port	data transferred from the port	hardware flow control changes
0	not logged	not logged	not logged	not logged
1	logged	not logged	not logged	not logged
2	logged	logged	logged	logged
3	logged	not logged	logged	logged
4	logged	logged	not logged	logged

Note: *logging levels are* **not** *a progression from no logging to all logging. Logging Level 0 is no logging, but Logging Level 4 is not 'more' logging than Logging Level 3: these two levels, for example, are different but 4 is not a more comprehensive amount of logging than 3.*

- click **Apply**.

Note: *in addition to the Logs which are transmitted for remote/USB flash storage, a cache of the most recent 8K of logged data per serial port is maintained locally. To view the local cache of logged serial port data select* **Manage > Port Logs**.


Console Server Settings
level 1 - user connects/disconnects to port
level 2 - input/output logging on ports + level 1
level 3 - input logging on ports + level 1
level 4 - output logging on ports + level 1

Console Server Mode ○
Enable remote network access to the console at this serial port.

Logging Level: level 0 - Disabled

Telnet

SSH □

6.6.3. Network TCP & UDP port logging

The *console server* supports optional logging of access to and communications with network attached Hosts.

For each Host, when you set up the Permitted Services which are authorized to be used, you also must set up the level of logging that is to be maintained for each service.

- Specify the logging level that is to be maintained for that particular TCP/UDP port/service, on that particular Host:

level	what is logged
0	Turns off logging for the selected TCP/UDP port to the selected Host.
1	Logs all connection events to the port.
2	Logs all data transferred to and from the port.

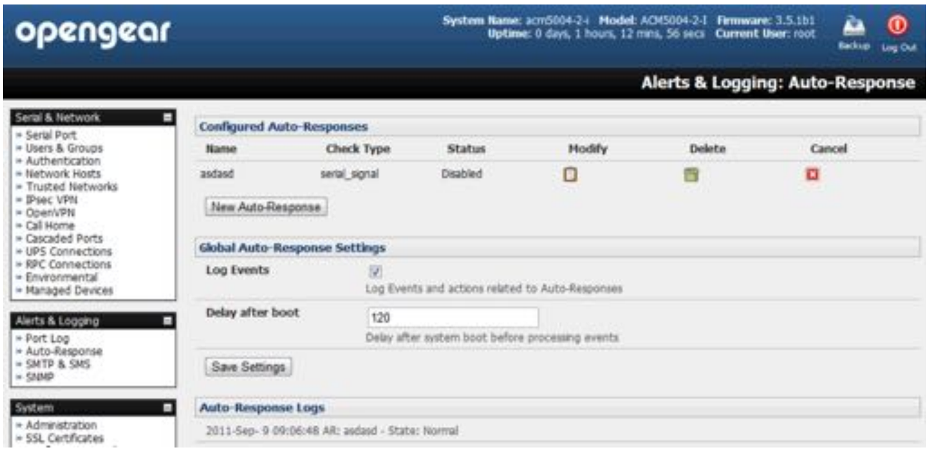
- Click **Add**.
- click **Apply**.

6.6.4. Auto-response event logging

- Navigate to **Alerts & Logging > Auto-Response**.
- In the **Global Auto-Response Settings** section, check the *Log Events* check box.
- Click **Save Settings**.

6.6.5. Power device logging

The *console server* also logs access and communications with network attached hosts and maintain a history of the UPS and PDU power status.



System Name: acm5004-2-i Model: ACM5004-2-I Firmware: 3.5.1b1
Uptime: 0 days, 1 hours, 12 mins, 56 secs Current User: root

Alerts & Logging: Auto-Response

Configured Auto-Responses

Name	Check Type	Status	Modify	Delete	Cancel
asdasd	serial_signal	Disabled	□	▨	☒

New Auto-Response

Global Auto-Response Settings

Log Events ☑
Log Events and actions related to Auto-Responses

Delay after boot 120
Delay after system boot before processing events

Save Settings

Auto-Response Logs

2011-Sep- 9 09:06:48 AR: asdasd - State: Normal

To activate and set the desired levels of logging for UPS and PDU devices see chapter 7.

7. Power, environment, & digital I/O

Opengear *console servers* manage Remote Power Control devices (RPCs including PDUs and IPMI devices) and Uninterruptible Power Supplies (UPSes). They also monitor remote operating environments using Environmental Monitoring Devices (EMDs) and sensors, and can provide digital I/O control.

7.1. Remote power control (RPC)

The *console server* Management Console monitors and controls Remote Power Control (RPC) devices using the embedded PowerMan and Network UPS Tools open source management tools and Opengear's power management software. RPCs include power distribution units (PDUs) and IPMI power devices.

Serial PDUs invariably can be controlled using their command line console, so you could manage the PDU through the console server using a remote Telnet client. Also you could use proprietary software tools no doubt supplied by the vendor. This generally runs on a remote Windows PC and you could configure the *console server* serial port to operate with a serial COM port redirector in the PC (as detailed in chapter 3).

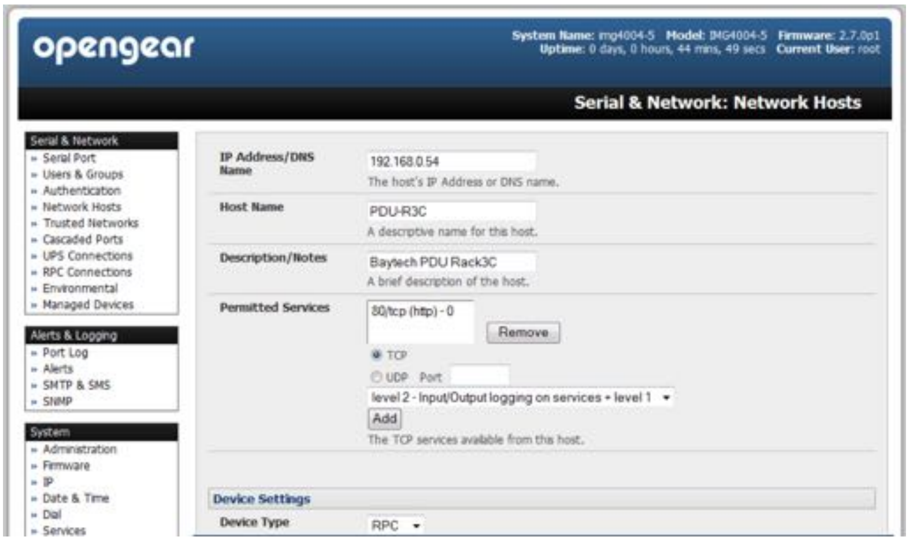
Similarly, network-attached PDUs can be controlled with a browser (with SDT as detailed in chapter 5.3) or an SNMP management package or using the vendor supplied control software. Also servers and network-attached appliances with embedded IPMI service processors or BMCs invariably are supplied with their own management tools (like SoL) that provide secure management when connected using with *SDT Connector*.

For simplicity, however, all these devices can now all be controlled through the one window using the Management Console's RPC remote power control tools.

7.1.1. RPC connection

Serial and network connected RPCs must first be connected to, and configured to communicate with, the *console server*.

- For serial RPCs connect the PDU to the selected serial port on the *console server*.
- Navigate to **Serial & Network > Serial Port**.
- Configure the **Common Settings** of that port with the RS232 properties etc required by the PDU (see chapter 3.1.1).
- Select *RPC* as the *Device Type*.
- Similarly for each network connected RPC, go to **Serial & Network > Network Hosts** and configure the RPC as a connected Host by specifying its *Device Type* as RPC
- click **Apply**.



IP Address/DNS Name: 192.168.0.54
The host's IP Address or DNS name.

Host Name: PDU-R3C
A descriptive name for this host.

Description/Notes: Baytech PDU Rack3C
A brief description of the host.

Permitted Services: 80/tcp (http) - 0
● TCP
○ UDP Port
level 2 - Input/Output logging on services + level 1
The TCP services available from this host.

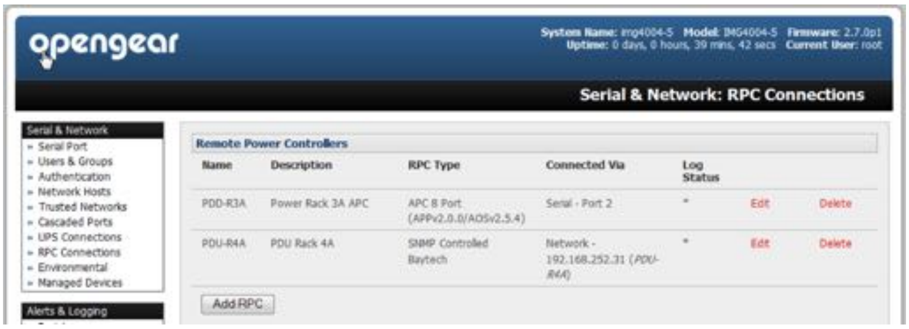
Device Settings

Device Type: RPC

See chapter 4.4 for more on Network Hosts.

- Navigate to **Serial & Network > RPC Connections**.

  The RPC connections that have already been configured will present.

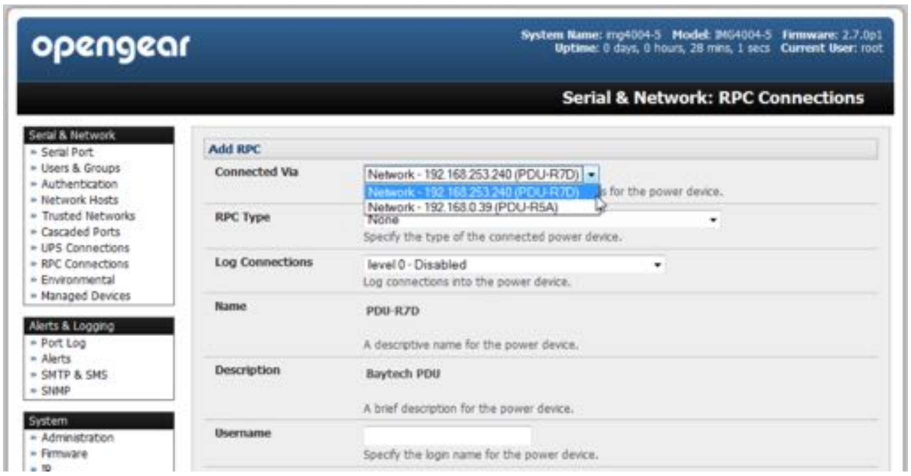


Remote Power Controllers

Name	Description	RPC Type	Connected Via	Log Status		
PDD-R3A	Power Rack 3A APC	APC 8 Port (APPv2.0.0/AOSv2.5.4)	Serial - Port 2	*	Edit	Delete
PDU-R4A	PDU Rack 4A	SNMP Controlled Baytech	Network - 192.168.252.31 (*PDU-R4A*)	*	Edit	Delete

- Click **Add RPC**.
- *Connected Via* presents a list of serial ports and network Host connections that you have set up with device type RPC but have yet to connect to a specific RPC device.

- When you select *Connected Via* for a Network RPC connection, the corresponding *Host Name/Description* set up for that connection will be entered as the *Name* and *Description* for the power device.



System Name: img4004-5 Model: IMG4004-5 Firmware: 2.7.0p1
Uptime: 0 days, 0 hours, 28 mins, 1 secs Current User: root

Serial & Network: RPC Connections

Add RPC

Connected Via: Network - 192.168.253.240 (PDU-R7D)
Network - 192.168.253.240 (PDU-R7D)
Network - 192.168.0.39 (PDU-R5A)
...s for the power device.

RPC Type: None
Specify the type of the connected power device.

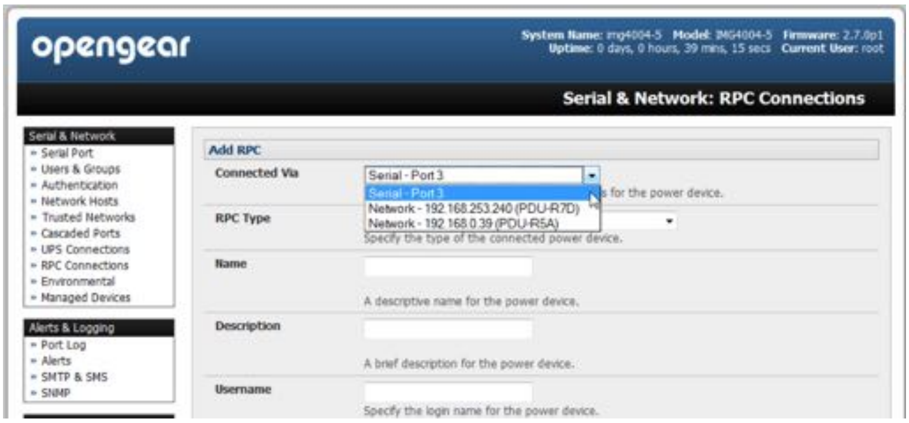
Log Connections: level 0 - Disabled
Log connections into the power device.

Name: PDU-R7D
A descriptive name for the power device.

Description: Baytech PDU
A brief description for the power device.

Username:
Specify the login name for the power device.

- Alternatively if you select Serial connection for *Connected Via*, you will need to enter a Name and Description for the power device.



System Name: img4004-5 Model: IMG4004-5 Firmware: 2.7.0p1
Uptime: 0 days, 0 hours, 39 mins, 15 secs Current User: root

Serial & Network: RPC Connections

Add RPC

Connected Via: Serial - Port 3
Serial - Port 3
Network - 192.168.253.240 (PDU-R7D)
Network - 192.168.0.39 (PDU-R5A)
...s for the power device.

RPC Type:
Specify the type of the connected power device.

Name:
A descriptive name for the power device.

Description:
A brief description for the power device.

Username:
Specify the login name for the power device.

- Select the appropriate *RPC Type* for the PDU (or IPMI) being connected.

  If you are connecting to the RPC via the network you will be presented with the IPMI protocol options and the SNMP RPC Types currently supported by the embedded Network UPS Tools.

  If you are connecting to the RPC by a serial port you will be presented with all the serial RPC types currently supported by the embedded PowerMan and Opengear's power manager.

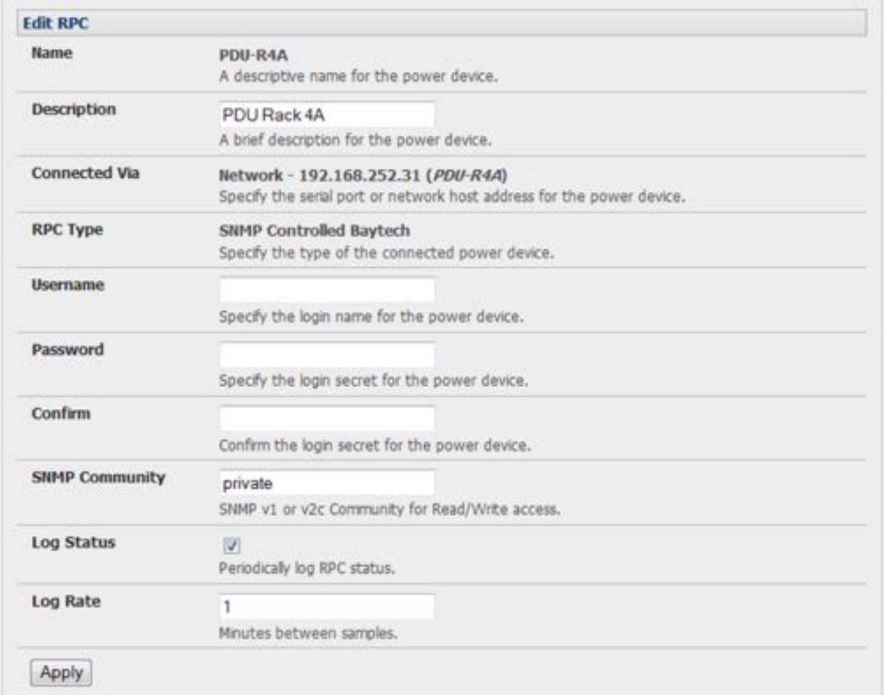
- Enter the *Username* and *Password* used to login into the RPC

  These login credentials are *not* related to the *Users* and access privileges configured in **Serial & Networks > Users & Groups**.

- If SNMP protocol is selected enter the SNMP v1 or v2c Community for Read/Write access.

  By default this would be *private*.

- Check *Log Status*.



Edit RPC

Name	PDU-R4A A descriptive name for the power device.
Description	PDU Rack 4A A brief description for the power device.
Connected Via	Network - 192.168.252.31 (*PDU-R4A*) Specify the serial port or network host address for the power device.
RPC Type	SNMP Controlled Baytech Specify the type of the connected power device.
Username	Specify the login name for the power device.
Password	Specify the login secret for the power device.
Confirm	Confirm the login secret for the power device.
SNMP Community	private SNMP v1 or v2c Community for Read/Write access.
Log Status	☑ Periodically log RPC status.
Log Rate	1 Minutes between samples.

- Secify the *Log Rate* (minutes between samples) if you wish the status from this RPC to be logged.

  These logs can be views from **Status > RPC Status**.

- Click **Apply**.

For SNMP PDUs the *console server* will now probe the configured RPC to confirm the RPC Type matches and will report the number of outlets it finds that can be controlled. If unsuccessful it will report *Unable to probe outlets* and you will need to check the RPC settings, the network connection or the serial connection.

For serially connected RPC devices, a new Managed Device (with the same name as given to the RPC) will be created. The *console server* will then configure the RPC with the number of outlets specified in the selected RPC Type or will query the RPC itself for this information.

Note: Opengear's console servers support the majority of the popular network and serial PDUs. If your PDU is not on the default list then support can be added directly (see chapter 14) or by having the PDU supported added to either the Network UPS Tools or PowerMan open source projects.

IPMI service processors and BMCs can be configured so all authorized users can use the Management Console to remotely cycle power and reboot computers, even when their operating system is unresponsive. To set up IPMI power control:

- enter the IP address or domain name of the BMC or service processor (for example, a Dell DRAC) in **Serial & Network > Network Hosts**.
- then in **Serial & Network > RPC Connections** specify the *RPC Type* to be IPMI1.5 or 2.0.

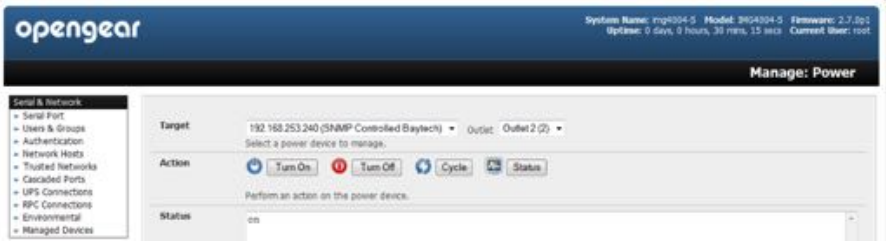
7.1.2. RPC access privileges & alerts

Set PDU and IPMI alerts using **Alerts & Logging > Alerts** (see chapter 6). Assign users to access and control outlets on each RPC via **Serial & Network > User & Groups** (see chapter 3).

7.1.3. User power management

The Power Manager allows *users* and *administrators* to access and control configured serial- & network-attached PDU power strips, and servers with embedded IPMI processors or BMCs.

- Select **Manage > Power**.



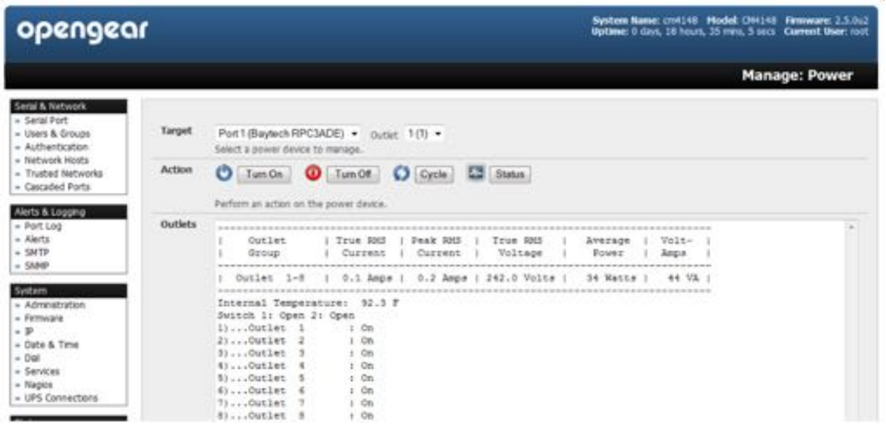
System Name: im4004-5 Model: IM4004-5 Firmware: 2.7.0p1
Uptime: 0 days, 0 hours, 30 mins, 15 secs Current User: root

Target: 192.168.253.240 (SNMP Controlled Baytech) Outlet: Outlet 2 (2)
Select a power device to manage.

Action
Perform an action on the power device.

Status: on

- Select the *Target* power device to be controlled.
- If the RPC supports outlet level control, select the *Outlet* to be controlled.
- Initiate the desired Action by selecting the appropriate icon:



System Name: cm4148 Model: CM4148 Firmware: 2.5.0u2
Uptime: 0 days, 18 hours, 35 mins, 5 secs Current User: root

Target: Port 1 (Baytech RPC3ADE) Outlet: 1 (1)
Select a power device to manage.

Action
Perform an action on the power device.

Outlets

```
-------------------------------------------------------------------------------
|    Outlet      | True RMS  | Peak RMS  |  True RMS   |   Average  |  Volt-  |
|    Group       |  Current  |  Current  |   Voltage   |    Power   |  Amps   |
-------------------------------------------------------------------------------
|  Outlet  1-8   |  0.1 Amps |  0.2 Amps | 242.0 Volts |   34 Watts |   44 VA |
-------------------------------------------------------------------------------
Internal Temperature:  92.3 F
Switch 1: Open 2: Open
1)...Outlet  1       : On
2)...Outlet  2       : On
3)...Outlet  3       : On
4)...Outlet  4       : On
5)...Outlet  5       : On
6)...Outlet  6       : On
7)...Outlet  7       : On
8)...Outlet  8       : On
```

Note: icons will present only for operations that are supported by the Target you have selected.

Turn On.

Turn Off.

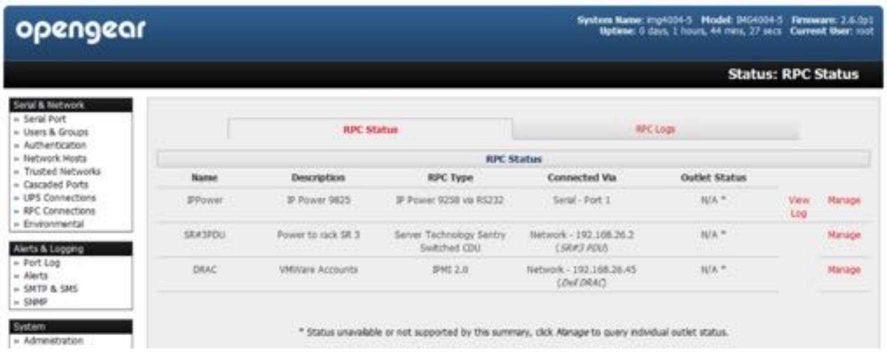
Cycle.

Status.

7.1.4. RPC status

You can monitor the current status of your network and serially connected PDUs and IPMI RPCs.

- **Select Status > RPC Status.**



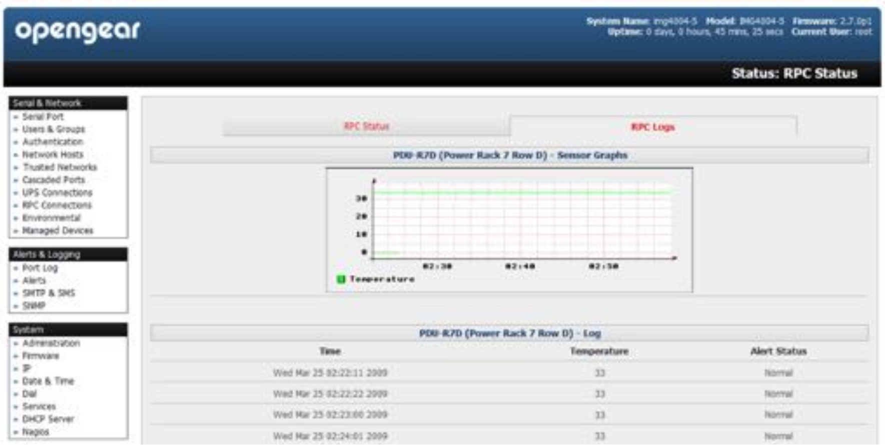
RPC Status

Name	Description	RPC Type	Connected Via	Outlet Status		
IPPower	IP Power 9825	IP Power 9258 via RS232	Serial - Port 1	N/A *	View Log	Manage
SR#3PDU	Power to rack SR 3	Server Technology Sentry Switched CDU	Network - 192.168.26.2 *(SR#3 PDU)*	N/A *		Manage
DRAC	VMWare Accounts	IPMI 2.0	Network - 192.168.26.45 *(Dell DRAC)*	N/A *		Manage

* Status unavailable or not supported by this summary, click Manage to query individual outlet status.

A table with the summary status of all connected RPC hardware will display.

- Click on **View Log** or select the **RPCLogs** tab.



PDU-R7D (Power Rack 7 Row D) - Log

Time	Temperature	Alert Status
Wed Mar 25 02:22:11 2009	33	Normal
Wed Mar 25 02:22:22 2009	33	Normal
Wed Mar 25 02:23:00 2009	33	Normal
Wed Mar 25 02:24:01 2009	33	Normal

A table of the history and detailed graphical information on the selected RPC will present.

- Click **Manage** to query or control the individual power outlet.

  This will take you to **Manage > Power**.

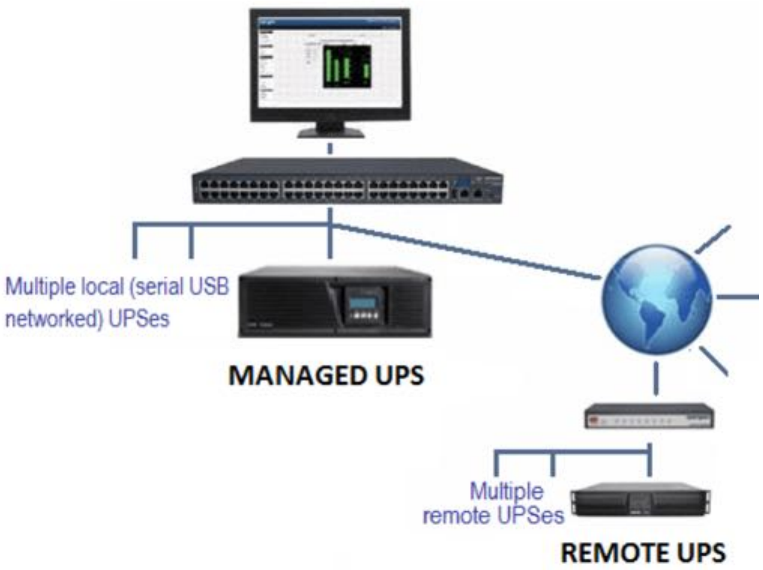
7.2. Uninterruptible power supply (UPS) control

Opengear *console servers* can be configured to manage locally and remotely connected UPS hardware using Network UPS Tools.

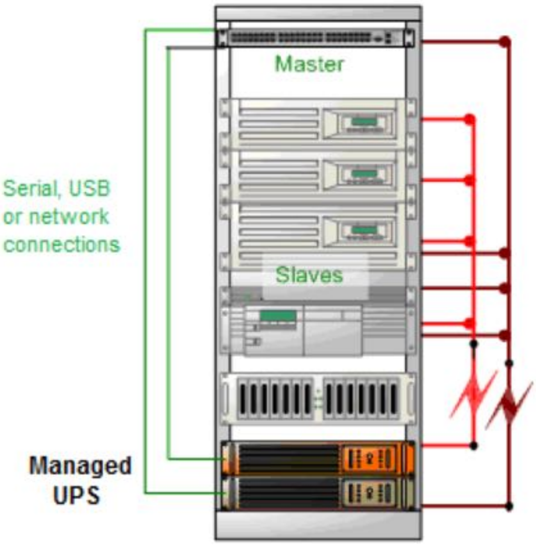
Network UPS Tools (NUT) is a group of open source programs that provide a common interface for monitoring and administering UPS hardware; and ensuring safe shutdowns of the systems which are connected. NUT is built on a networked model with a layered scheme of drivers, server and clients. It is covered in some detail in chapter 7.2.6.

7.2.1. Managed UPS connections

A Managed UPS is a UPS that is directly connected as a Managed Device to the *console server*. It can be connected by serial or USB cable or by the network. The *console server* becomes the master of this UPS, and runs a `upsd` server to allow other computers that are drawing power through the UPS (slaves) to monitor the UPS status and take appropriate action, such as shutdown, in event of low UPS battery.



The *console server* may or may not be drawing power itself through the Managed UPS. When the UPS's battery power reaches critical, the *console server* signals, waits for slaves to shut down, then powers off the UPS.

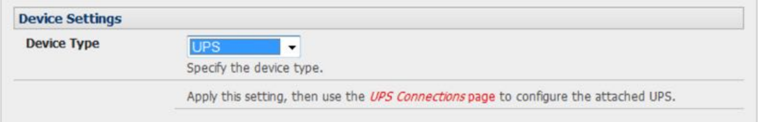


Serial and network connected UPSes must first be connected to, and configured to communicate with the *console server*.

For serial UPSes attach the UPS to the selected serial port on the *console server*:

- navigate to **Serial and Network > Serial Port**.

- configure the **Common Settings** of that port with the properties (RS232 etc) required by the UPS (see chapter 3.1.1).
- select UPS as the *Device Type*.



Device Settings

Device Type: UPS

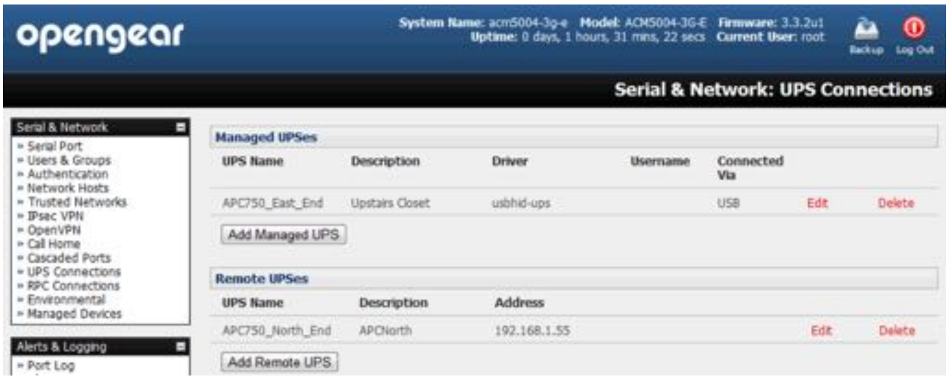
Specify the device type.

Apply this setting, then use the *UPS Connections* page to configure the attached UPS.

For each network connected UPS:

- navigate to **Serial & Network > Network Hosts**.
- configure the UPS as a *connected Host* by specifying its *Device Type* as *UPS*.
- click **Apply**.

Note: USB-connected UPS hardware requires no equivalent configuration.



System Name: acm5004-3g-e Model: ACM5004-3G-E Firmware: 3.3.2u1
Uptime: 0 days, 1 hours, 31 mins, 22 secs Current User: root

Serial & Network: UPS Connections

Managed UPSes

UPS Name	Description	Driver	Username	Connected Via		
APC750_East_End	Upstairs Closet	usbhid-ups		USB	Edit	Delete

Remote UPSes

UPS Name	Description	Address		
APC750_North_End	APCNorth	192.168.1.55	Edit	Delete

- Navigate to **Serial & Network > UPS Connections**.

  The Managed UPSes section will display all UPS connections which have already been configured.

- Click **Add Managed UPS**.
- Select if the UPS will be *Connected Via USB* or over a pre-configured *serial port* or via *SNMP/HTTP/HTTPS* over the preconfigured network Host connection.

Note: when you select a network UPS connection, the corresponding Host Name/Description that you set up for that connection will be entered as the Name and Description for the power device. Alternatively, if you select to Connect Via a USB or serial connection you will need to enter a Name and Description for the power device. These details will also be used to create a new Managed Device entry for the serial/USB connected UPS devices.

- Enter the login details.

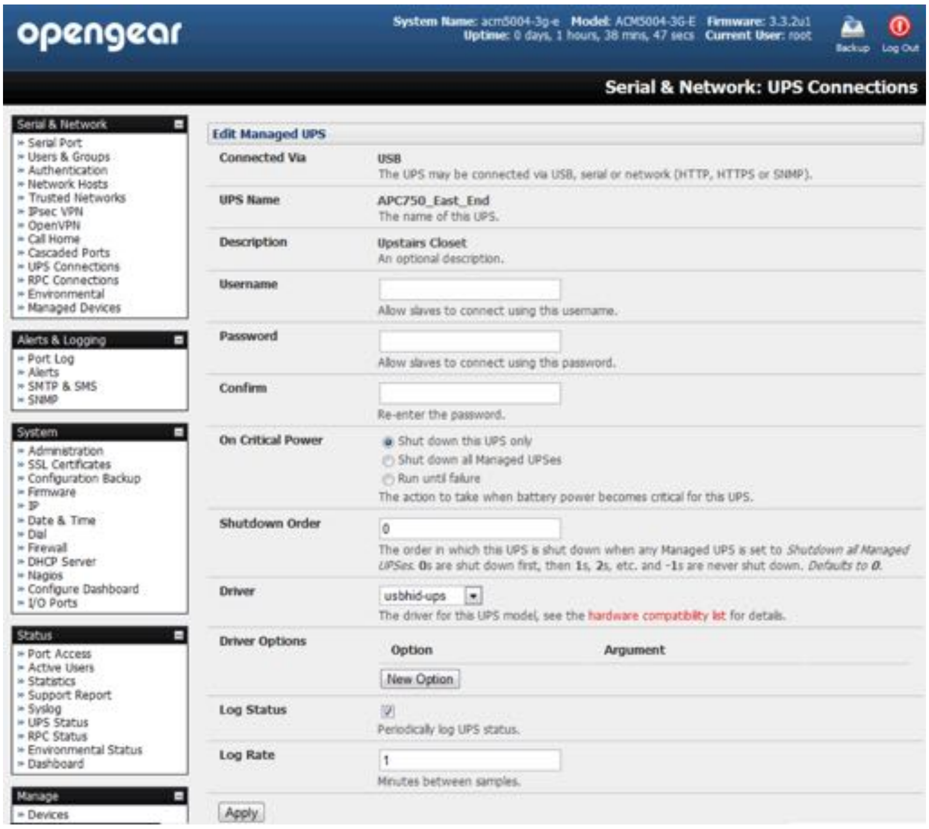
  This Username and Password is used by slaves of this UPS (that is, other computers that are drawing power through this UPS) to connect to the *console server* to monitor the UPS status so they can shut themselves down when battery power is low.

  Monitoring will typically be performed using the upsmon client running on the slave server (see chapter 7.2.3).

Note: these login credentials are not related to the Users and access privileges configured in **Serial**

& Networks > Users & Groups.

- Select the action to take when UPS battery power becomes critical: Shut down the UPS or Shut down all Managed UPSes or simply Run until failure.



System Name: acm5004-3g-e Model: ACM5004-3G-E Firmware: 3.3.2u1
Uptime: 0 days, 1 hours, 38 mins, 47 secs Current User: root

Serial & Network: UPS Connections

Edit Managed UPS

Connected Via	USB The UPS may be connected via USB, serial or network (HTTP, HTTPS or SNMP).
UPS Name	APC750_East_End The name of this UPS.
Description	Upstairs Closet An optional description.
Username	 Allow slaves to connect using this username.
Password	 Allow slaves to connect using this password.
Confirm	 Re-enter the password.
On Critical Power	● Shut down this UPS only ○ Shut down all Managed UPSes ○ Run until failure The action to take when battery power becomes critical for this UPS.
Shutdown Order	0 The order in which this UPS is shut down when any Managed UPS is set to *Shutdown all Managed UPSes*. **0**s are shut down first, then **1**s, **2**s, etc. and **-1**s are never shut down. *Defaults to 0.*
Driver	usbhid-ups The driver for this UPS model, see the hardware compatibility list for details.
Driver Options	Option Argument New Option
Log Status	☑ Periodically log UPS status.
Log Rate	1 Minutes between samples.

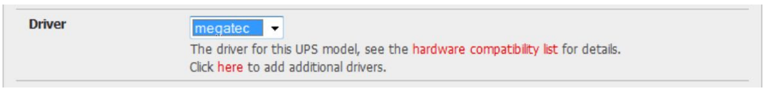
Apply

the shutdown script `/etc/scripts/ups-shutdown` can be customized so, in the event of a critical power failure (when the UPS battery runs out) you can program the *console server* to perform last gasp actions before power is lost. See the Opengear FAQ for details. It is generally simpler, however, to perform such last gasp actions by triggering Auto-Response on the UPS hitting *batt* or *lowbatt*. See chapter 6.

- If you have multiple UPSes and require them to be shut down in a specific order, specify the *Shutdown Order* for this UPS.

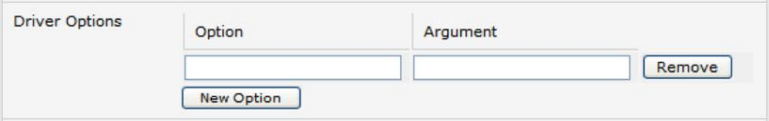
  This is a whole positive number, a 0 or -1. 0s are shut down first, then 1s, 2s, 3s and so on. -1s are not shut down at all. The default value is 0.

- Select the *Driver* that will be used to communicate with the UPS.



Driver	megatec The driver for this UPS model, see the hardware compatibility list for details. Click here to add additional drivers.

- Click *New Options* in **Driver Options** if you need to set driver-specific options for your selected NUT driver and hardware combination.



Driver Options

Option	Argument	
		Remove

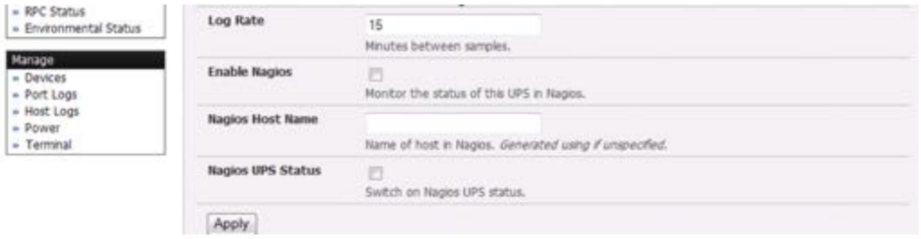
New Option

For more details see http://www.networkupstools.org/doc.

- Check *Log Status* and specify the Log Rate (minutes between samples) if you wish the status from this UPS to be logged.

  These logs can then be viewed at **Status > UPS Status**.

If you have enabled Nagios services you will presented with an option for Nagios monitoring.



Log Rate	15 Minutes between samples.
Enable Nagios	□ Monitor the status of this UPS in Nagios.
Nagios Host Name	 Name of host in Nagios. *Generated using if unspecified.*
Nagios UPS Status	□ Switch on Nagios UPS status.

- Check *Enable Nagios* to enable this UPS to be monitored using Nagios central management.
- Check *Enable Shutdown Script* if this is the UPS providing power to the *console server* itself.

  In the event of a critical power failure you can perform last gasp actions on the *console server* before power is lost.

  This is achieved by placing a custom script in `/etc/config/scripts/ups-shutdown` (you may use the provided `/etc/scripts/ups-shutdown` as a template). This script is only run when then UPS reaches critical battery status.

Click **Apply**.

Note: you can customize the `upsmon`, `upsd` *and* `upsc` *settings for this UPS hardware directly from the command line.*

7.2.2. Remote UPS management

A Remote UPS is a UPS that is connected as a Managed Device to some remote *console server* which is being monitored (but not managed) by your console server.

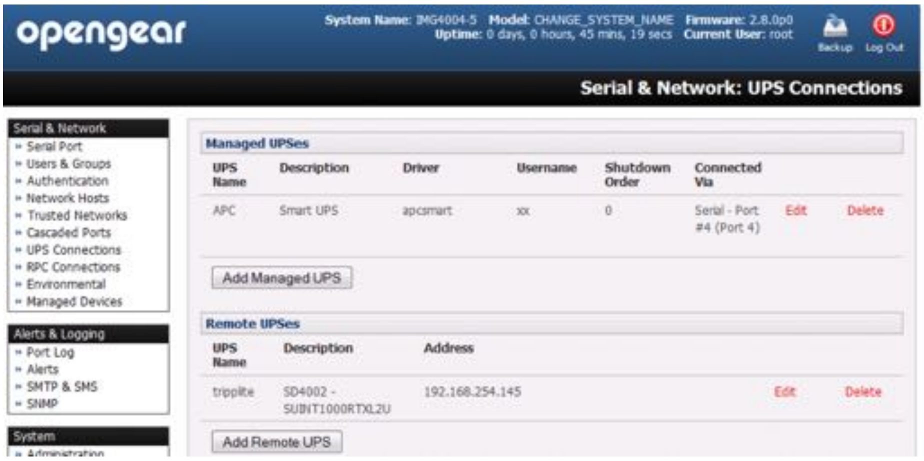
The `upsc` and `upslog` clients in the Opengear console server can configured to monitor remote servers that are running Network UPS Tools managing their locally connected UPSes. These remote servers might be other Opengear console servers or generic Linux servers running NUT. So all these distributed UPSes (which may be spread in a row in a data center, or around a campus property or across the country) can be centrally monitored through the one central console server window.

An example where centrally monitoring remotely distributed UPSes is useful is a campus or large business complex where there's a multitude of computer and other equipment sites spread afar, each with their own UPS supply. Many of these (particularly the smaller sites) will be USB or serially connected.

Having a ACM5000 or ACM5500 at these remote sites allows the systems manager to centrally monitor the power supply status at all sites, centralize alarms, and, consequently, be warned to initiate a call-out or take shut down actions.

To add a Remote UPS:

- navigate to **Serial & Network > UPS**.



System Name: IMG4004-5 **Model:** CHANGE_SYSTEM_NAME **Firmware:** 2.8.0p0
Uptime: 0 days, 0 hours, 45 mins, 19 secs **Current User:** root

Serial & Network: UPS Connections

Managed UPSes

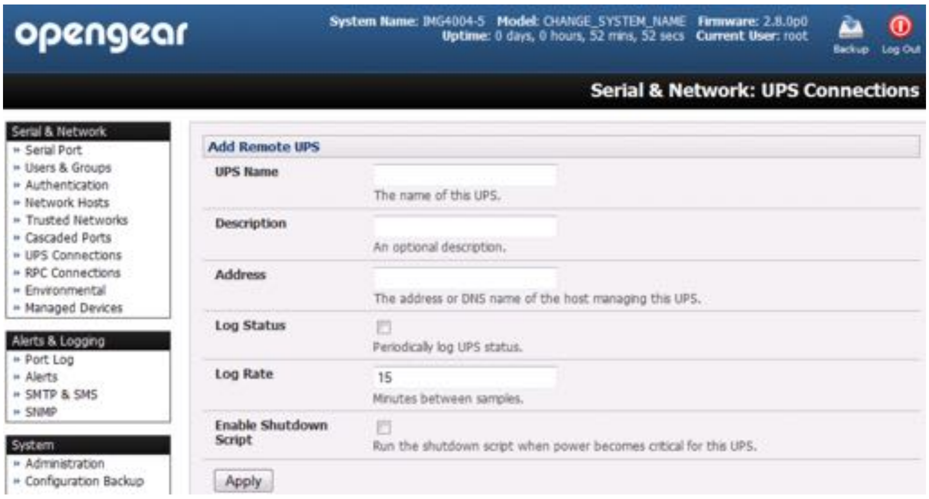
UPS Name	Description	Driver	Username	Shutdown Order	Connected Via		
APC	Smart UPS	apcsmart	xx	0	Serial - Port #4 (Port 4)	Edit	Delete

Remote UPSes

UPS Name	Description	Address		
tripplite	SD4002 - SUINT1000RTXL2U	192.168.254.145	Edit	Delete

The Remote UPSes section displays all the remote UPS devices being monitored

- click **Add Remote UPS**.



System Name: IMG4004-5 **Model:** CHANGE_SYSTEM_NAME **Firmware:** 2.8.0p0
Uptime: 0 days, 0 hours, 52 mins, 52 secs **Current User:** root

Serial & Network: UPS Connections

Add Remote UPS

UPS Name	The name of this UPS.
Description	An optional description.
Address	The address or DNS name of the host managing this UPS.
Log Status	□ Periodically log UPS status.
Log Rate	15 Minutes between samples.
Enable Shutdown Script	□ Run the shutdown script when power becomes critical for this UPS.

- enter the *UPS Name* of the remote UPS to be remotely monitored.

  This name must be the name that the remote UPS was configured with on the remote *console server* as the remote *console server* may itself have multiple UPSes attached that it is managing locally with NUT.

- optionally enter a Description.

- enter the IP Address or DNS name of the remote console server that is managing the remote UPS.

  This may be another Opengear *console server* or it may be a generic Linux server running Network UPS Tools.

- check *Log Status*.

- specify the Log Rate (minutes between samples) if you wish the status from this UPS to be logged.

  These logs can then be viewed at **Status > UPS Status**.

- check *Enable Shutdown Script* if this remote UPS is the UPS providing power to the *console server* itself.

  In the event the UPS reaches critical battery status the custom script in `/etc/config/scripts/ups-shutdown` is run enabling you to perform any 'last gasp' actions.

click **Apply**.

Note: the Remote UPS feature is supported on all console servers running firmware v2.8 and later. Earlier versions supported a single remote monitored UPS which could be set to trigger the console server shutdown script.

7.2.3. Controlling UPS-powered computers

One of the advantages of having a Managed UPS is that you can configure computers that draw power through that UPS to be shut down gracefully in the event of UPS problems.

For Linux computers this can be done by setting up `upsmon` on each computer and directing them to monitor the console server that is managing their UPS.

This will set the specific conditions that will be used to initiate a power down of the computer. For example, non-critical servers may be powered down some seconds after the UPS starts running on battery where more critical servers may not be shut down until a low battery warning is received. Refer to the online NUT documentation for details on how this is done:

http://eu1.networkupstools.org/doc/2.2.0/INSTALL.html
http://linux.die.net/man/5/upsmon.conf
http://linux.die.net/man/8/upsmon

An example `upsmon.conf` entry might look like:

```
MONITOR managedups@192.168.0.1 1 username password slave
```

upsmon.conf portion	meaning
manageup	The UPS Name of the managed UPS.
192.168.0.1	The IP address of the Opengear *console server*.
1	Indicates the server has a single power supply attached to this UPS.
username	The username of the managed UPS.
password	The password of the managed UPS.

There are NUT monitoring clients available for Windows computers (for example, WinNUT).

If you have an RPC (PDU) it is also possible to shut down UPS-powered computers and other equipment without them have a client running (for example, communications and surveillance gear). Set up a UPS alert and use this to trigger a script which controls a PDU to shut off the power (see chapter 14).

7.2.4. UPS alerts

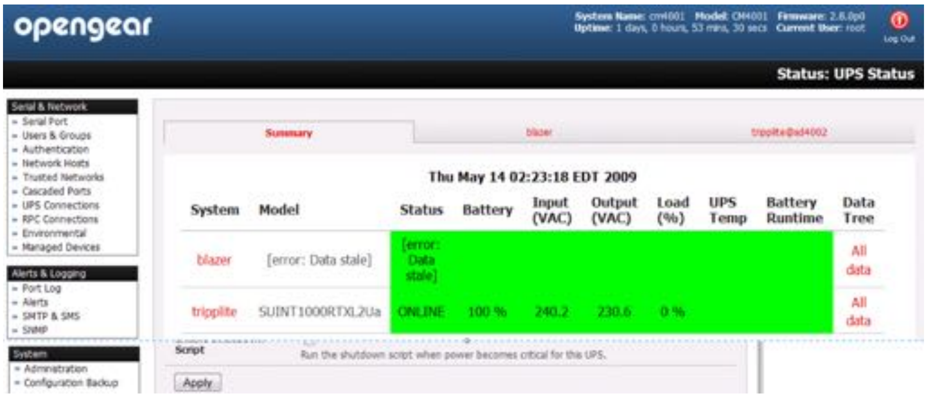
Set UPS alerts using **Alerts & Logging > Alerts**. See chapter 6.

7.2.5. UPS status

You can monitor the current status of your network-connected, serially-connected or USB-connected Managed UPSes and any configured Remote UPSes.

- Navigate to **Status > UPS Status**.

  A table with the summary status of all connected UPS hardware will display.



System Name: cm4001 Model: CM4001 Firmware: 2.8.0p0
Uptime: 1 days, 0 hours, 53 mins, 30 secs Current User: root

Status: UPS Status

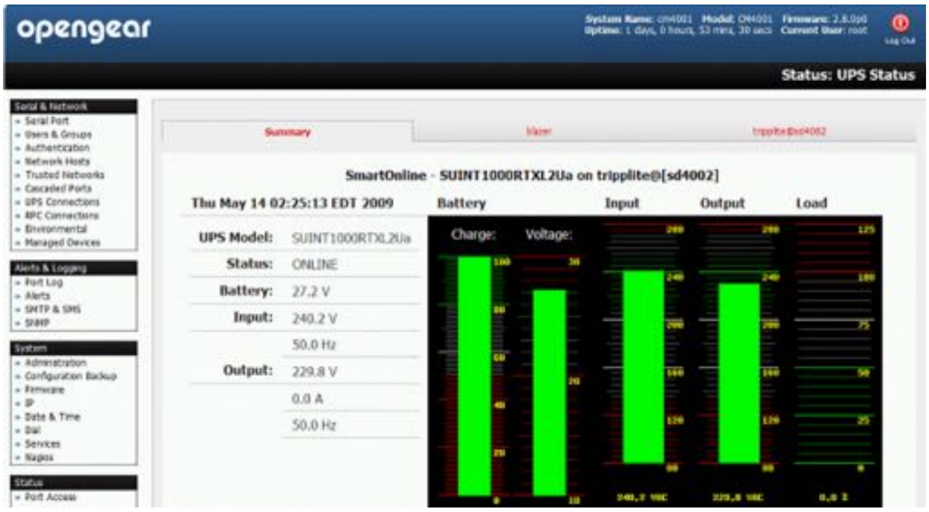
Thu May 14 02:23:18 EDT 2009

System	Model	Status	Battery	Input (VAC)	Output (VAC)	Load (%)	UPS Temp	Battery Runtime	Data Tree
blazer	[error: Data stale]	[error: Data stale]							All data
tripplite	SUINT1000RTXL2Ua	ONLINE	100 %	240.2	230.6	0 %			All data

Script: Run the shutdown script when power becomes critical for this UPS.

- Click on any given UPS *System* name in the table.

  More detailed graphical information on the select UPS System will present.



System Name: cm4001 Model: CM4001 Firmware: 2.8.0p0
Uptime: 1 days, 0 hours, 53 mins, 30 secs Current User: root

Status: UPS Status

SmartOnline - SUINT1000RTXL2Ua on tripplite@[sd4002]

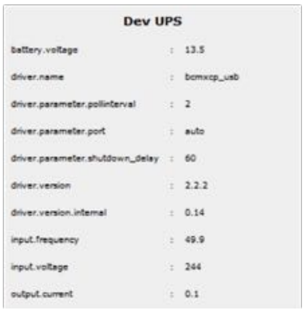
Thu May 14 02:25:13 EDT 2009

UPS Model: SUINT1000RTXL2Ua
Status: ONLINE
Battery: 27.2 V
Input: 240.2 V
50.0 Hz
Output: 229.8 V
0.0 A
50.0 Hz

- Click on any given UPS System's *All Data* link in the table.

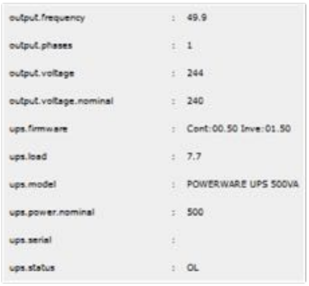
  Status and configuration information on the selected UPS System presents.

- Select **UPS Logs**.



Dev UPS

```
battery.voltage                    :  13.5
driver.name                        :  bcmxcp_usb
driver.parameter.pollinterval      :  2
driver.parameter.port              :  auto
driver.parameter.shutdown_delay    :  60
driver.version                     :  2.2.2
driver.version.internal            :  0.14
input.frequency                    :  49.9
input.voltage                      :  244
output.current                     :  0.1
```



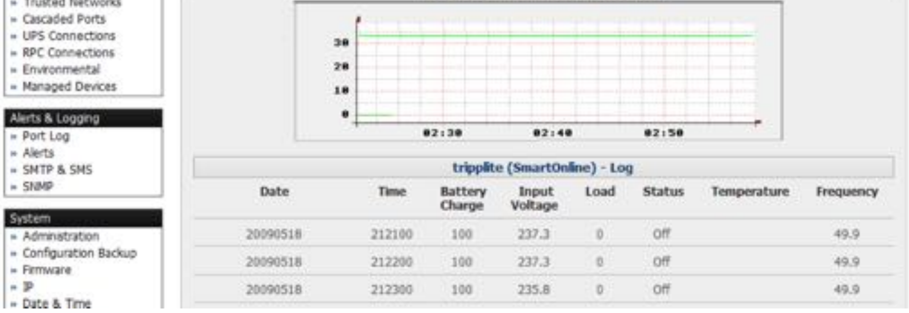
```
output.frequency                   :  49.9
output.phases                      :  1
output.voltage                     :  244
output.voltage.nominal             :  240
ups.firmware                       :  Cont:00.50 Inve:01.50
ups.load                           :  7.7
ups.model                          :  POWERWARE UPS 500VA
ups.power.nominal                  :  500
ups.serial                         :
ups.status                         :  OL
```

The log table of the load, battery charge level, temperature and other status information

System Name: cm4001 Model: CM4001 Firmware: 2.8.0p0
Uptime: 4 days, 2 hours, 15 mins, 49 secs Current User: root

Status: UPS Status

tripplite (SmartOnline) - Status Graph



tripplite (SmartOnline) - Log

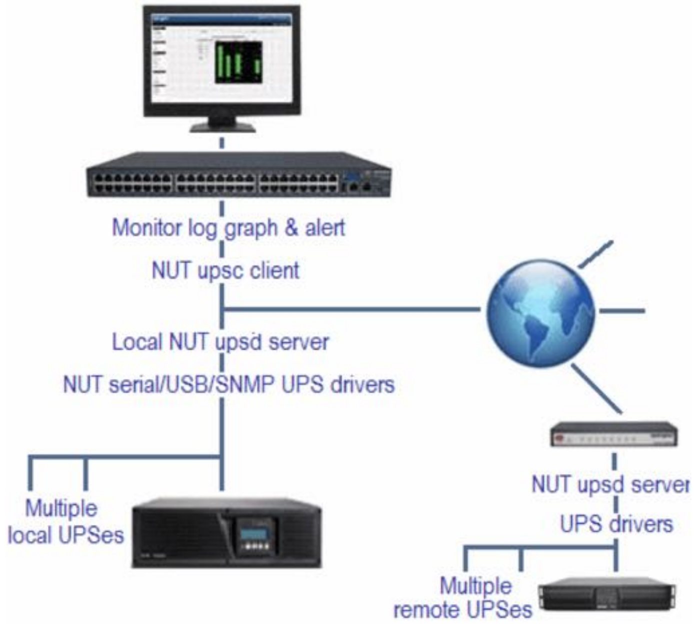
Date	Time	Battery Charge	Input Voltage	Load	Status	Temperature	Frequency
20090518	212100	100	237.3	0	Off		49.9
20090518	212200	100	237.3	0	Off		49.9
20090518	212300	100	235.8	0	Off		49.9

from all the managed and monitored UPS systems is presented.

This information is logged for all UPSes which were configured with *Log Status* checked. The information is also presented graphically.

7.2.6. Overview of Network UPS tools (NUT)

Network UPS Tools (NUT) is built on a networked model with a layered scheme of drivers, server and clients. NUT can be configured using the Management Console as described above, or you can configure the tools and manage the UPSes directly from the command line. This section provides an overview of NUT., Full NUT documentation is available at http://networkupstools.org/documentation.html.



The driver programs talk directly to the UPS equipment and run on the same host as the NUT network server (upsd). Drivers are provided for a wide assortment of equipment from most of the popular UPS vendors and understand the specific language of each UPS. They communicate to serial-, USB- and SNMP network- connected UPS hardware and map the communications back to a compatibility layer. This means both an expensive ‘smart’ protocol UPS and a simple ‘power strip’ model can be handled transparently.

The NUT network server program `upsd` is responsible for passing status data from the drivers to the client programs via the network. `upsd` can cache the status from multiple UPSes and then serve this status data to many clients. upsd also contains access control features to limit the abilities of the clients (for example, so only authorized hosts may monitor or control the UPS hardware).

There are a number of NUT clients that connect to `upsd` to check on the status of the UPS hardware and do things based on the status. These clients can run on the same host as the NUT server or they can communicate with the NUT server over the network (enabling them to monitor any UPS anywhere).

- The `upsc` client provides a quick way to poll the status of a UPS server. It can be used inside shell scripts and other programs that need UPS data but don't want to include the full interface
- The `upsmon` client enables servers that draw power through the UPS to shutdown gracefully when the battery power reaches critical
- There are also logging clients (`upslog`) and third party interface clients (Big Sister, Cacti, Nagios, Windows and more).

The latest release of NUT (2.7.4) also controls PDU systems. It can do this either natively using SNMP or through a binding to Powerman (open source software from Livermore Labs that is also embedded in Opengear *console servers*).

These NUT clients and servers are all embedded in each Opengear console server (with a Management Console presentation layer added). They also run remotely on distributed console servers and other remote NUT monitoring systems. This layered distributed NUT architecture enables:

- Multiple manufacturer support.

  NUT can monitor UPS models from 79 different manufacturers and PDUs from a growing number of vendors, all via a unified interface.
- Multiple architecture support.

  NUT can manage serial- and USB-connected UPS models with the same common interface. Network-connected USB and PDU equipment can also be monitored using SNMP.
- Multiple clients monitoring the one UPS.

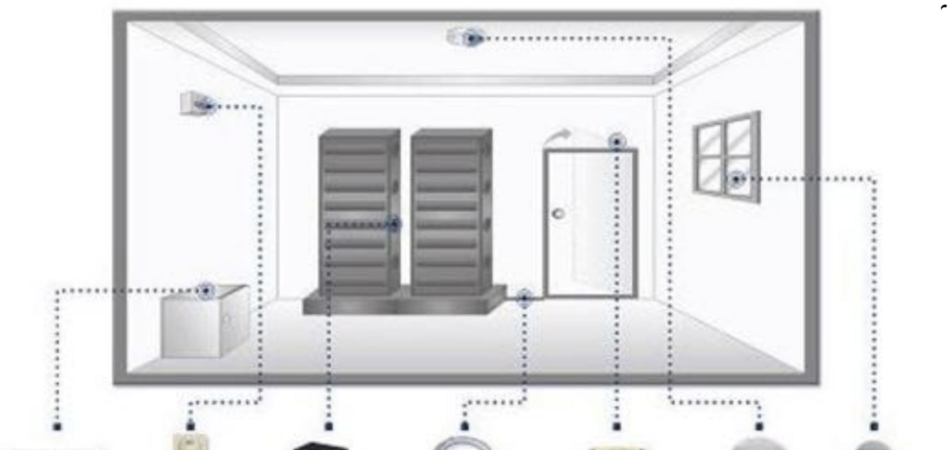
  Multiple systems may monitor a single UPS using only their network connections. As well there is a wide selection of client programs which support monitoring UPS hardware via NUT (Big Sister, Cacti, Nagios and more).
- Central management of multiple NUT servers.

  A central NUT client can monitor multiple NUT servers that may be distributed throughout the data center, across a campus or around the world.

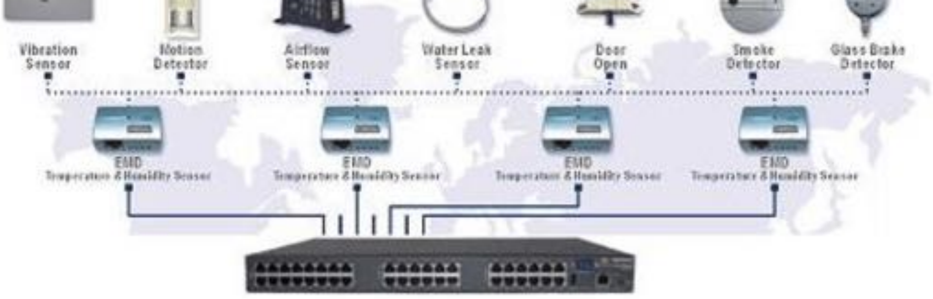
NUT supports the more complex power architectures found in data centers, communications centers and distributed office environments where: UPSes from many vendors power many systems with many clients; and larger UPSes power multiple devices; and many of these UPSes are, in turn, dual powered.

7.3. Environmental monitoring

Opengear *console servers* can be configured to monitor their operating environment.



External E console


Vibration Sensor
Motion Detector
Airflow Sensor
Water Leak Sensor
Door Open
Smoke Detector
Glass Brake Detector
EMD Temperature & Humidity Sensor
EMD Temperature & Humidity Sensor
EMD Temperature & Humidity Sensor
EMD Temperature & Humidity Sensor

server serial port. Each *console server* can support multiple EMDs.

Each EMD device has an internal temperature and humidity sensor plus one or two general purpose status sensor ports which can be connected to smoke detectors, water detectors, vibration sensors or open-door sensors.

The ACM5000 and ACM5500 advanced console server models also each have an internal temperature sensor and can optionally be configured to have up to four general purpose status sensor ports (which can be connected to smoke detectors, water detectors, vibration sensors, or open-door sensors) directly connected.

Using the Management Console, *Administrators* can view the ambient temperature (in °C or °F) and humidity (as a percentage) and configure alerts to monitor the status and sensors to automatically send alarms progressively from warning levels to critical.

7.3.1. Connecting the EMD & its sensors

Environmental Monitor Device (EMD)

EMD adapter

EMD sensors

The Environmental Monitor Device (EMD) connects to any serial port on the console server via a special EMD Adapter and standard CAT5 cable. The sensors then screw into the EMD.

Note: the EMD is powered over the serial port connection and communicates using a custom handshake protocol. It is not an RS232 device and should not be connected without the adapter.

- Plug the male RJ plug on the EMD Adapter into the EMD.
- Connect the Adapter to the console server serial port using the provided UTP cable.

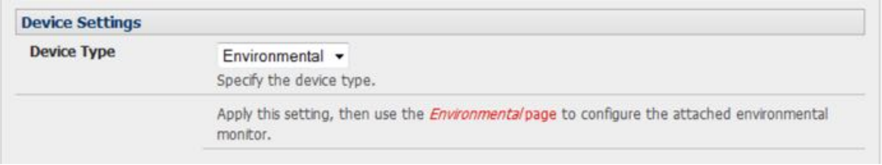
  If the 2 meter (6′) UTP cable provided with the EMD is not long enough it can be replaced with a standard Cat5 UTP cable up to 10 meters (33′) in length.
- Screw the bare wires on any smoke detector, water detector, vibration sensor, open-door sensor or general purpose open/close status sensors into the terminals on the EMD.

Note: you can attach two sensors onto the terminals on EMDs that are connected to console servers with Opengear Classic and Cisco Rolled pinouts. However console servers with -02 pinouts only support attaching a single sensor to each EMD.

EMDs work with Opengear *console servers* only and cannot be connected to standard RS232 serial ports on other appliances.

- Navigate to **Serial & Network > Serial Port**.
- Select *Environmental* as the *Device Type*.

  No particular settings are required.



Device Settings

Device Type: Environmental

Specify the device type.

Apply this setting, then use the *Environmental* page to configure the attached environmental monitor.

- Click **Apply**.

7.3.2. Connecting sensors to ACM5000s, ACM5500s, & ACM7000s

You can connect EMDs (and their attached environmental sensors) to the ACM5000's serial ports, as detailed above. ACM5000s also supports direct environmental sensor connection.

All ACM5000 models (except the ACM5004-2-I) can be configured with the environmental option –E. Models with this option have a green connector block on the side (marked SENSORS 1 -4) and up to four environmental sensors can be directly attached to this block.

The ACM5004-2-I model is supplied with a green connector block on the side by default. The first two connectors on this block (marked DIO1 and DIO2) can be configured to have external environmental sensors attached.

ACM5508-2-I and ACM5504-5-G-I models also ship with a green connector block on the side. The first two connectors on this block (marked DIO1 and DIO2) can be configured to have external environmental sensors attached.

ACM7000 models ship with an in-built, black, spring cage I/O connector block for attaching environmental sensors and digital I/O devices.

ACM5000-E sensor inputs are four *dry contact* inputs. These are normally open (NO) and sensed as TTL high or digital 1. When activated, external devices (door close, vibration, water, smoke) present a short circuit, the contact *closes to ground* and is read as TTL low or digital 0.

For custom applications the state (closed or open) of non-Opengear dry contact sensors can be sensed through the UI or command line.The sensor pins can also be controlled as outputs: set the pins as TTL high (1) or low (0) as required for their low voltage/low current application.

ACM5000s and ACM5000 -Is have dedicated I/O (DIO1 & DIO2) and output only pins (OUT1 & OUT2), the latter having inverting outputs with higher voltage/current transistor. By default each SENSOR and DIO port is configured as an Input for external environmental sensors.

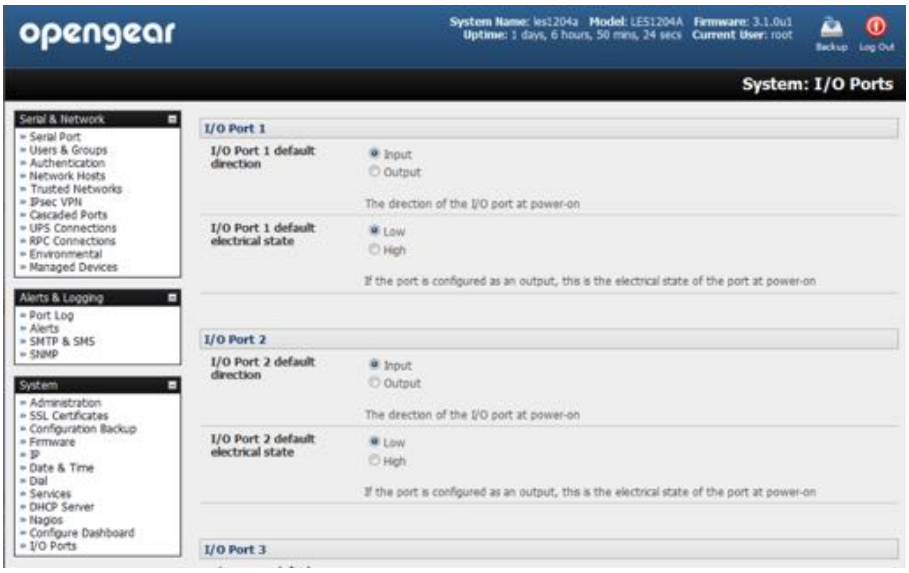
- To confirm the direction and state configurations for these ports navigate to **System > I/O**.

  A table with the summary status of the four digital I/O ports will present.

port label	equivalent hardware label
I/O Port 1	DIO1 or SENSOR1
I/O Port 2	DIO2 or SENSOR2
I/O Port 3	SENSOR3
I/O Port 4	SENSOR4

- Screw the bare wires on a smoke detector, water detector, vibration sensor, open-door sensor or general purpose open/close status sensor into the SENSOR or DIO terminals on the green connector block.

  As Inputs, the SENSOR and DIO ports are notionally attached to the internal EMD.



System Name: les1204a Model: LES1204A Firmware: 3.1.0u1
Uptime: 1 days, 6 hours, 50 mins, 24 secs Current User: root

System: I/O Ports

I/O Port 1

I/O Port 1 default direction: ● Input ○ Output
The direction of the I/O port at power-on

I/O Port 1 default electrical state: ● Low ○ High
If the port is configured as an output, this is the electrical state of the port at power-on

I/O Port 2

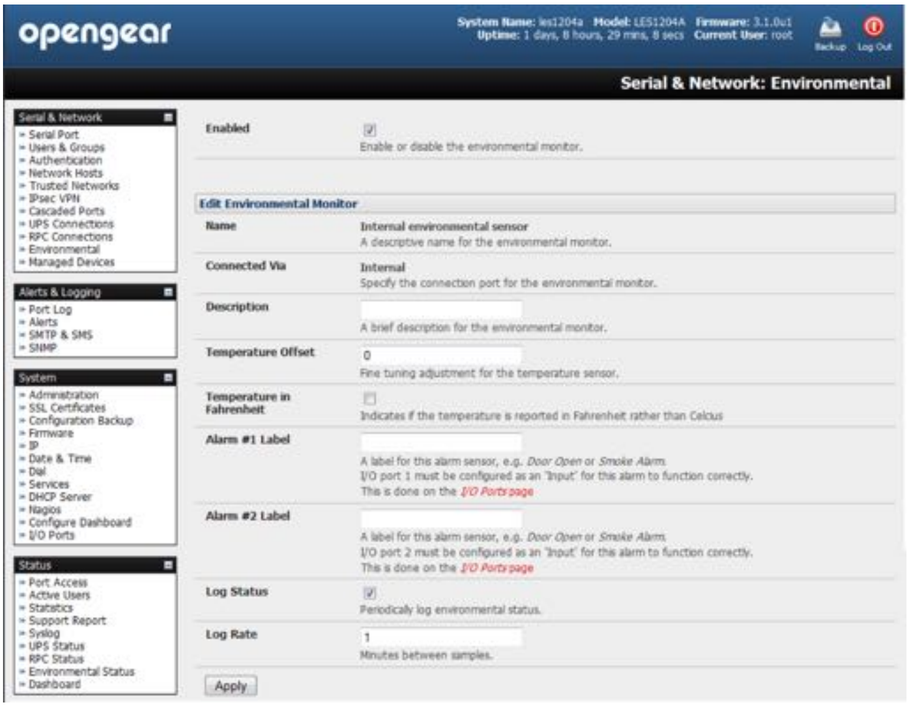
I/O Port 2 default direction: ● Input ○ Output
The direction of the I/O port at power-on

I/O Port 2 default electrical state: ● Low ○ High
If the port is configured as an output, this is the electrical state of the port at power-on

I/O Port 3

- Navigate to **Serial & Network > Environmental Status**.
- Enable the Internal EMD.
- Configure the attached sensors as alarms.

  Details for doing this are covered in the next section.



System Name: les1204a **Model:** LES1204A **Firmware:** 3.1.0u1
Uptime: 1 days, 8 hours, 29 mins, 8 secs **Current User:** root

Serial & Network: Environmental

Enabled ☑
Enable or disable the environmental monitor.

Edit Environmental Monitor

Name **Internal environmental sensor**
A descriptive name for the environmental monitor.

Connected Via **Internal**
Specify the connection port for the environmental monitor.

Description
A brief description for the environmental monitor.

Temperature Offset 0
Fine tuning adjustment for the temperature sensor.

Temperature in Fahrenheit □
Indicates if the temperature is reported in Fahrenheit rather than Celcius

Alarm #1 Label
A label for this alarm sensor, e.g. *Door Open* or *Smoke Alarm*.
I/O port 1 must be configured as an 'Input' for this alarm to function correctly.
This is done on the *I/O Ports page*

Alarm #2 Label
A label for this alarm sensor, e.g. *Door Open* or *Smoke Alarm*.
I/O port 2 must be configured as an 'Input' for this alarm to function correctly.
This is done on the *I/O Ports page*

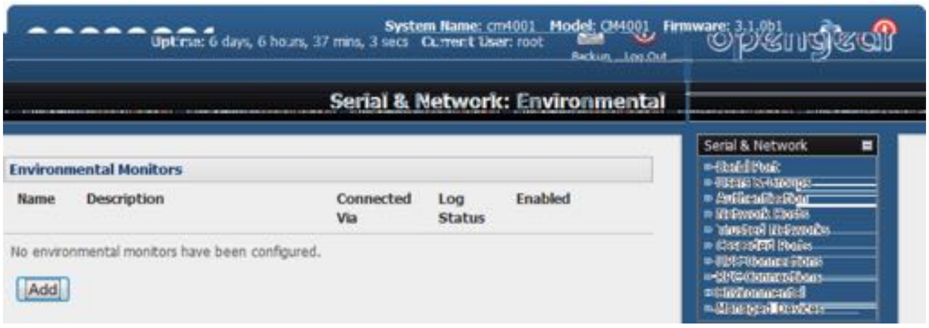
Log Status ☑
Periodically log environmental status.

Log Rate 1
Minutes between samples.

7.3.3. Adding EMD & configuring the sensors

- Navigate to **Serial & Network > Environmental**.

  This will display external EMDs and internal EMD (that is, sensors that may be directly attached to an ACM) that have already been configured.



System Name: cm4001 **Model:** CM4001 **Firmware:** 3.1.0b1
Uptime: 6 days, 6 hours, 37 mins, 3 secs **Current User:** root

Serial & Network: Environmental

Environmental Monitors

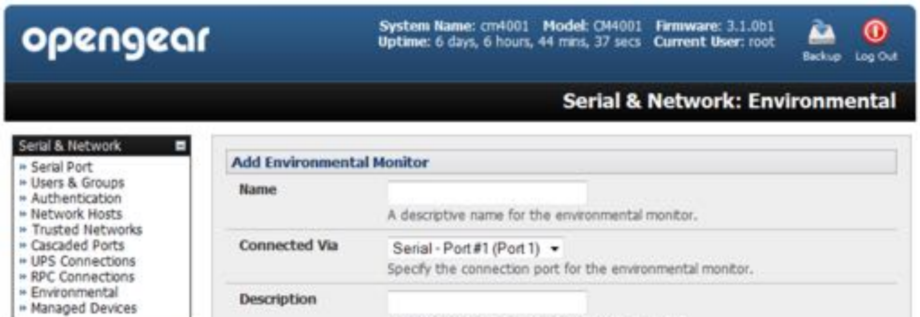
Name	Description	Connected Via	Log Status	Enabled

No environmental monitors have been configured.

- To add a new EMD click **Add**.
- enter a *Name*.
- Optionally enter a *Description*.
- Select the pre-configured serial port that the EMD will be *Connected Via*.
- Optionally calibrate the EMD with a *Temperature Offset* (+ or - °C) or *Humidity Offset* (+ or percent).

Note: if you check **Temperature in Fahrenheit** *the temperature will be reported in Fahrenheit. Otherwise it will be reported in degrees Celsius.*

- Provide Labels for each of the alarm sensors used (for example, Door Open or Smoke Alarm).



System Name: cm4001 **Model:** CM4001 **Firmware:** 3.1.0b1
Uptime: 6 days, 6 hours, 44 mins, 37 secs **Current User:** root

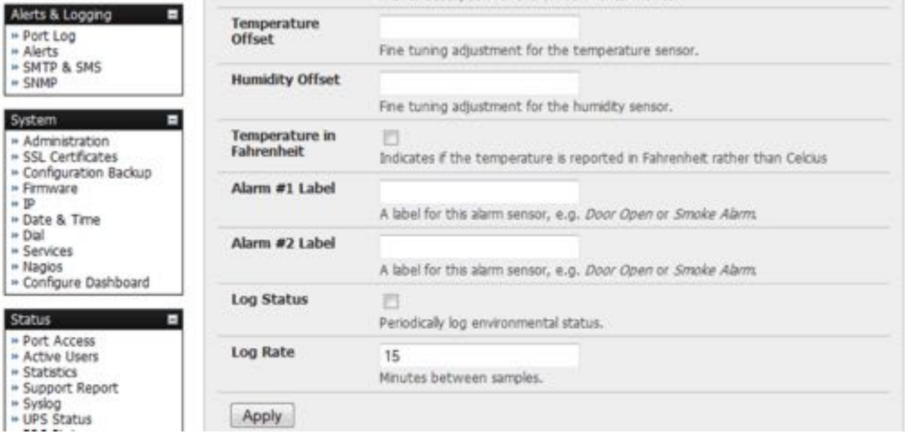
Serial & Network: Environmental

Add Environmental Monitor

Name
A descriptive name for the environmental monitor.

Connected Via Serial - Port #1 (Port 1)
Specify the connection port for the environmental monitor.

Description



Temperature Offset: Fine tuning adjustment for the temperature sensor.

Humidity Offset: Fine tuning adjustment for the humidity sensor.

Temperature in Fahrenheit: □ Indicates if the temperature is reported in Fahrenheit rather than Celcius

Alarm #1 Label: A label for this alarm sensor, e.g. *Door Open* or *Smoke Alarm*

Alarm #2 Label: A label for this alarm sensor, e.g. *Door Open* or *Smoke Alarm*

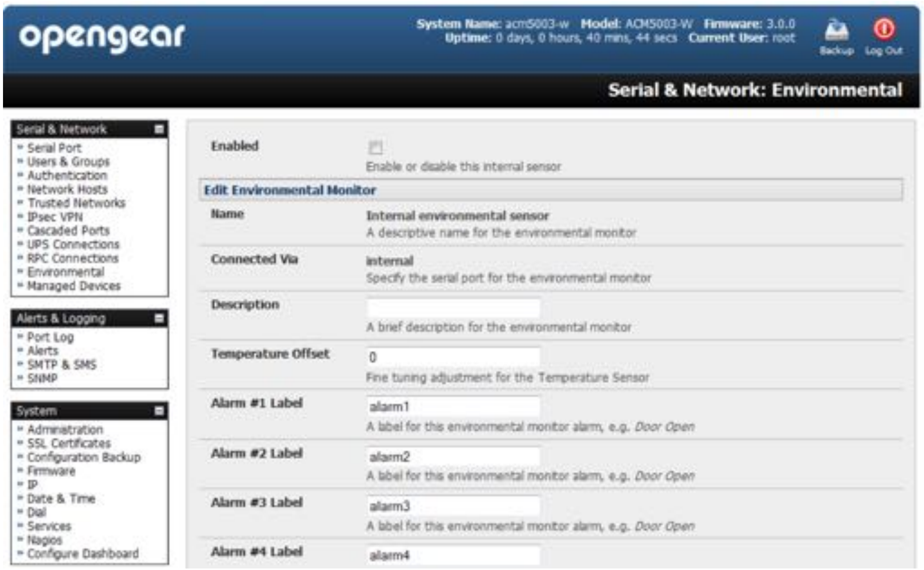
Log Status: □ Periodically log environmental status.

Log Rate: 15 Minutes between samples.

- Check *Log Status*.
- Specify the Log Rate (minutes between samples) if you wish the status from this EMD to be logged. These logs can be viewed at Status > Environmental Status.
- Click **Apply**.

This will also create a new Managed Device with the same name.

- For the ACM5000-E select **Serial & Network > Environmental**.



System Name: acm5003-w Model: ACM5003-W Firmware: 3.0.0
Uptime: 0 days, 0 hours, 40 mins, 44 secs Current User: root

Serial & Network: Environmental

Enabled: □ Enable or disable this internal sensor

Edit Environmental Monitor

Name: Internal environmental sensor — A descriptive name for the environmental monitor

Connected Via: internal — Specify the serial port for the environmental monitor

Description: A brief description for the environmental monitor

Temperature Offset: 0 — Fine tuning adjustment for the Temperature Sensor

Alarm #1 Label: alarm1 — A label for this environmental monitor alarm, e.g. *Door Open*

Alarm #2 Label: alarm2 — A label for this environmental monitor alarm, e.g. *Door Open*

Alarm #3 Label: alarm3 — A label for this environmental monitor alarm, e.g. *Door Open*

Alarm #4 Label: alarm4

- check *Enabled*.
- Set temperature offsets and label the sensors as described above.

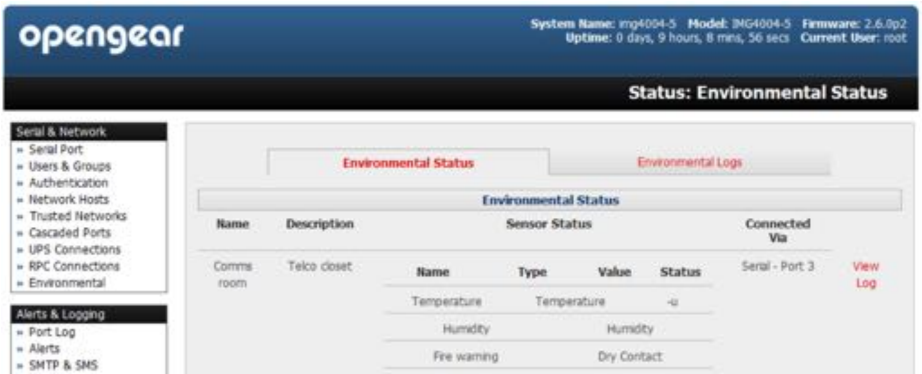
7.3.4. Environmental alerts

Set temperature, humidity and probe status alerts using **Alerts & Logging> Alerts**. See chapter 6.

7.3.5. Environmental status

You can monitor the current status of any and all configured external EMDs and their sensors, and any internal or directly attached sensors.

- Navigate to **Status > Environmental Status**.

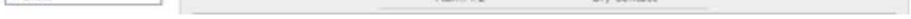


System Name: img4004-5 Model: IMG4004-5 Firmware: 2.6.0p2
Uptime: 0 days, 9 hours, 8 mins, 56 secs Current User: root

Status: Environmental Status

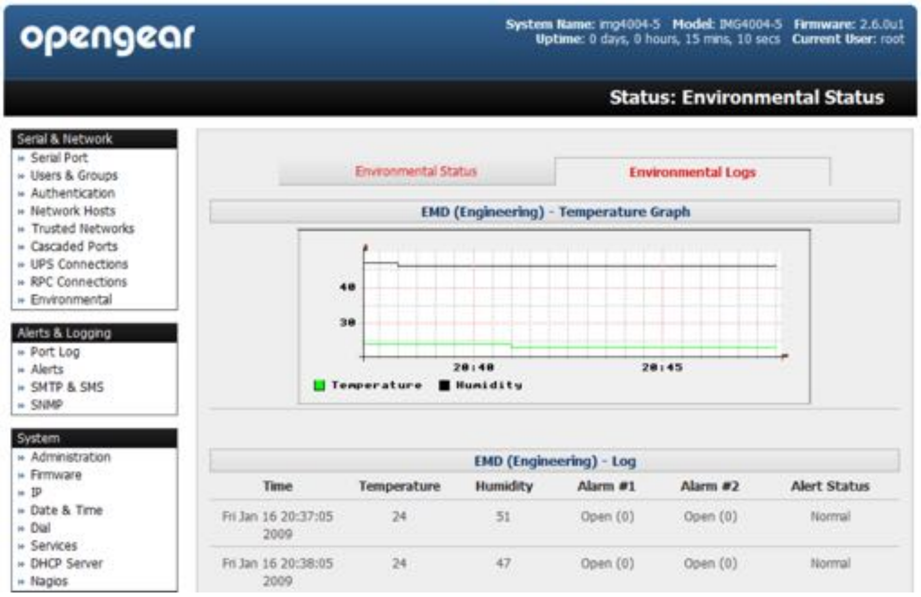
Environmental Status

Name	Description	Sensor Status				Connected Via
		Name	Type	Value	Status	
Comms room	Telco closet	Temperature	Temperature	-u		Serial - Port 3
		Humidity	Humidity			
		Fire warning	Dry Contact			



A table with the summary status of all connected EMD hardware will display.

- Click on *View Log* or click the **Environmental Logs** tab.



System Name: img4004-5 Model: IMG4004-5 Firmware: 2.6.0u1
Uptime: 0 days, 0 hours, 15 mins, 10 secs Current User: root

Status: Environmental Status

EMD (Engineering) - Log

Time	Temperature	Humidity	Alarm #1	Alarm #2	Alert Status
Fri Jan 16 20:37:05 2009	24	51	Open (0)	Open (0)	Normal
Fri Jan 16 20:38:05 2009	24	47	Open (0)	Open (0)	Normal

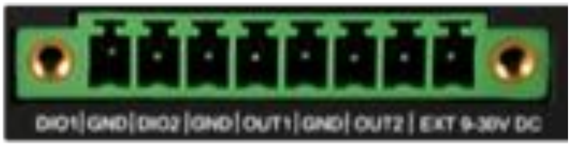
A table and graphical plot of the log history of the select EMD will present.

7.4. Digital I/O ports

ACM5000 -I models and ACM5500 -I models have four digital interface ports which present on a green connector block on the side of the unit.

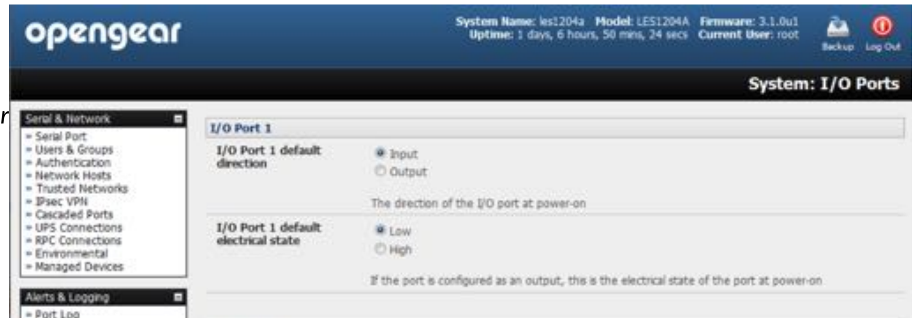
DIO1 and DIO2 are two TTL level digital I/O ports: 5V max @ 20mA.

OUT1 and OUT2 are two High-Voltage digital output ports: >5V to <= 30V @100mA.



ACM7000 models ship with an in-built, black, spring cage I/O connector block for attaching environmental sensors and digital I/O devices.

These I/O ports are configured via **System > I/O Ports**. Each port can be configured with a default direction and state.



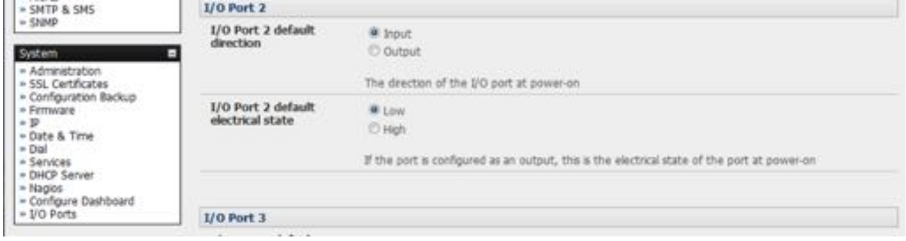
System Name: les1204a Model: LES1204A Firmware: 3.1.0u1
Uptime: 1 days, 6 hours, 50 mins, 24 secs Current User: root

System: I/O Ports

I/O Port 1

I/O Port 1 default direction: ● Input ○ Output
The direction of the I/O port at power-on

I/O Port 1 default electrical state: ● Low ○ High
If the port is configured as an output, this is the electrical state of the port at power-on



I/O Port 2

I/O Port 2 default direction: ● Input ○ Output

The direction of the I/O port at power-on

I/O Port 2 default electrical state: ● Low ○ High

If the port is configured as an output, this is the electrical state of the port at power-on

I/O Port 3

- Navigate to **System > I/O Ports**.

7.4.1. Digital I/O output configuration

Each of the two digital I/O ports (DIO1 and DIO2) can be configured as an Input or Output port. To use them as digital outputs first configure the port direction on System > I/O Ports.

The DIO1 and DIO2 pins are current limited by the chip to 20mA and accept 5V levels, so they cannot, for example, drive a relay.

You can change the output states using the `ioc` command line utility. The following text is the `ioc` help text (also available by running `ioc --help`):

```
-p  pin_num  pin number (1 to 4)
-d  pin_dir  pin direction (0 = output 1 = input)
-v  pin_val  pin electrical value in output mode \
             (0 = low 1 = high)
-r           reset pins to all inputs and low
-g           displays the pin directions and current values
-l           load pin configuration from configlity
```

For example, to set pin 1 to a low output, type:

```
ioc -p 1 -d 0 -v 0
```

To pulse one of these outputs, use a script like the following:

```
ioc -p 1 -d 0 -v 1
sleep 1
ioc -p 1 -d 0 -v 0
```

This sets the output high for 1 second, then returns it to low (assuming the initial state is low).

7.4.2. Digital I/O input configuration

When either of the two digital I/O (DIO1 & DIO2) outlets is configured as an *Input* on the **System > I/O Ports**, it can be used to monitor the current status of any attached sensor.

When configured as inputs (the factory default) these first two ports are notionally attached to an internal EMD. To configure them as alarms, go to the **Status > Environmental Status** and edit and enable the Internal EMD.

Note: the low voltage circuits in DIO1 and DIO2 should not be wired to voltages greater than 5V DC.

ALternatively, these input ports can be monitored using the `ioc` command line utility (as detailed in 7.4.1 above).

7.4.3. High-voltage outputs

OUT1 and OUT2 (internally, DIO3 & DIO4) outlets are wired as high voltage outputs. The way these outputs are expected to be used is to pull a power connected line to ground (that is, the OUT1 and OUT2 transistors are open collector).

The I/O port header includes a 12v reference line (VIN) which can be used to detect the line state change.

For example, to light a 12v LED using the high voltage outputs, connect the positive leg of the LED to the 12v reference, and the negative leg to output pin 4. Due to the way that the I/O port is connected internally, the output has to be set *high* to pull the output to ground.

The following command will switch on the led:

```
ioc -p 4 -d 0 -v 1
```

OUT1 and OUT2 transistors can operate with a supply of >5V to <= 30V @100mA. This means to drive a relay circuit you must guarantee it doesn’t provide more than 100mA when set to 1.

7.4.4. DIO SNMP status

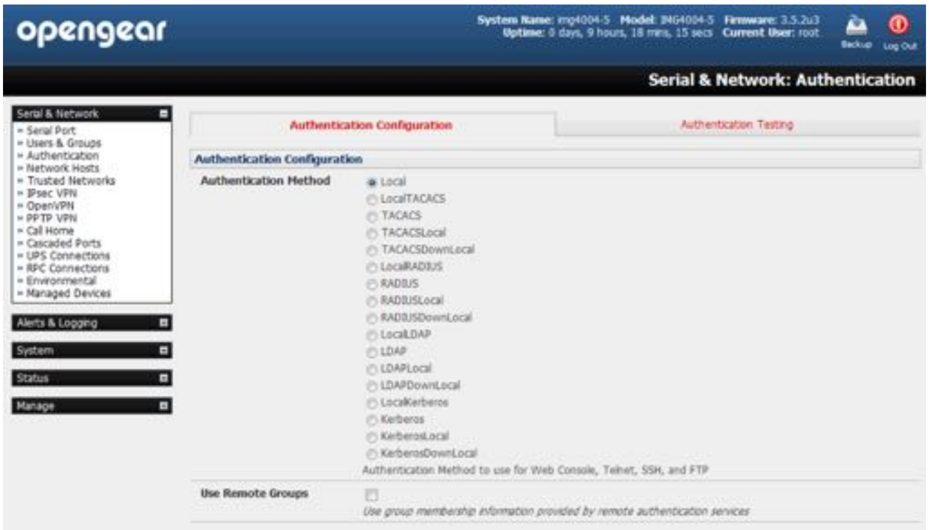
As of firmware v3.9, there is a SNMP status table which reports on the status of the digital IO ports.

The table’s OID is `OG-STATUSv2-MIB::ogEmdDioTable`. Performing an `snmpwalk` on this table on a *console server* with DIO produces something like the following (the specifics will vary depending on device status):

```
$ snmpwalk -v2c -c public -M $MIBSDIR -m ALL t5:161
1.3.6.1.4.1.25049.16.5
OG-STATUS-MIB::ogDioStatusName.1 = STRING: DIO 1
OG-STATUS-MIB::ogDioStatusName.2 = STRING: DIO 2
OG-STATUS-MIB::ogDioStatusName.3 = STRING: DIO 3
OG-STATUS-MIB::ogDioStatusName.4 = STRING: DIO 4
OG-STATUS-MIB::ogDioStatusType.1 = INTEGER: ttlInputOutput(0)
OG-STATUS-MIB::ogDioStatusType.2 = INTEGER: ttlInputOutput(0)
OG-STATUS-MIB::ogDioStatusType.3 = INTEGER: highVoltageOutput(1)
OG-STATUS-MIB::ogDioStatusType.4 = INTEGER: highVoltageOutput(1)
OG-STATUS-MIB::ogDioStatusDirection.1 = INTEGER: input(1)
OG-STATUS-MIB::ogDioStatusDirection.2 = INTEGER: input(1)
OG-STATUS-MIB::ogDioStatusDirection.3 = INTEGER: input(1)
OG-STATUS-MIB::ogDioStatusDirection.4 = INTEGER: input(1)
OG-STATUS-MIB::ogDioStatusState.1 = INTEGER: low(0)
OG-STATUS-MIB::ogDioStatusState.2 = INTEGER: high(1)
OG-STATUS-MIB::ogDioStatusState.3 = INTEGER: high(1)
OG-STATUS-MIB::ogDioStatusState.4 = INTEGER: high(1)
OG-STATUS-MIB::ogDioStatusCounter.1 = Counter64: 0
OG-STATUS-MIB::ogDioStatusCounter.2 = Counter64: 0
OG-STATUS-MIB::ogDioStatusCounter.3 = Counter64: 0
OG-STATUS-MIB::ogDioStatusCounter.4 = Counter64: 0
OG-STATUS-MIB::ogDioStatusTriggerMode.1 = INTEGER:
risingFallingEdge(3)
OG-STATUS-MIB::ogDioStatusTriggerMode.2 = INTEGER:
risingFallingEdge(3)
OG-STATUS-MIB::ogDioStatusTriggerMode.3 = INTEGER:
risingFallingEdge(3)
OG-STATUS-MIB::ogDioStatusTriggerMode.4 = INTEGER:
risingFallingEdge(3)
```

8. Authentication

The *console server* platform is a dedicated Linux computer, and it embodies a myriad of popular and proven Linux software modules for networking, secure access (OpenSSH), secure communications (OpenSSL) and sophisticated user authentication (PAM, RADIUS, TACACS+, Kerberos and LDAP).



System Name: img4004-5 Model: IMG4004-5 Firmware: 3.5.2u3
Uptime: 0 days, 9 hours, 18 mins, 15 secs Current User: root

Authentication Configuration

Authentication Method
- ● Local
- ○ LocalTACACS
- ○ TACACS
- ○ TACACSLocal
- ○ TACACSDownLocal
- ○ LocalRADIUS
- ○ RADIUS
- ○ RADIUSLocal
- ○ RADIUSDownLocal
- ○ LocalLDAP
- ○ LDAP
- ○ LDAPLocal
- ○ LDAPDownLocal
- ○ LocalKerberos
- ○ Kerberos
- ○ KerberosLocal
- ○ KerberosDownLocal

Authentication Method to use for Web Console, Telnet, SSH, and FTP

Use Remote Groups ☐
Use group membership information provided by remote authentication services

This chapter details how the *Administrator* can use the Management Console to establish remote AAA authentication for all connections to the *console server* and attached serial and network host devices.

This chapter also covers establishing a secure link to the Management Console using HTTPS and using OpenSSL and OpenSSH for establishing secure Administration connection to the *console server*.

More details on RSA SecurID and working with Windows IAS can be found in the FAQs at https://opengear.zendesk.com/.

8.1. Authentication configuration

Authentication can be performed locally, or remotely using an LDAP, Radius, Kerberos or TACACS+ authentication server. The default authentication method for the *console server* is *Local*.

Any authentication method that is configured will be used for authentication of any user who attempts to log in through Telnet, SSH or the Web Manager to the *console server* and any connected serial port or network host devices.

The *console server* can be configured to the default (*Local*) or an alternate authentication method (*TACACS*, *RADIUS*, *LDAP* or *Kerberos*) with the option of a selected order in which local and remote authentication is to be used.

- **Local/TACACS/RADIUS/LDAP/Kerberos**

  Tries local authentication first, falling back to remote if local fails.

- **TACACS/RADIUS/LDAP/Kerberos Local**

  Tries remote authentication first, falling back to local if remote fails.

- **TACACS/RADIUS/LDAP/Kerberos Down/Local**

  Tries remote authentication first, falling back to local if the remote authentication returns an error condition (e.g. the remote authentication server is down or inaccessible).

8.1.1. Local authentication

- Navigate to Serial and Network > Authentication.
- Check *Local*.
- Click **Apply**.

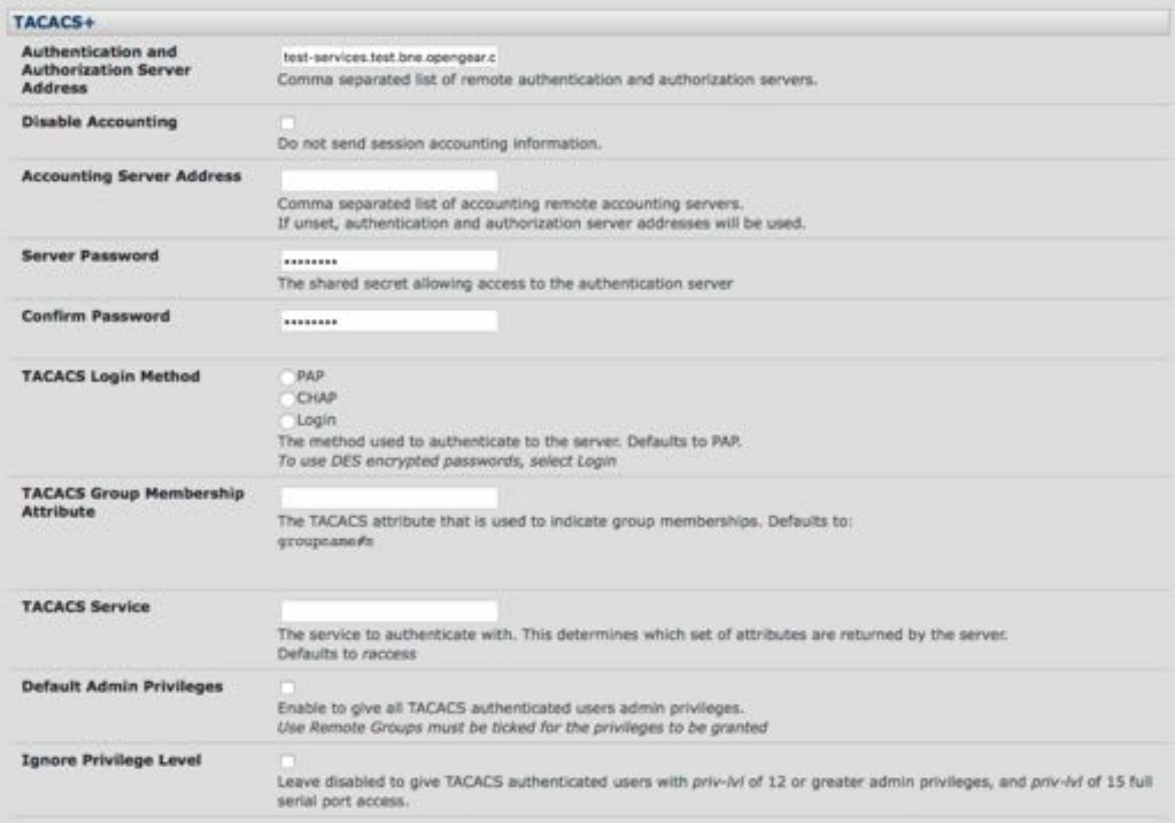
8.1.2. TACACS authentication

Perform the following procedure to configure the TACACS+ authentication method to be used whenever the *console server* or any of its serial ports or hosts is accessed.

- Select **Serial and Network > Authentication**.
- check *TACACS*, *LocalTACACS*, *TACACSLocal* or *TACACSDownLocal*.
- Enter the *Server Address* (IP or host name) of the remote Authentication/Authorization server.

  Multiple remote servers may be specified in a comma separated list. Each server is tried in succession.

- Session accounting is on by default. If session accounting information is not wanted, check the Disable Accounting checkbox.



TACACS+

Authentication and Authorization Server Address	test-services.test.bne.opengear.c Comma separated list of remote authentication and authorization servers.
Disable Accounting	□ Do not send session accounting information.
Accounting Server Address	Comma separated list of accounting remote accounting servers. If unset, authentication and authorization server addresses will be used.
Server Password	•••••••• The shared secret allowing access to the authentication server
Confirm Password	••••••••
TACACS Login Method	○ PAP ○ CHAP ○ Login The method used to authenticate to the server. Defaults to PAP. *To use DES encrypted passwords, select Login*
TACACS Group Membership Attribute	The TACACS attribute that is used to indicate group memberships. Defaults to: groupname#n
TACACS Service	The service to authenticate with. This determines which set of attributes are returned by the server. Defaults to *raccess*
Default Admin Privileges	□ Enable to give all TACACS authenticated users admin privileges. *Use Remote Groups must be ticked for the privileges to be granted*
Ignore Privilege Level	□ Leave disabled to give TACACS authenticated users with *priv-lvl* of 12 or greater admin privileges, and *priv-lvl* of 15 full serial port access.

One reason for not wanting session accounting: if the authentication server does not respond to accounting requests, said request may introduce a delay when logging in.

- In addition to multiple remote servers you can also enter for separate lists of Authentication/Authorization servers and Accounting servers.

  If no Accounting servers are specified, the Authentication/Authorization servers are used instead.

- Enter and confirm the *Server Password*.
- Select the method to be used to authenticate to the server (defaults to PAP).

  To use DES encrypted passwords, select *Login*.

- If required, enter the *TACACS Group Membership Attribute* to be used to indicate group memberships (defaults to *groupname#n*).
- If required, specify *TACACS Service* to authenticate with.

  This determines which set of attributes are returned by the server (defaults to *raccess*).

- If required, check *Default Admin Privileges* to give all TACACS+ authenticated users admin privileges.
- *Use Remote Groups* must also be ticked for these privileges to be granted.
- The *TACACS Privilege Level* feature only applies to TACACS remote authentication.

When *Ignore Privilege Level* is enabled, the `priv-lvl` setting for all of the users defined on the TACACS AAA server will be ignored.

Note: An Opengear device normally interprets a user with a TACACS `priv-lvl` *of 12 or above as an admin user. There is a special case where a user with a* `priv-lvl` *of 15 is also given access to all configured serial ports. When the* **Ignore Privilege Level** *option is enabled (that is, it is checked in the UI) there are no escalations of privileges based on the* `priv-lvl` *value from the TACACS server. Also: if the only thing configured for one or more TACACS users is the* `priv-lvl` *(for example, no specific port access or group memberships are set), then enabling this feature will revoke access to the* **console server** *for those users as the they won't be a member of any groups, even if the Retrieve Remote groups option in the* **Authentication** *menu is enabled.*

- Click **Apply**.

TACACS+ remote authentication will now be used for all user access to console server and serially or network attached devices.

The Terminal Access Controller Access Control System (TACACS+) security protocol is a protocol developed by Cisco. It provides detailed accounting information and flexible administrative control over the authentication and authorization processes.

TACACS+ allows for a single access control server (the TACACS+ daemon) to provide authentication, authorization, and accounting services independently. Each service can be tied into its own database to take advantage of other services available on that server or on the network, depending on the capabilities of the daemon.

8.1.3. RADIUS authentication

The Remote Authentication Dial-In User Service (RADIUS) protocol was developed by Livingston Enterprises as an access server authentication and accounting protocol.

The RADIUS server can support a variety of methods to authenticate a user.

When it is provided with the username and original password given by the user, it can support PPP, PAP or CHAP, UNIX login, and other authentication mechanisms.

More information on configuring remote RADIUS servers can be found https://freeradius.org/ and https://cisco.com/c/en/us/support/docs/security-vpn/remote-authentication-dial-user-service-radius/12433-32.html.

Perform the following procedure to configure the RADIUS authentication method to be used whenever the *console server* or any of its serial ports or hosts is accessed:

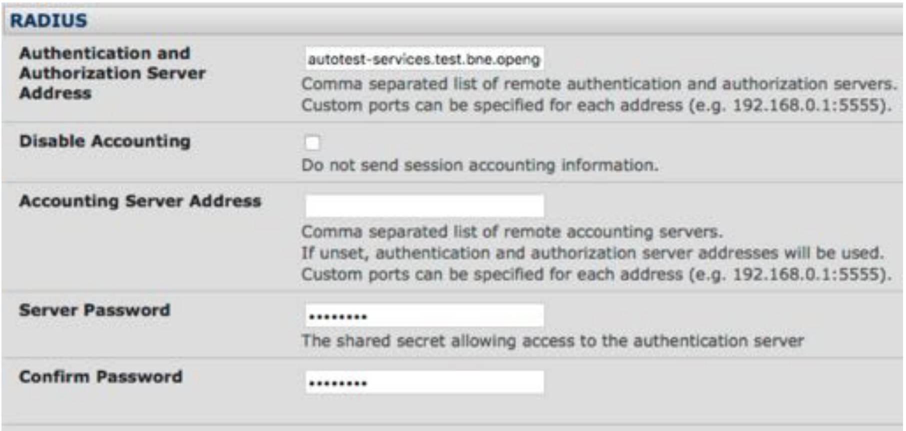
- Select **Serial & Network > Authentication** and check *RADIUS*, *LocalRADIUS*, *RADIUSLocal* or *RADIUSDownLocal*.

- Enter the *Server Address* (IP or host name) of the remote *Authentication and Authorization server*.

  Multiple remote servers may be specified in a comma separated list. Each server is tried in succession.

- Session accounting is on by default. If session accounting information is not wanted, check the *Disable Accounting* checkbox.

One reason for not wanting session accounting: if the authentication server does not respond to accounting requests, said request may introduce a delay when logging in.



RADIUS

Authentication and Authorization Server Address: autotest-services.test.bne.openg
Comma separated list of remote authentication and authorization servers.
Custom ports can be specified for each address (e.g. 192.168.0.1:5555).

Disable Accounting: □
Do not send session accounting information.

Accounting Server Address:
Comma separated list of remote accounting servers.
If unset, authentication and authorization server addresses will be used.
Custom ports can be specified for each address (e.g. 192.168.0.1:5555).

Server Password: ••••••••
The shared secret allowing access to the authentication server

Confirm Password: ••••••••

- In addition to multiple remote servers, you can also enter separate lists of *Authentication and Authorization servers* and *Accounting servers*.

  If no *Accounting servers* are specified, the *Authentication and Authorization servers* are used instead.

- Enter the *Server Password*.
- Click **Apply**.

  RADIUS remote authentication will now be used for all user access to console server and serially or network attached devices.

8.1.4. LDAP authentication

The Lightweight Directory Access Protocol (LDAP) is based on the X.500 standard, but significantly simpler and more readily adapted to meet custom needs. The core LDAP specifications are all defined in RFCs. LDAP is a protocol used to access information stored in an LDAP server.

With firmware v3.11 and later, LDAP authentication now supports OpenLDAP servers, using the POSIX -style schema for user and group definitions.

Performing simple authentication against any LDAP server (AD or OpenLDAP) is straight forward, as they both follow the common LDAP standards and protocols. The harder part is configuring how to get the extra data about the users (for example, the groups they are in).

On an Opengear device, we may be configured to look at group information from an LDAP server for authentication and authorization. This group information is potentially stored in a number of different ways. Active Directory has one method; OpenLDAP has two others.

Active Directory method

Each entry for a user will have multiple *memberOf* attributes. Each *memberOf* value is the full DN of the group they belong to. (The entry for the user will be of objectClass *user*.)

OpenLDAP/POSIX method 1

Each entry for a user must have a *gidNumber* attribute. This will be an integer value, which is the user's primary group (for example, mapping to the `/etc/passwd` file, with the group ID field).

To determine which group this is, search for an entry in the directory that has that group ID, which will give the group name. (The users are of objectClass *posixAccount*, and the groups are of objectClass *posixGroup*.)

OpenLDAP/POSIX method 2

Each group entry in the group tree of objectClass *posixGroup* may have multiple *memberUid* attributes. These represent secondary groups (for example, mapping to the `/etc/groups` file). Each attribute would contain a username.

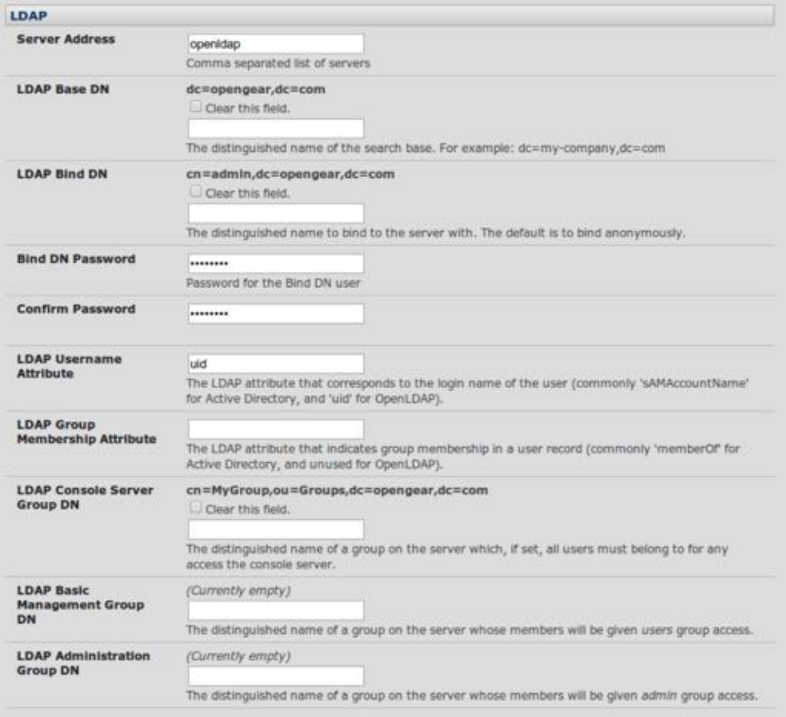
To cater for all these possibilities, the `pam_ldap` module has been modified to do group lookups for each of these three styles. This allows us to have a relatively generic configuration, and not be concerned with how the LDAP directory is set up.

There are only two parameters that need to be configured, based on what the user wishes to look up: the LDAP username and group membership attributes.

To clarify to the user what parameters to use, the descriptions for these fields have been updated to prompt the user for common or likely attributes. For example, the two configuration fields have descriptions as follows:

LDAP Username Attribute: the LDAP attribute that corresponds to the login name of the user (commonly 'sAMAccountName' for Active Directory, and 'uid' for OpenLDAP).

LDAP Group Membership Attribute: the LDAP attribute that indicates group membership in a user record (commonly 'memberOf' for Active Directory, and unused for OpenLDAP).



LDAP

Server Address	openldap Comma separated list of servers
LDAP Base DN	**dc=opengear,dc=com** □ Clear this field. The distinguished name of the search base. For example: dc=my-company,dc=com
LDAP Bind DN	**cn=admin,dc=opengear,dc=com** □ Clear this field. The distinguished name to bind to the server with. The default is to bind anonymously.
Bind DN Password	•••••••• Password for the Bind DN user
Confirm Password	••••••••
LDAP Username Attribute	uid The LDAP attribute that corresponds to the login name of the user (commonly 'sAMAccountName' for Active Directory, and 'uid' for OpenLDAP).
LDAP Group Membership Attribute	The LDAP attribute that indicates group membership in a user record (commonly 'memberOf' for Active Directory, and unused for OpenLDAP).
LDAP Console Server Group DN	**cn=MyGroup,ou=Groups,dc=opengear,dc=com** □ Clear this field. The distinguished name of a group on the server which, if set, all users must belong to for any access the console server.
LDAP Basic Management Group DN	*(Currently empty)* The distinguished name of a group on the server whose members will be given *users* group access.
LDAP Administration Group DN	*(Currently empty)* The distinguished name of a group on the server whose members will be given *admin* group access.

Note: The **libldap** *library is fussy about ensuring SSL connections are using certificates signed by a trusted CA. Consequently it is often not easy to set up a connection to an LDAP server using SSL. See https://opengear.zendesk.com/entries/29959515-LDAP-over-SSL for more.*

Perform the following procedure to configure the LDAP authentication method to be used whenever the console server or any of its serial ports or hosts is accessed:

- navigate to **Serial & Network > Authentication**.
- check *LDAP* or *LocalLDAP* or *LDAPLocal* or *LDAPDownLocal*.
- enter the *Server Address* (IP or host name) of the remote Authentication server.

  Multiple remote servers may be specified in a comma separated list. Each server is tried in succession.
- check the Server Protocol checkbox to select if SSL is to be used or enforced for communications with the LDAP server.

  Console servers running firmware v3.11 and above offer three options for LDAPS (LDAP over SSL):

  LDAP over SSL preferred will attempt to use SSL for authentication. If it fails, it will fall back to LDAP without SSL.

  LDAP over SSL may fail due to certificate errors or the LDAP server not being contactable on the LDAPS port.

  LDAP over SSL only. This setting will configure the Opengear device to only accept LDAP over SSL. If LDAP over SSL fails you will only be able to log into the console server as `root`.

  LDAP (no SSL) only. This setting will configure the Opengear device to only accept LDAP without SSL. If LDAP without SSL fails you will only be able to log into the console server as `root`.
- Check the *Ignore SSL Certificate Error* check box if you wish to ignore SSL certificate errors, allowing LDAP over SSL to work regardless of these errors.

  This allows you to use any certificate, self-signed or otherwise, on the LDAP server without having to install any certificates on the *console server*.

  If this setting is not checked, you must install the CA (certificate authority) certificate with which the LDAP server's certificate was signed, onto the *console server*. For example, the LDAP server is serving with a certificate signed using the certificate `myCA.crt`.

Note: The certificate must be in CRT format and `myCA.crt` *must be installed onto the* **console server** *at* `/etc/config/ldaps_ca.crt`*. The filename must be* `ldaps_ca.crt`*. Copy the file to this location and filename manually using* `scp` *or the like. For example:*

```
scp /local/path/to/myCA.crt
rt root@console_server:/etc/config/ldaps_ca.crt
```

- Enter the *Server Password*.
- Click **Apply**.

LDAP remote authentication will now be used for all user access to console server and serially or network attached devices

Further information on configuring remote RADIUS servers can be found at the following sites: http://ldapman.org/articles/intro_to_ldap.html, http://ldapman.org/servers.html, http://

linuxplanet.com/linuxplanet/tutorials/5050/1/, and http://linuxplanet.com/linuxplanet/tutorials/5074/4/.

8.1.5. RADIUS & TACACS user configuration

Users may be added to the local console server appliance. If they are not added and they log in via remote AAA, a user will be added for them. This user will not show up in the Opengear configurators unless they are specifically added, at which point they are transformed into a completely local user. The newly added user must authenticate off of the remote AAA server, and will have no access if it is down.

If a local user logs in, they may be authenticated or authorized from the remote AAA server, depending on the chosen priority of the remote AAA. A local user's authorization is the union of local and remote privileges.

Example 1

User Tim is locally added, and has access to ports 1 and 2. He is also defined on a remote TACACS server, which says he has access to ports 3 and 4. Tim may log in with either his local or TACACS password, and will have access to ports 1 through 4. If TACACS is down, he will need to use his local password, and will only be able to access ports 1 and 2.

Example 2

User Ben is only defined on the TACACS server, which says he has access to ports 5 and 6. When he attempts to log in a new user will be created for him, and he will be able to access ports 5 and 6. If the TACACS server is down he will have no access.

Example 3

User Paul is defined on a RADIUS server only. He has access to all serial ports and network hosts.

Example 4

User Don is locally defined on an appliance using RADIUS for AAA. Even if Don is also defined on the RADIUS server he will only have access to those serial ports and network hosts he has been authorized to use on the appliance.

If a *no local AAA* option is selected, then root will still be authenticated locally.

Remote users may be added to the `admin` group via either RADIUS or TACACS. Users may have a set of authorizations set on the remote TACACS server. Users automatically added by RADIUS will have authorization for all resources, whereas those added locally will still need their authorizations specified.

LDAP has not been modified, and will still need locally defined users.

Note: to interact with RADIUS, TACACS+ and LDAP with **console server** *firmware v2.4.2 and erarlier user accounts on the local* **console server** *must also be set up. All resource authorizations must be added to the local appliance. With this release, if remote AAA is selected, it is used for password checking only. Root is always authenticated locally. Changes to PAM configurations will be destroyed next time the authentication configurator is run.*

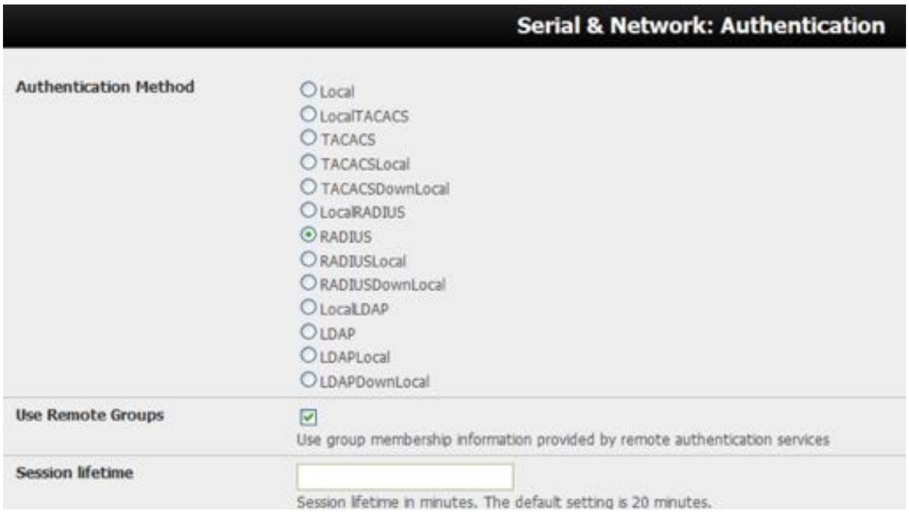
8.1.6. Group support with remote authentication

All console servers allow remote authentication via RADIUS, LDAP and TACACS+. With firmware v3.2 and later, RADIUS and LDAP can provide additional restrictions on user access based on group information or membership. For example, with remote group support, users can belong to a local group that has been setup to have restricted access to serial ports, network hosts and managed devices.

Remote authentication with group support works by matching a local group name with a remote group name provided by the authentication service. If the list of remote group names returned by the authentication service matches any local group names, the user is given permissions as configured in the local groups.

To enable group support to be used by remote authentication services:

- navigate to **Serial & Network > Authentication**.
- select the relevant *Authentication Method*.



Serial & Network: Authentication

Authentication Method
○ Local
○ LocalTACACS
○ TACACS
○ TACACSLocal
○ TACACSDownLocal
○ LocalRADIUS
● RADIUS
○ RADIUSLocal
○ RADIUSDownLocal
○ LocalLDAP
○ LDAP
○ LDAPLocal
○ LDAPDownLocal

Use Remote Groups ☑
Use group membership information provided by remote authentication services

Session lifetime
Session lifetime in minutes. The default setting is 20 minutes.

- check the *Use Remote Groups* checkbox.

8.1.7. Remote groups with RADIUS authentication

- Enter the *RADIUS Authentication* and *Authorization Server Address* and *Server Password*.
- Click **Apply**.
- Edit the Radius user's file to include group information and restart the Radius server.

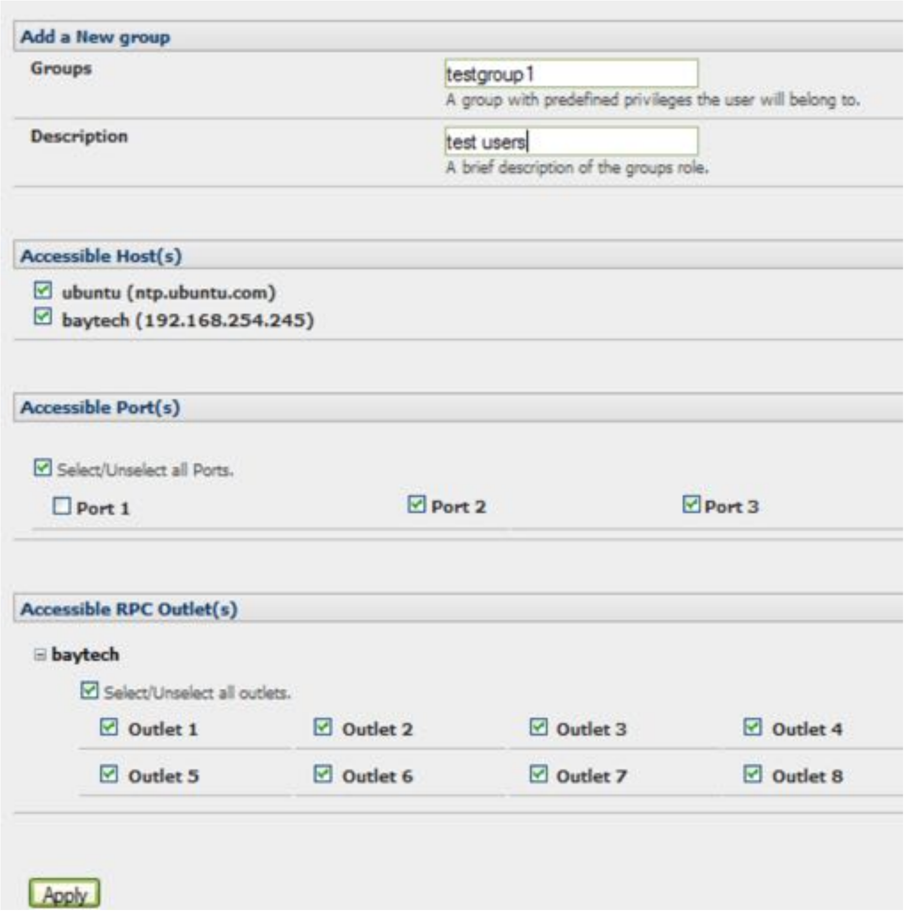
When using RADIUS authentication, group names are provided to the *console server* using the `Framed-Filter-Id` attribute. This is a standard RADIUS attribute, and may be used by other devices that authenticate via RADIUS.

To interoperate with other devices using this field, the group names can be added to the end of any existing content in the attribute, in the following format:

```
:group_name=testgroup1,users:
```

This example sets the remote user as a member of `testgroup1` and `users`, if these groups exist on the *console server*. Groups that do not exist on the *console server* are ignored.

When setting the `Framed-Filter-Id`, the system may also remove the leading colon for an



Add a New group

Groups: testgroup1
A group with predefined privileges the user will belong to.

Description: test users
A brief description of the groups role.

Accessible Host(s)

☑ ubuntu (ntp.ubuntu.com)
☑ baytech (192.168.254.245)

Accessible Port(s)

☑ Select/Unselect all Ports.

□ Port 1 ☑ Port 2 ☑ Port 3

Accessible RPC Outlet(s)

⊟ baytech

☑ Select/Unselect all outlets.

☑ Outlet 1 ☑ Outlet 2 ☑ Outlet 3 ☑ Outlet 4
☑ Outlet 5 ☑ Outlet 6 ☑ Outlet 7 ☑ Outlet 8

empty field. To work around this, add some dummy text to the start of the string. For example:

```
dummy:group_name=testgroup1,users:
```

If no group is specified for a user — for example *AmandaJones* — then the user will have limited console access, with no user interface or serial port access.

Default groups available on the *console server* include `admin` for administrator access and `users` for general user access.

```
TomFraser     Cleartext-Password := "FraTom70"
              Framed-Filter-Id=":group_name=admin:"

AmandaJones   Cleartext-Password := "JonAma83"

FredWhite     Cleartext-Password := "WhiFre62"
              Framed-Filter-Id=":group_name=testgroup1,users:"

JanetLong               Cleartext-Password := "LonJan57"
              Framed-Filter-Id=":group_name=admin:"
```

Additional local groups such as testgroup1 can be added via **Users & Groups > Serial & Network**.

8.1.8. Remote groups with LDAP authentication

Unlike RADIUS, LDAP has built in support for group provisioning, which makes setting up remote groups easier. The *console server* will retrieve a list of all the remote groups that the user is a direct member of, and compare their names with local groups on the *console server*.

Note: spaces in an LDAP group name will be converted to underscores.

For example, in an existing Active Directory setup, a group of users may be part of the *UPS Admin* and *Router Admin* groups.

On the *console server*, these users will be required to have access to a group `Router_Admin`, with access to port 1 (connected to the router), and another group, `UPS_Admin`, with access to port 2 (connected to the UPS).

Once LDAP is setup, users that are members of each group will have the appropriate permissions to access the router and UPS.

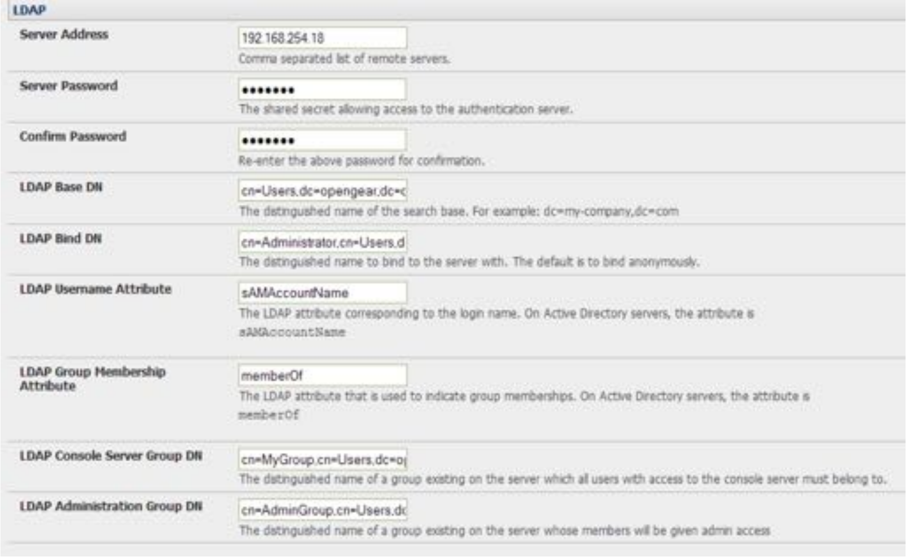
Currently, the only LDAP directory service that supports group provisioning is Microsoft Active Directory. Support is planned for OpenLDAP at a later time.

To enable group information to be used with an LDAP server:

- Complete the fields for standard LDAP authentication including *LDAP Server Address*, *Server Password*, *LDAP Base DN*, *LDAP Bind DN* and *LDAP User Name Attribute*.
- Enter *memberOf* for *LDAP Group Membership Attribute* as group membership is currently only supported on Active Directory servers.
- If required, enter the group information for *LDAP Console Server Group DN*, *LDAP Administration Group DN*, or both.

  A user must be a member of the *LDAP Console Server Group DN* group to gain access to the console and user interface. For example, the user must be a member of *MyGroup* on the Active Server to gain access to the *console server*.

  Additionally, a user must be a member of the *LDAP Administration Group DN* in order to gain *administrator* access to the console server. For example, the user must be a member of *AdminGroup* on the Active Server to receive administration privileges on the console server.



LDAP

Server Address: 192.168.254.18
Comma separated list of remote servers.

Server Password: •••••••
The shared secret allowing access to the authentication server.

Confirm Password: •••••••
Re-enter the above password for confirmation.

LDAP Base DN: cn=Users.dc=opengear.dc=c
The distinguished name of the search base. For example: dc=my-company,dc=com

LDAP Bind DN: cn=Administrator.cn=Users.d
The distinguished name to bind to the server with. The default is to bind anonymously.

LDAP Username Attribute: sAMAccountName
The LDAP attribute corresponding to the login name. On Active Directory servers, the attribute is sAMAccountName

LDAP Group Membership Attribute: memberOf
The LDAP attribute that is used to indicate group memberships. On Active Directory servers, the attribute is memberOf

LDAP Console Server Group DN: cn=MyGroup.cn=Users.dc=o
The distinguished name of a group existing on the server which all users with access to the console server must belong to.

LDAP Administration Group DN: cn=AdminGroup.cn=Users.dc
The distinguished name of a group existing on the server whose members will be given admin access

- Click **Apply**.

- Ensure the LDAP service is operational and group names are correct within the Active Directory.

Note: When you are using remote groups with LDAP remote auth, you need to have corresponding local groups on the console server. Where the LDAP group names can contain upper case and space characters, however, the local group name on the console server must be all lower case and the spaces replaced with underscrores. For example, a remote group on the LDAP server may be **My Ldap Access Group**. *The corresponding local group on the console server must be* **my_ldap_access_group**. *The local group on the console server must specify what the group member is granted access to for any group membership to be effective.*

8.1.9. Remote groups with TACACS+ authentication

When using TACACS+ authentication, there are two ways to grant a remotely authenticated user privileges. The first is to set the `priv-lvl` and port attributes of the `raccess` service to 12. See chapter 8.2 for more.

Additionally, or alternatively, group names can be provided to the *console server* using the groupname custom attribute of the `raccess` service.

An example Linux `tac-plus config` snippet might look like:

```
user = myuser {
  service = raccess {
    groupname="users"
    groupname1="routers"
    groupname2="dracs"
  }
}
```

You may also specify multiple groups in one comma-delimited. Fore example

```
groupname="users,routers,dracs"
```

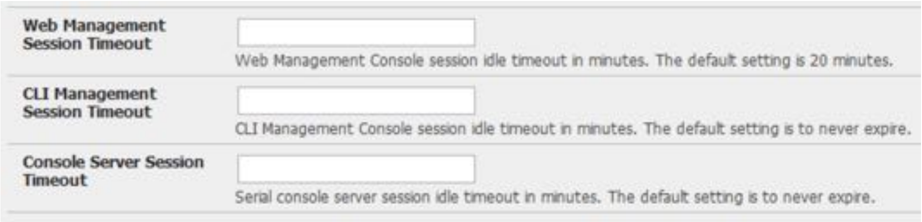
Note: the maximum length of the attribute value string is 255 characters.

To use an attribute name other than "groupname", set the **Authentication > TACACS+ > TACACS Group Membership Attribute**.

8.1.10. Idle timeout

You can specify the time the console server waits before it terminates an idle `ssh`, `pmshell` or web connection.

- Navigate to **Serial & Network > Authentication**.



Web Management Session Timeout	Web Management Console session idle timeout in minutes. The default setting is 20 minutes.
CLI Management Session Timeout	CLI Management Console session idle timeout in minutes. The default setting is to never expire.
Console Server Session Timeout	Serial console server session idle timeout in minutes. The default setting is to never expire.

- set a *Web Management Session Timeout* in minutes.

This specifies the browser console session idle timeout. The default setting is 20 minutes.

- Set a *CLI Management Session Timeout* in minutes.

  This specifies the `ssh` console session idle timeout. The default setting is to never expire.

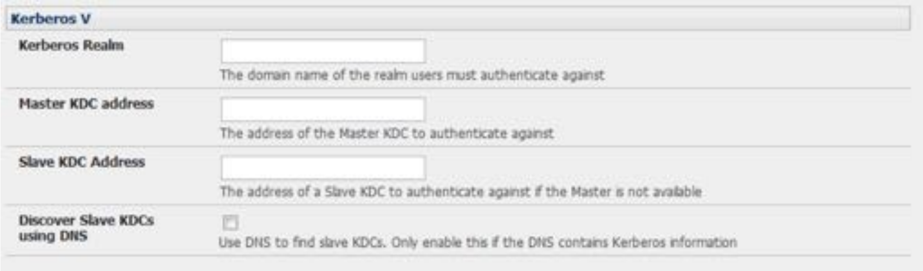
- Set a *Console Server Session Timeout* in minutes.

  This specifies the `pmshell` serial *console server* session idle timeout. The default setting is to never expire.

8.1.11. Kerberos authentication

Kerberos authentication can be used with UNIX and Windows (Active Directory) Kerberos servers. This form of authentication does not provide group information, so a local user with the same username must be created, and permissions set.

Note: Kerberos is sensitive to time differences between the Key Distribution Center (KDC) authentication server and the client device. Make sure that NTP is enabled, and the time zone is set correctly on the console server.



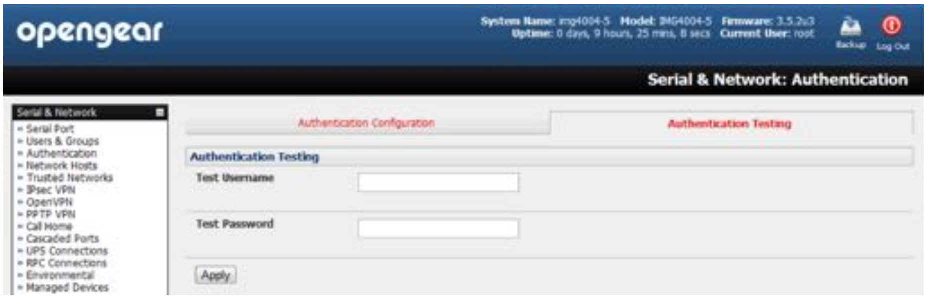
Kerberos V

Kerberos Realm	The domain name of the realm users must authenticate against
Master KDC address	The address of the Master KDC to authenticate against
Slave KDC Address	The address of a Slave KDC to authenticate against if the Master is not available
Discover Slave KDCs using DNS	□ Use DNS to find slave KDCs. Only enable this if the DNS contains Kerberos information

When authenticating against Active Directory, the Kerberos Realm will be the domain name, and the Master KDC will be the address of the primary domain controller.

8.1.12. Authentication testing

Console servers running firmware V3.5.2u3 or later include the **Serial & Network > Authentication > Authentication Testing** tab



Authentication Testing

Test Username

Test Password

Apply

This tab enables the connection to the remote authentication server to be tested.

8.2. Pluggable authentication modules (PAM)

Console servers support RADIUS, TACACS+ and LDAP for two-factor authentication via PAM (Pluggable Authentication Modules). PAM is a flexible mechanism for authenticating users. Nowadays a number of new ways of authenticating users have become popular. The challenge is that each time a new authentication scheme is developed; it requires all the necessary programs (login, ftpd etc.) to be rewritten to support it.

PAM provides a way to develop programs that are independent of authentication scheme. These programs need ‘authentication modules’ attached to them at run-time in order to work. Which authentication module is attached is dependent on the local system setup and is at the discretion of the local *Administrator*.

The *console server* family supports PAM to which we have added the following modules for remote authentication:

module	binary	source
RADIUS	pam_radius_auth	https://freeradius.org/pam_radius_auth/
TACACS+	pam_tacplus	https://github.com/jeroennijhof/pam_tacplus
LDAP	pam_ldap	http://padl.com/OSS/pam_ldap.html

Further modules can be added as required.

Changes made to files in `/etc/config/pam.d/` will persist, even if the authentication configurator is run.

- Users added on demand.

  When a user attempts to log in, but does not already have an account on the console server, a new user account will be created. This account will have no rights, and no password set. They will not appear in the Opengear configuration tools.

  Automatically added accounts will not be able to log in if the remote servers are unavailable

- Admin rights granted over AAA.

  Users may be granted Administrator rights via networked AAA.

  For TACACS a `priv-lvl` of 12 or above indicates an *administrator*.

  For RADIUS, *administrators* are indicated via the Framed Filter ID. See the example configuration files below for example.

- Authorization via TACACS, LDAP or RADIUS for using remote groups.

  See chapter 8.1.6.

- Authorization via TACACS for both serial ports and host access.

  Permission to access resources may be granted via TACACS by indicating an Opengear Appliance and a port or networked host the user may access. See the example configuration files below for example.

TACACS example

```
user = tim {
    service = raccess {
    priv-lvl = 11
    port1 = acm7004/port02
  }
  global = cleartext mit
}
```

RADIUS example

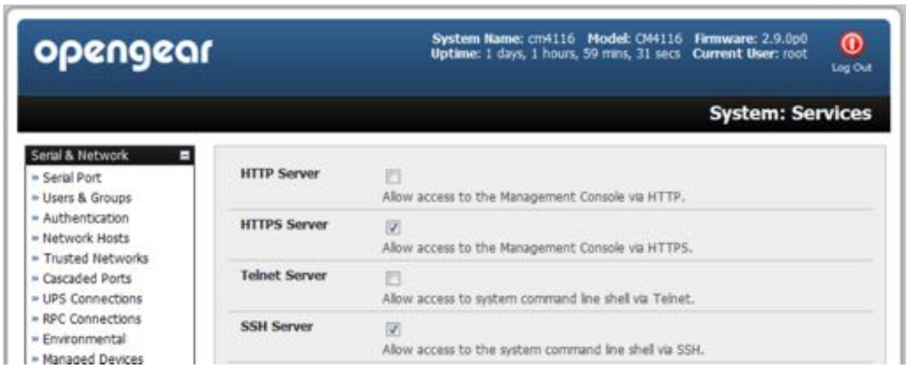
```
paul Cleartext-Password: = "luap"
     Service-Type = Framed-User,
     Fall-Through = No,
     Framed-Filter-Id =":group_name=admin:"
```

The list of groups may include any number of entries separated by a comma. If the admin group is included, the user will be made an *Administrator*.

If there is already a `Framed-Filter-Id`, add the list of `group_names` after the existing entries, including the separating colon `:`.

8.3. SSL certificate

The *console server* uses the Secure Socket Layer (SSL) protocol for encrypted network traffic between itself and a connected user.



HTTP Server □ Allow access to the Management Console via HTTP.

HTTPS Server ☑ Allow access to the Management Console via HTTPS.

Telnet Server □ Allow access to system command line shell via Telnet.

SSH Server ☑ Allow access to the system command line shell via SSH.

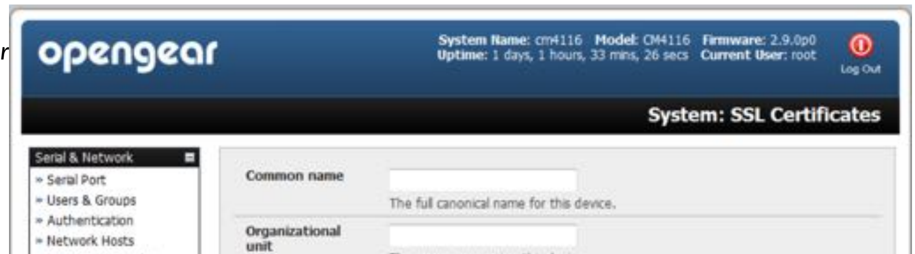
During connection establishment the console server has to expose its identity to the user's browser using a cryptographic certificate. The default certificate that comes with the console server device upon delivery is for testing purpose only and should not be relied on for secured global access.

Note: **system administrators** *must not rely on the default certificate as the secured global access mechanism for use through Internet.*

- Switch to your preferred browser.
- enter `https://ip-address-or-hostname-of-console-server-here/`.

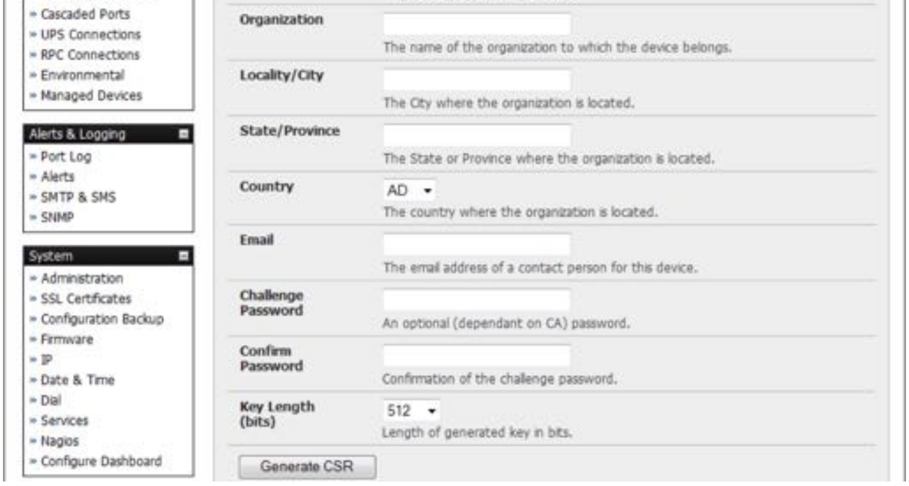
  Your browser may respond with a message that verifies the security certificate is valid but notes that it is not necessarily verified by a certifying authority.
- To proceed you need to click **yes** if you are using Internet Explorer or select *accept this certificate permanently (or temporarily)* if you are using Mozilla Firefox.
- The Management Console login will present.
- Enter an *Administrator's* username and password as normal.

Note: it is recommended you generate and install a new base64 X.509 certificate that is unique for each particular console server.


opengear
System Name: cm4116 Model: CM4116 Firmware: 2.9.0p0
Uptime: 1 days, 1 hours, 33 mins, 26 secs Current User: root
Log Out
System: SSL Certificates
Serial & Network
Serial Port
Users & Groups
Authentication
Network Hosts

Common name: The full canonical name for this device.

Organizational unit



Organization	The name of the organization to which the device belongs.
Locality/City	The City where the organization is located.
State/Province	The State or Province where the organization is located.
Country	AD The country where the organization is located.
Email	The email address of a contact person for this device.
Challenge Password	An optional (dependant on CA) password.
Confirm Password	Confirmation of the challenge password.
Key Length (bits)	512 Length of generated key in bits.

To generate a new base64 X.509 certificate, the *console server* must be enabled to generate a new cryptographic key and the associated Certificate Signing Request (CSR) that needs to be certified by a Certification Authority (CA).

A certification authority verifies that you are the person who you claim you are, and signs and issues a SSL certificate to you. To create and install a SSL certificate for the console server:

- Navigate to **System > SSL Certificate**.
- Fill out the presented fields.

  Common name: the network name of the *console server* once it is installed in the network. Usually the fully qualified domain name. It is identical to the name used to access the *console server* with a web browser (without the “http://” prefix). If the name given here and the actual network name differ, the browser will pop up a security warning when the console server is accessed using https.

  Organizational Unit: this field is used for specifying to which department within an organization the console server belongs.

  Organization: the name of the organization to which the console server belongs.

  Locality/City: the city where the organization is located.

  State/Province: the state or province where the organization is located.

  Country: the two-letter ISO code designating the country where the organization is located.

  For example, *DE* for Germany and *US* for the the United States of America.

Note: the country code must be entered in **ALL CAPS**.

  Email: the email address of the person responsible for the console server and its security.

  Challenge Password: some certification authorities require a challenge password to authorize later changes on the certificate (for example, revocation of the certificate).

  Confirm Challenge Password: confirmation of the *Challenge Password*.

  Key length: this is the length of the generated key in bits. 1024 Bits are supposed to be sufficient for most cases. Longer keys may result in slower response time of the console server during connection establishment.

- click **Generate CSR**.

  The Certificate Signing Request (CSR) generation is initiated.

- Click **Download** to copy the CSR to your administration machine.
- Send the saved CSR string to a Certification Authority (CA). for certification.

You will get the new certificate from the CA after a more or less complicated traditional authentication process (depending on the CA).

- Upload the certificate received from your CA to the *console server* using the **Upload** button.

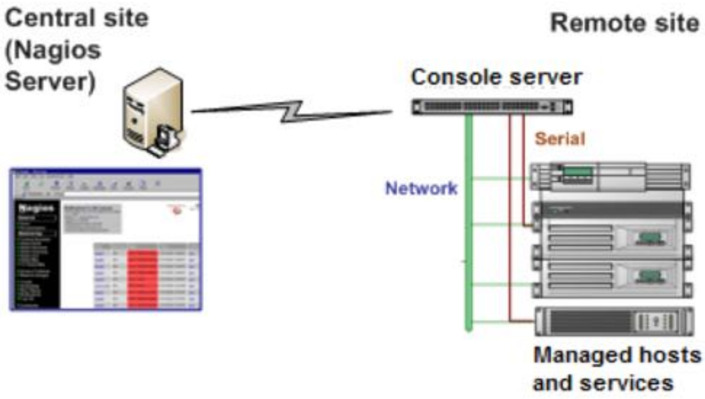
After completing these steps the *console server* has its own certificate that is used for identifying the console server to its users.

Note: Information on issuing certificates and configuring HTTPS from the command line can be found in chapter 14.

9. Nagios integration

Nagios is a powerful, highly extensible open source tool for monitoring network hosts and services. The core Nagios software package will typically be installed on a server or virtual server, the central Nagios server.

Console servers operate in conjunction with a central/upstream Nagios server to provide distributing monitoring of attached network hosts and serial devices. They embed the NSCA (Nagios Service Checks Acceptor) and NRPE (Nagios Remote Plug-in Executor) add-ons – this allows them to communicate with the central Nagios server, eliminating the need for a dedicated slave Nagios server at remote sites.



The console server products all support distributed monitoring. Even if distributed monitoring is not required, the Console servers can be deployed locally alongside the Nagios monitoring host server, to provide additional diagnostics and points of access to managed devices.

Note: If you have an existing Nagios deployment, you may wish to use the **console server** *gateways in a distributed monitoring server capacity only. If this case and you are already familiar with Nagios, skip ahead to chapter 9.3.*

9.1. Nagios overview

Nagios provides central monitoring of the hosts and services in your distributed network. Nagios is freely downloadable, open source software. This section offers a quick background of Nagios and its capabilities. A complete overview, FAQ and comprehensive documentation is available at https://nagios.org/.

Nagios forms the core of many leading commercial system management solutions such as GroundWork, https://gwos.com/.

Nagios does take some time to install and configure. Once it is up and running, however, it provides an outstanding network monitoring system. With Nagios you can:

- display tables showing the status of each monitored server and network service in real time
- use a wide range of freely available plug-ins to make detailed checks of specific services. For example, don't just check a database is accepting network connections, check that it can actually validate requests and return real data.
- Display warnings and send warning e-mails, pager or SMS alerts when a service failure or degradation is detected.
- Assign contact groups who are responsible for specific services in specific time frames.

9.2. Configuring Nagios distributed monitoring

To activate the *console server* Nagios distributed monitoring:

Nagios integration must be enabled and a path established to the central/upstream Nagios server.

If the *console server* is to periodically report on Nagios monitored services, then the NSCA client embedded in the console server must be configured. The NSCA program enables scheduled check-ins with the remote Nagios server and is used to send passive check results across the network to the remote server.

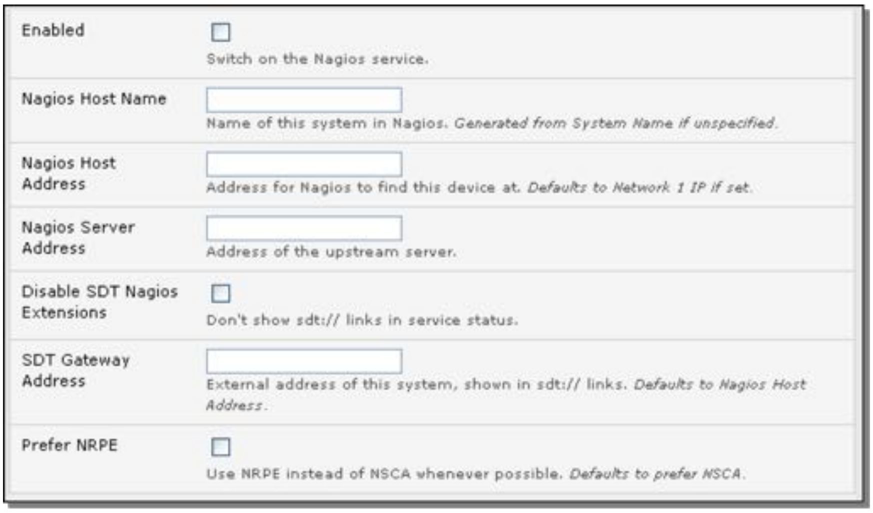
If the Nagios server is to actively request status updates from the *console server*, then the NRPE server embedded in the console server must be configured. The NRPE server is the Nagios daemon for executing plug-ins on remote hosts.

Each of the Serial Ports and each of the Hosts connected to the *console server* which are to be monitored must have Nagios enabled and any specific Nagios checks configured.

Lastly the central/upstream Nagios monitoring host must be configured.

9.2.1. Enable Nagios on the console server

- Navigate to **System > Nagios**.



Enabled	□ Switch on the Nagios service.
Nagios Host Name	Name of this system in Nagios. *Generated from System Name if unspecified.*
Nagios Host Address	Address for Nagios to find this device at. *Defaults to Network 1 IP if set.*
Nagios Server Address	Address of the upstream server.
Disable SDT Nagios Extensions	□ Don't show sdt:// links in service status.
SDT Gateway Address	External address of this system, shown in sdt:// links. *Defaults to Nagios Host Address.*
Prefer NRPE	□ Use NRPE instead of NSCA whenever possible. *Defaults to prefer NSCA.*

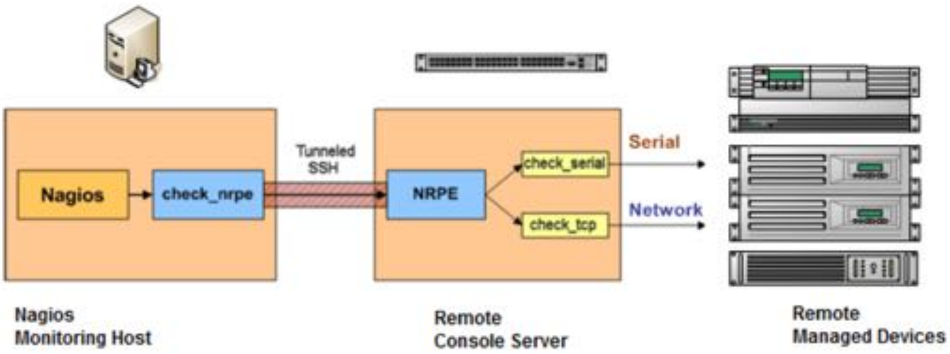
- Check *Enabled*.
- Enter the *Nagios Host Name* the *console server* will be referred to in the Nagios server.

  This is generated from the local System Name (**System > Administration**) if unspecified.
- In *Nagios Host Address*, enter the address or hostname the upstream Nagios server uses to reach the *console server*. This defaults to the 1st network port: *Network (1)* (**System > IP)**.
- In *Nagios Server Address* enter the IP address or DNS name that the *console server* will use to reach the upstream Nagios monitoring server.
- Check the *Disable SDT Nagios Extensions* option to disable *SDT Connector* integration with your Nagios server at the head end. Only check to run vanilla Nagios monitoring.
- If not, enter the IP address or DNS name the SDT Nagios clients will use to reach the console server in *SDT Gateway Address*.
- Check *Prefer NRPE* to use NRPE when possible (that is, for all communication except alerts).

  When NRPE and NSCA are both enabled, NSCA is the preferred method for communicating with the upstream Nagios server.

9.2.2. Enable NRPE monitoring

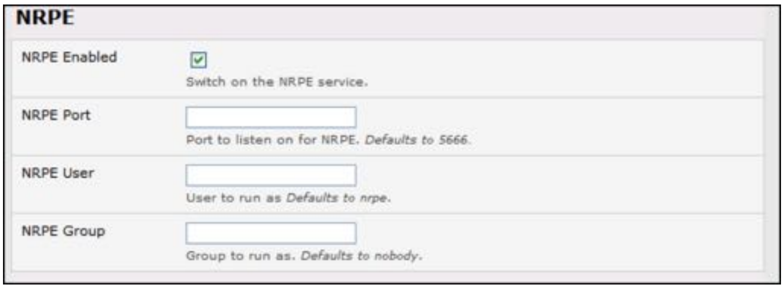
Enabling NRPE allows you to execute plug-ins (such as `check_tcp` and `check_ping`) on the remote *console server* to monitor serial or network attached remote servers.



This will offload CPU load from the upstream Nagios monitoring machine which is especially valuable if you are monitoring hundreds or thousands of hosts.

To enable NRPE:

- Select **System > Nagios**.



NRPE

NRPE Enabled	☑ Switch on the NRPE service.
NRPE Port	Port to listen on for NRPE. *Defaults to 5666.*
NRPE User	User to run as *Defaults to nrpe.*
NRPE Group	Group to run as. *Defaults to nobody.*

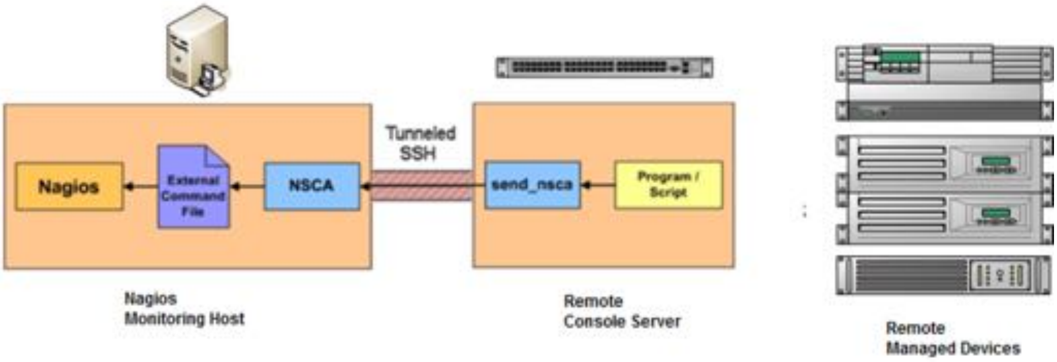
- Check *NRPE Enabled*.
- Enter the details of the user connection to the upstream Nagios monitoring server.

  Refer the sample Nagios configuration example below for details of configuring specific NRPE checks.

By default the console server will accept a connection between the upstream Nagios monitoring server and the NRPE server with SSL encryption, without SSL, or tunneled through SSH. The security for the connection is configured at the Nagios server.

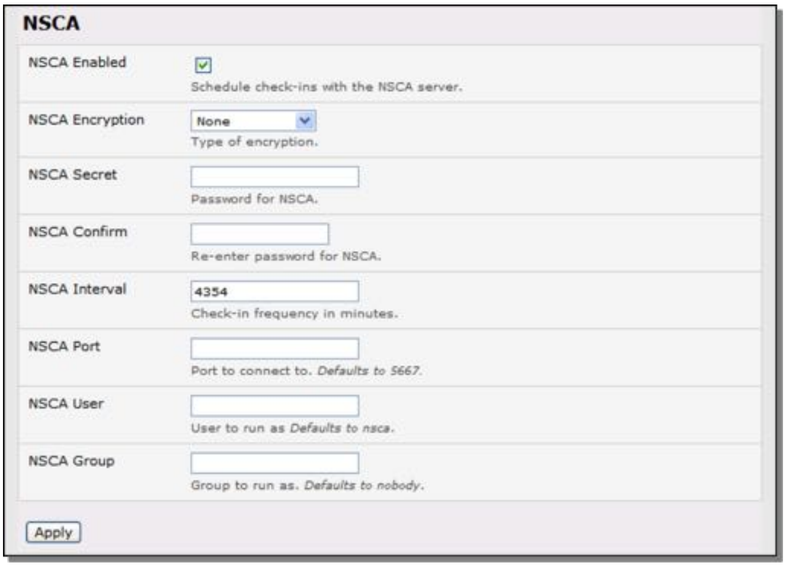
9.2.3. Enable NSCA monitoring

NSCA is the mechanism that allows you to send passive check results from the remote console server to the Nagios daemon running on the monitoring server.



To enable NSCA:

- Navigate to **System > Nagios**.
- Check the *NSCA Enabled* checkbox.
- Select the *NSCA Encryption* to be used from the drop down menu.
- Enter an *NSCA Secret* password.
- Specify an *NSCA Interval* (in minutes).



NSCA

NSCA Enabled	☑ Schedule check-ins with the NSCA server.
NSCA Encryption	None Type of encryption.
NSCA Secret	Password for NSCA.
NSCA Confirm	Re-enter password for NSCA.
NSCA Interval	4354 Check-in frequency in minutes.
NSCA Port	Port to connect to. *Defaults to 5667.*
NSCA User	User to run as *Defaults to nsca.*
NSCA Group	Group to run as. *Defaults to nobody.*

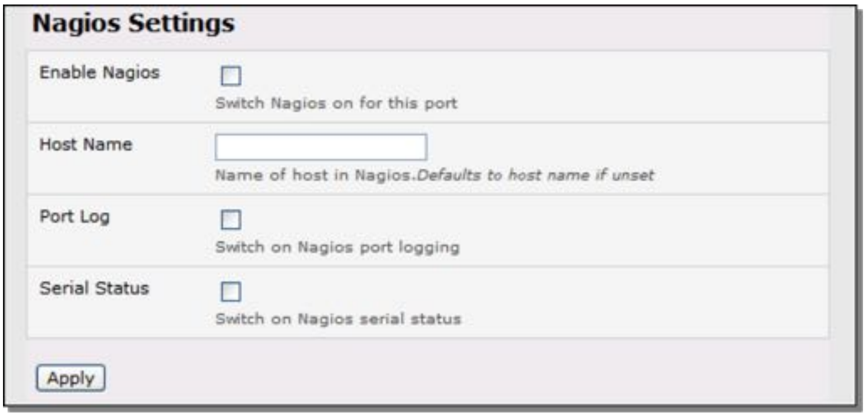
For more on configuring specific NSCA checks, see the sample Nagios configuration below.

9.2.4. Configure selected serial ports for Nagios monitoring

The individual serial ports connected to the *console server* to be monitored must be configured for Nagios checks. See chapter 3.4 for details on enabling Nagios monitoring for Hosts that are network connected to the *console server*.

To enable Nagios to monitor on a device connected to the console server serial port:

- navigate to **Serial & Network > Serial Port**.
- click *Edit* on the serial Port # to be monitored.



Nagios Settings

Enable Nagios	□ Switch Nagios on for this port
Host Name	Name of host in Nagios.*Defaults to host name if unset*
Port Log	□ Switch on Nagios port logging
Serial Status	□ Switch on Nagios serial status

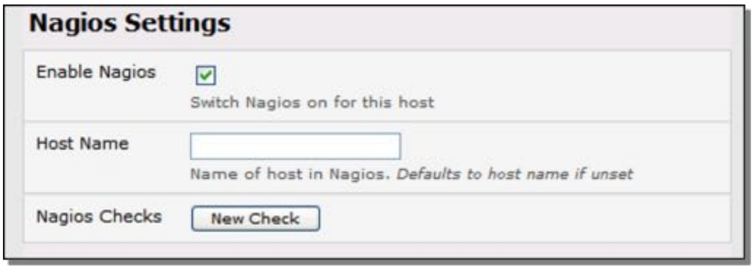
- check the *Enable Nagios* checkbox.
- specify the *Host Name* of the device on the upstream server.
- check the checkboxes of the Nagios checks to be run on this port.

  Serial Status monitors the handshaking lines on the serial port. *Check Port* monitors the data logged for the serial port.

9.2.5. Configure selected network ports for Nagios monitoring

The individual network hosts connected to the *console server* to be monitored must also be configured for Nagios checks.

- Navigate to **Serial & Network > Network Port**.
- Click *Edit* on the Network Host to be monitored



Nagios Settings

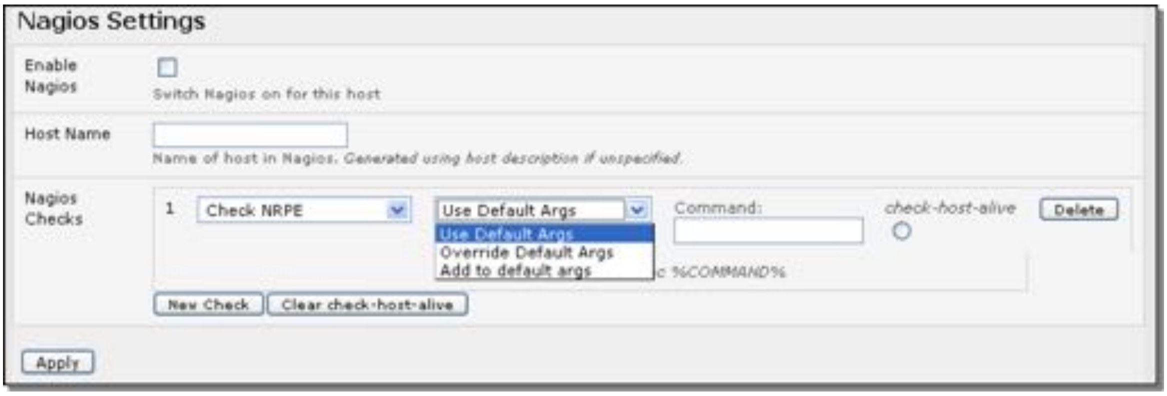
Enable Nagios ☑ Switch Nagios on for this host

Host Name Name of host in Nagios. *Defaults to host name if unset*

Nagios Checks

- Check the *Enable Nagios* checkbox.
- Specify the *Host Name* of the device as it will appear on the upstream Nagios server.
- Click **New Check** to add a specific check which will be run on this host.
- Select *Check Permitted TCP* or *Check Permitted UDP* to monitor a service that you have previously added as a permitted service.
- Alternatively, select *Check TCP* or *Check UDP* to specify a service port that you wish to monitor, but do not wish to allow external (*SDT Connector*) access to.
- The *Nagios Check* nominated as the *check-host-alive* check is the check used to determine whether the network host itself is up or down.

  Typically this will be *Check Ping*, although in some cases the host will be configured not to respond to pings.



Nagios Settings

Enable Nagios □ Switch Nagios on for this host

Host Name Name of host in Nagios. *Generated using host description if unspecified.*

Nagios Checks 1 Check NRPE Use Default Args Command: check-host-alive ○

- You can deselect *check-host-alive*.

  If *check-host-alive* check is de-selected, the host will always be assumed to be up.
- If required, customize the selected *Nagios Checks* to use custom arguments.
- Click **Apply**.

9.2.6. Configure the upstream Nagios monitoring host

For configuring the upstream server refer to the Nagios documentation, at https://nagios.org/documentation/.

The section entitled Distributed Monitoring steps through what you need to do to configure NSCA on the upstream server (under Central Server Configuration)

NRPE Documentation has recently been added which steps through configuring NRPE on the upstream server http://nagios.sourceforge.net/docs/nrpe/NRPE.pdf

At this stage, Nagios at the upstream monitoring server has been configured, and individual serial port and network host connections on the console server configured for Nagios monitoring. If NSCA is enabled, each selected check will be executed once over the period of the check interval. If NRPE is enabled, then the upstream server will be able to request status updates under its own scheduling.

9.3. Advanced distributed monitoring configuration

9.3.1. Sample Nagios configuration

An example configuration for Nagios is listed below. It shows how to set up a remote *console server* to monitor a single host, with both network and serial connections.

For each check it has two configurations: one for NRPE and one for NSCA.

In practice, these would be combined into a single check which used NSCA as a primary method, falling back to NRPE if a check was late. For details see the Nagios documentation — at https://nagios.org/documentation/ — on Service and Host Freshness Checks.

```
; Host definitions
; Opengear console server

define host {
  use                           generic-host
  host_name                     opengear
  alias                         Console server
  address                       192.168.254.147
}

; Managed Host
define host {
  use                           generic-host
  host_name                     server
  alias                         server
  address                       192.168.254.227
}

; NRPE daemon on gateway
define command {
  command_name                  check_nrpe_daemon
  command_line                  $USER1$/check_nrpe -H \
                                192.168.254.147 -p 5666
}
```

```
define service {
  service_description           NRPE Daemon
  host_name                     opengear
  use                           generic-service
  check_command                 check_nrpe_daemon
}

; Serial Status
define command {
  command_name                  check_serial_status
  command_line                  $USER1$/check_nrpe -H \
                                192.168.254.147 -p 5666 -c \
                                check_serial_$HOSTNAME$
}

define service {
  service_description           Serial Status
  host_name                     server
  use                           generic-service
  check_command                 check_serial_status
}

define service {

  service_description           serial-signals-server
  host_name                     server
  use                           generic-service
  check_command                 check_serial_status
  active_checks_enabled         0
  passive_checks_enabled        1
}

define servicedependency {
  name                          opengear_nrpe_daemon_dep
  host_name                     opengear
  dependent_host_name           server
  dependent_service_description Serial Status
  service_description           NRPE Daemon
  execution_failure_criteria    w,u,c
}

; Port Log
define command {
  command_name                  check_port_log
  command_line                  $USER1$/check_nrpe -H \
                                192.168.254.147 -p 5666 -c \
                                port_log_$HOSTNAME$
}

define service {
  service_description           Port Log
  host_name                     server
  use                           generic-service
  check_command                 check_port_log
}

define service {
  service_description           port-log-server
  host_name                     server
  use                           generic-service
  check_command                 check_port_log
  active_checks_enabled         0
  passive_checks_enabled        1
}

define servicedependency {
  name                          opengear_nrpe_daemon_dep
  host_name                     opengear
  dependent_host_name           server
  dependent_service_description Port Log
  service_description           NRPE Daemon
  execution_failure_criteria    w,u,c
}

; Ping
define command {
  command_name                  check_ping_via_opengear
  command_line                  $USER1$/check_nrpe -H \
                                192.168.254.147 -p 5666 -c \
                                host_ping_$HOSTNAME$
}

define service {
  service_description           Host Ping
  host_name                     server
  use                           generic-service
  check_command                 check_ping_via_opengear
}

define service {
  service_description           host-ping-server
  host_name                     server
  use                           generic-service
  check_command                 check_ping_via_opengear
  active_checks_enabled         0
  passive_checks_enabled        1

}

define servicedependency {
  name                          opengear_nrpe_daemon_dep
  host_name                     opengear
  dependent_host_name           server
  dependent_service_description Host Ping
  service_description           NRPE Daemon
  execution_failure_criteria    w,u,c
```

```
}

; SSH Port
define command {
  command_name                  check_conn_via_opengear
  command_line                  $USER1$/check_nrpe -H \
                                192.168.254.147 -p 5666 -c \
                                host_$HOSTNAME$_$ARG1$_$ARG2$
}

define service {
  service_description           SSH Port
  host_name                     server
  use                           generic-service
  check_command                 check_conn_via_opengear!tcp!22
}

define service {
  service_description           host-port-tcp-22-server
                              ; host-port-<protocol>-<port>-<host>
  host_name                     server
  use                           generic-service
  check_command                 check_conn_via_opengear!tcp!22
  active_checks_enabled         0
  passive_checks_enabled        1
}

define servicedependency {
  name                          opengear_nrpe_daemon_dep
  host_name                     opengear
  dependent_host_name           server
  dependent_service_description SSH Port
  service_description           NRPE Daemon
  execution_failure_criteria    w,u,c
}
```

9.3.2. Basic Nagios plug-ins

Plug-ins are compiled executables or scripts that can be scheduled to be run on the *console server* to status check a connected host or service. This status is communicated to the Nagios server which uses the results to monitor the status of the network. *Console servers* are preconfigured with a selection of checks that are part of the Nagios plug-ins package.

plug-in	description and notes
check_tcp	Used to check open ports on network hosts.
check_udp	Used to check open ports on network hosts.
check_ping	Used to check network host availability.
check_nrpe	Used to execute arbitrary plug-ins in other devices.
check_serial_signals	Used to monitor handshaking lines on serial ports. Opengear-specific.
check_port_log	Used to monitor the data logged for a serial port. Opengear-specific.

9.3.3. Additional plug-ins

Additional Nagios plug-ins (listed below) are available for all CM7100-, IM7200- and IM4200-series devices.

check_apt	check_by_ssh	check_clamd	check_apt	check_by_ssh	check_clamd
check_dig	check_dns	check_dummy	check_fping	check_ftp	check_game
check_hpjd	check_http	check_imap	check_jabber	check_ldap	check_load
check_mrtg	check_mrtgtraf	check_nagios	check_nntp	check_nntps	check_nt
check_ntp	check_nwstat	check_overcr	check_ping	check_pop	check_procs
check_real	check_simap	check_smtp	check_snmp	check_spop	check_ssh
check_ssmtp	check_swap	check_tcp	check_time	check_udp	check_ups
check_users					

These plug-ins from the Nagios plug-ins package can be downloaded from ftp://ftp.opengear.com/. There also are bash scripts which can be downloaded and run (primarily `check_log.sh`).

To configure additional checks, the downloaded plug-in program must be saved in the tftp `addins` directory on the USB flash drive and the downloaded text plug-in file saved in `/etc/config/`.

To enable these additional plug-ins:

- navigate to **Serial & Network > Network Port**.
- click *Edit* for the Network Host to be monitored.
- select *New Checks*.

  The additional check options will have been included in the updated Nagios Checks list, and you can again customize the arguments.

If you need other plug-ins to be loaded into the CM7100, IM7200 or IM4200 firmware:

- If the plug-in is a Perl script, it must be rewritten. The *console server* does not support Perl at this point.

  If you do require Perl support, please make a feature request to support@opengear.com.
- Individual compiled programs may be generated using `gcc` for ARM.

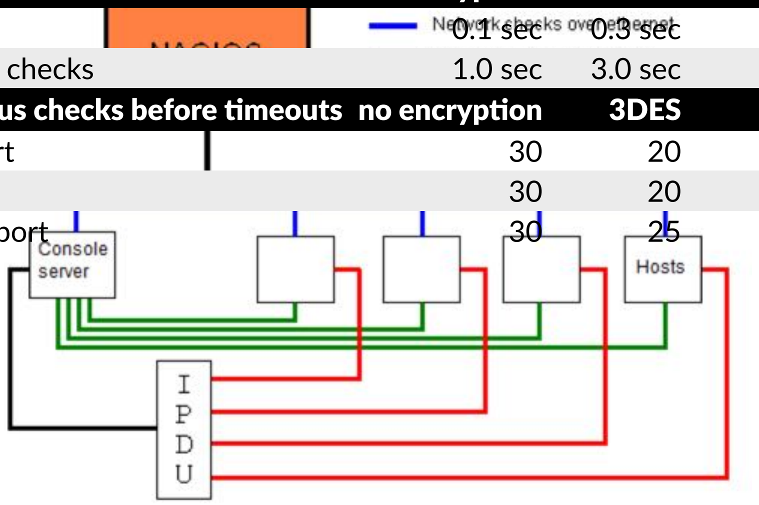
  Again contact support@opengear.com for details.

9.3.4. Number of supported devices

Ultimately the number of devices that can be supported by any particular console server is a function of the number of checks being made, and how often they are performed. Access method will also play a part. The table below shows the performance of three of the *console server* models (1/2-port, 8-port and 16/48 port):

NSCA tests	no encryption	3DES	SSH
1 check	~ 0.5 sec	~ 0.5 sec	~ 0.5 sec
100 sequential checks	100.0 sec	100.0 sec	100.0 sec

10 sequential checks, batched upload	1.5 sec	2.0 sec	1.0 sec
100 sequential checks, batched upload	7.0 sec	11.0 sec	6.0 sec
NRPE tests	**no encryption**	**3DES**	**tunneled over SSH**
1 check	0.1 sec	0.3 sec	0.1 sec
10 simultaneous checks	1.0 sec	3.0 sec	1.3 sec
max simultaneous checks before timeouts	**no encryption**	**3DES**	**SSH tunnel**
1-port and 2-port	30	20	25
8-port	30	20	25
16-port and 48-port	30	25	35



The results were from running tests 5 times in succession with no timeouts on any runs. However there are a number of ways to increase the number of checks you can do:

Usually when using NRPE checks, an individual request will need to set up and tear down an SSL connection. This overhead can be avoided by setting up an SSH session to the console server and tunneling the NRPE port. This allows the NRPE daemon to be run securely without SSL encryption, as SSH will take care of the security.

When the console server submits NSCA results it staggers them over a certain time period (e.g. 20 checks over 10 minutes will result in two check results every minute). Staggering the results like this means that in the event of a power failure or other incident that causes multiple problems, the individual freshness checks will be staggered too.

NSCA checks are also batched. So in the previous example the two checks per minute will be sent through in a single transaction.

9.3.5. Distributed monitoring usage scenarios

Below are a number of distributed Nagios monitoring scenarios.

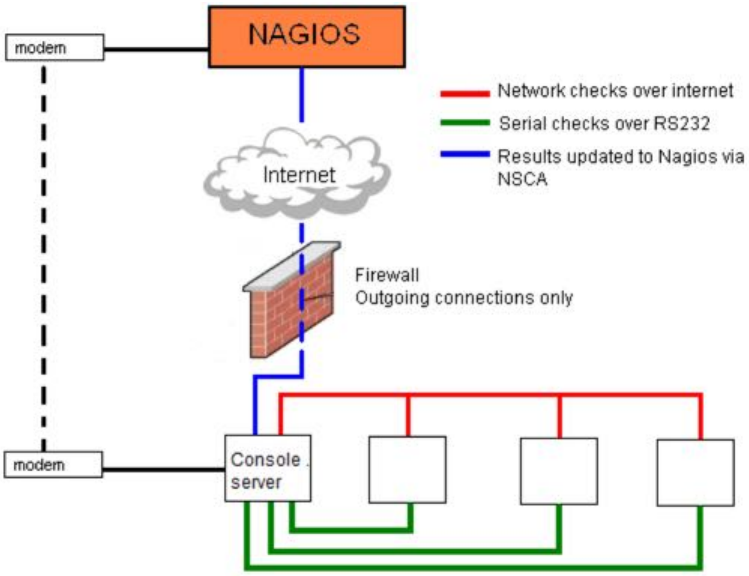
Local office

In this scenario, the *console server* is set up to monitor the console of each managed device. It can be configured to make a number of checks, either actively at the Nagios server's request, or passively at preset intervals, and submit the results to the Nagios server in a batch.

The console server may be augmented at the local office site by one or more Intelligent Power Distribution Units (IPDUs) to remotely control the power supply to the managed devices.

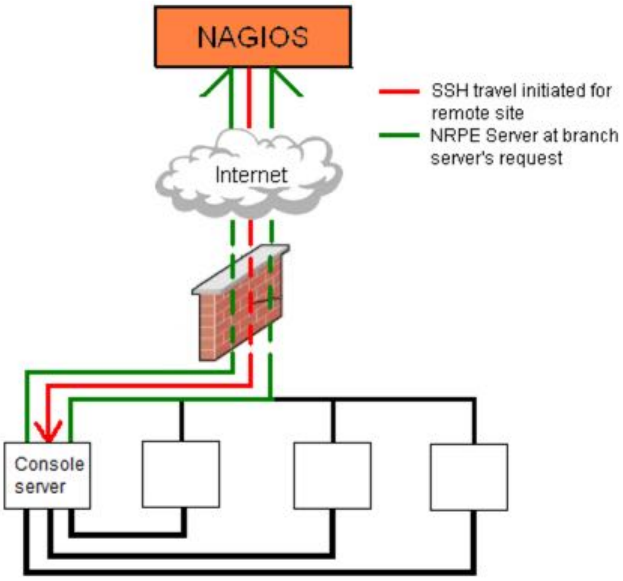
Remote site

In this scenario the *console server* NRPE server or NSCA client can be configured to make active checks of configured services and upload to the Nagios server waiting passively. It can also be configured to service NRPE commands to perform checks on demand.


modem
NAGIOS
Network checks over internet
Serial checks over RS232
Results updated to Nagios via NSCA
Internet
Firewall
Outgoing connections only
modem
Console server

In this situation, the *console server* will perform checks based on both serial and network access.

Remote site with restrictive firewall


NAGIOS
SSH travel initiated for remote site
NRPE Server at branch server's request
Internet
Console server

Opengear User Manual, page 243.

In this scenario the role of the *console server* will vary. One aspect may be to upload check results through NSCA.

Another may be to provide an SSH tunnel to allow the Nagios server to run NRPE commands.

Remote site with no network access

In this scenario the *console server* allows dial-in access for the Nagios server.

Periodically, the Nagios server will establish a connection to the *console server* and execute any NRPE commands, before dropping the connection.

10. System management

This chapter documents how the *Administrator* can perform a range of general *console server* system administration and configuration tasks such as:

- applying Soft and Hard Resets to the gateway.
- re-flashing the Firmware.
- configuring the Date, Time and NTP.
- setting up Backup of the configuration files.
- delayed configuration commits.
- configuring the console server in FIPS mode.

System administration and configuration tasks that are covered elsewhere include

chapter 2.2	resetting the system.
chapter 2.3	setting the *console server's* System IP Address.
chapter 2.4	Setting the Services permitted to access the *console server*.
chapter 4	Setting up OOB Dial-in.
chapter 11	Configuring the Dashboard.

10.1. System administration & reset

The *Administrator* can reboot or reset the gateway to default settings.

To affect a *soft* reset:

- navigate to **System > Administration**
- Select *Reboot*.
- click **Apply**.

The *console server* reboots with all settings (for example, the assigned network IP address) preserved. However this *soft* reset disconnects all users and ends any SSH sessions that had been established.

A *soft* reset will also be affected when you switch OFF power from the *console server*, and then switch the power back ON.

Note: if you cycle the power and the unit is writing to flash you could corrupt or lose data. The software reboot is the safer option.

To affect a *hard* reset or *hard* erase:

- Push the **Erase** button on the rear panel gently twice within a few seconds period while the unit is powered on..

  A ball point pen or bent paper clip is a suitable tool for performing this procedure. Do not use a graphite pencil.

This will reset the *console server* back to its factory default settings and clear the console server's stored configuration information (for example, the unit's IP address will be reset to 192.168.0.1).

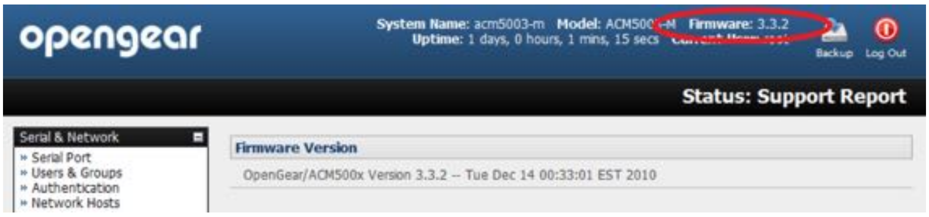
You will be prompted to log in and must enter the default administration username and password:

Username:	*root*
Password:	*default*

10.2. Firmware upgrades

Before upgrading you should ascertain if you are already running the most current firmware in your Opengear device. Your Opengear device will not allow you to upgrade to the same or an earlier version.

- The *Firmware* version is displayed in the header of each page.



System Name: acm5003-m **Model:** ACM5003-M **Firmware:** 3.3.2
Uptime: 1 days, 0 hours, 1 mins, 15 secs

Status: Support Report

Firmware Version

OpenGear/ACM500x Version 3.3.2 -- Tue Dec 14 00:33:01 EST 2010

- Alternately selecting **Status > Support Report** reports the *Firmware Version*.

- To upgrade, download the latest firmware image from ftp://ftp.opengear.com/ or http://opengear.com/firmware/.

  For ACM5000 family download `acm500x.flash`.

  For ACM5500 family download `acm500x.flash`.

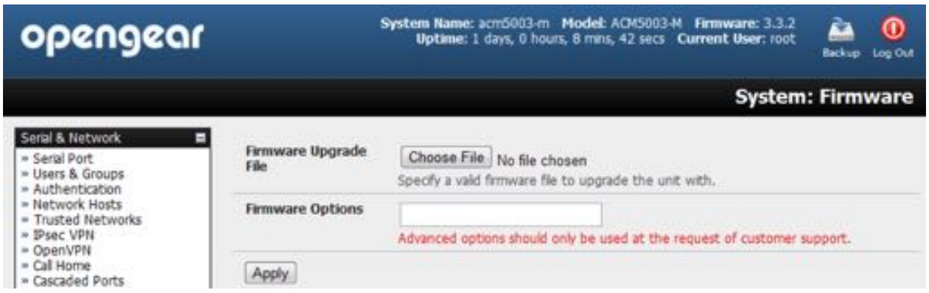
  For ACM7000 family download `acm700x.flash`.

  For CM7116/7132/7148-2/CM7196A-2 download `cm71xx.flash`.

  For IM4216-34 and IM4208/16/32/48-2 download `im42xx.flash`.

  For IM7208/16/32/48-2 download `im72xx.flash`.

- Save the firmware image file on to a system on the same subnet as the Opengear device.
- Also download and read the Release Notes file for the latest information.
- Select **System > Firmware** on the system to be upgraded.



System Name: acm5003-m Model: ACM5003-M Firmware: 3.3.2
Uptime: 1 days, 0 hours, 8 mins, 42 secs Current User: root

System: Firmware

Firmware Upgrade File: No file chosen
Specify a valid firmware file to upgrade the unit with.

Firmware Options:
Advanced options should only be used at the request of customer support.

- Specify the address and name of the downloaded firmware upgrade file, or browse the local subnet and locate the downloaded file.
- Click **Apply**.

  The Opengear device will undertake a soft reboot and commence upgrading the firmware. This process will take several minutes.

- After the firmware upgrade has completed, click **here** to return to the Management Console. Your Opengear device will have retained all its pre-upgrade configuration information.

10.3. Date & time configuration

It is important to set the local Date and Time in your Opengear appliance as soon as it is configured. Features such as Syslog and NFS logging use the system time for time-stamping log entries, while certificate generation depends on a correct Timestamp to check the validity period of the certificate.

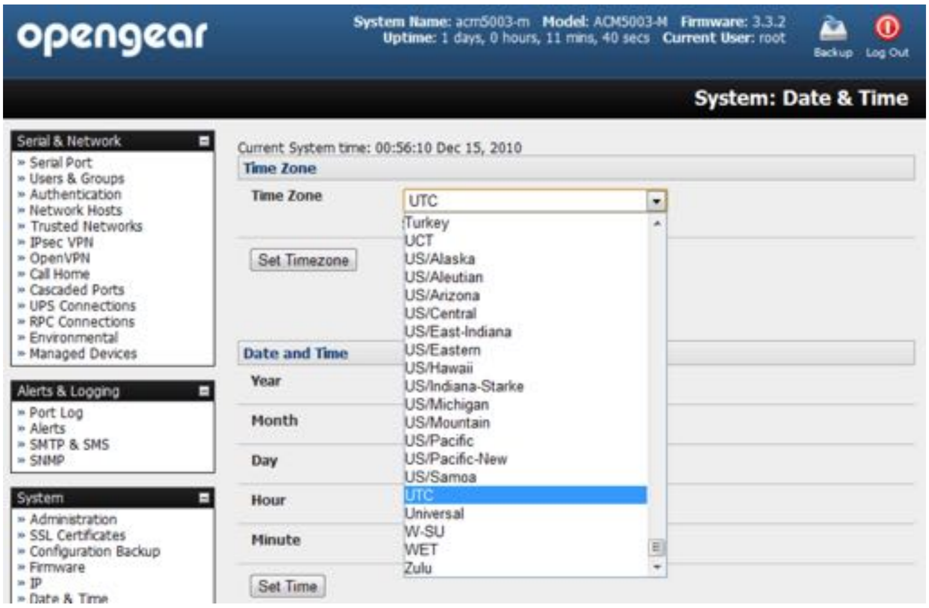
Your Opengear appliance can synchronize its system time with a remote Network Time Protocol (NTP) server. NTP uses Coordinated Universal Time (UCT) for all time synchronizations so it is not affected by different time zones. However you do need to specify your local time zone so the system clock shows correct local time.

- Select **System > Date & Time**.
- Set your appropriate region in the *Time Zone* selection box and click **Set Time**.

Note: with firmware v3.2.0 and later the Time Zone can also be set to UTC, which replaced Greenwich Mean Time as the World standard for time in 1986.

Configuring NTP ensures the Opengear appliance clock is kept extremely accurate once an Internet connection has been established.

- Select the *Enable NTP* checkbox in the **Network Time Protocol** section of the **System > Date & Time** page.
- Enter the IP address of the remote **NTP Server**.
- If your external NTP server requires authentication, specify the *NTP Authentication Key* and the *Key Index* to use when authenticating with the NTP server
- Click **Apply NTP Settings**.


System Name: acm5003-m Model: ACM5003-M Firmware: 3.3.2
Uptime: 1 days, 0 hours, 11 mins, 40 secs Current User: root

System: Date & Time

Current System time: 00:56:10 Dec 15, 2010

Time Zone

Time Zone: UTC

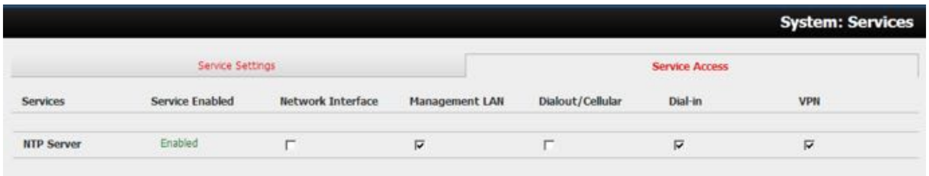
Date and Time

If remote NTP is not used, the time can be set manually:

- Enter the *Year*, *Month*, *Day*, *Hour* and *Minute* using the **Date and Time** selection boxes
- Check **Set Time**.

Opengear appliances have an internal, battery-backed hardware clock. Whether set manually, or set by an NTP server, the hardware clock is automatically updated. The clock's battery maintains the time and date across reboots and when the appliance is powered down.

With the NTP peering model, *console servers* can share time information with other connected devices, so all devices can be time synchronized. To do this, tick *Enable NTP* on the **Time and Date** page, and ensure the appropriate networks are selected on the **Service Access** page.


System: Services

Services	Service Enabled	Network Interface	Management LAN	Dialout/Cellular	Dial-in	VPN
NTP Server	Enabled	☐	☑	☐	☑	☑

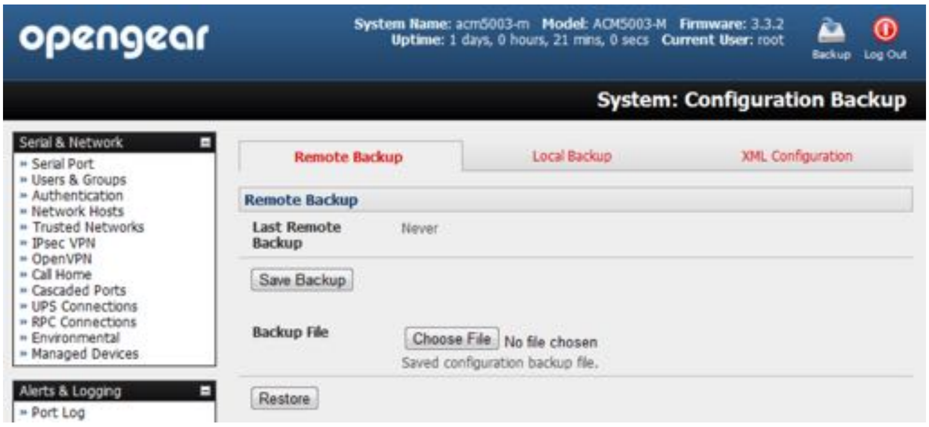
10.4. Backup configuration

It is recommended you back up the console server configuration whenever you make significant changes (such as adding new Users or Managed Devices) or before performing a firmware upgrade.

- Select **System > Configuration Backup** or click the Backup icon.

Backup

Note: configuration files can also be backed up from the command line (see chapter 13).



Last Remote Backup: Never

Backup File: No file chosen
Saved configuration backup file.

With all *console servers* you can save the backup file remotely on your PC and you can restore configurations from remote locations:

- Navigate to **System > Configuration Backup**.
- Click the **Remote Backup** tab.
- Click **Save Backup** in the Remote Backup section.

  The config backup file — `system-name_date_config.opg` — will be downloaded to your PC and saved in the location you nominate.

To restore a remote backup:

- Navigate to **System > Configuration Backup**.
- Click the **Remote Backup** tab.
- Click **Browse** in the Remote Backup section.
- Select the backup file you wish to restore.
- Click **Restore**
- Click **OK**.

Note: this will overwrite all the current configuration settings in your **console server.**

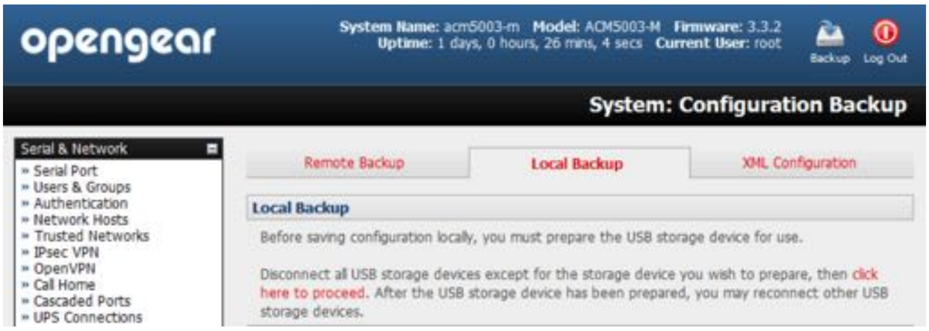
With some *console servers* you can save the backup file locally onto the USB storage. To do this your *console server* must support USB and you must have an internal or external USB flash drive installed.

To backup and restore using USB:

- Ensure the USB flash drive is the only USB device attached to the *console server*.
- Navigate to **System > Configuration Backup**.
- Select the **Local Backup** tab.
- click *click here to proceed*.

  This will set a Volume Label on the USB storage device.

  This preparation step is only necessary the first time, and will not affect any other information you have saved onto the USB storage device. However it is recommended that you back up any critical data from the USB storage device before using it with your console server. If there are multiple USB devices installed you will be warned to remove them.



System Name: acm5003-m Model: ACM5003-M Firmware: 3.3.2
Uptime: 1 days, 0 hours, 26 mins, 4 secs Current User: root

System: Configuration Backup

Local Backup

Before saving configuration locally, you must prepare the USB storage device for use.

Disconnect all USB storage devices except for the storage device you wish to prepare, then click here to proceed. After the USB storage device has been prepared, you may reconnect other USB storage devices.

- To back up to the USB enter a brief **Description** of the backup in the **Local Backup** menu and select **Save Backup**.
- The **Local Backup** menu will display all the configuration backup files you have stored onto the USB flash drive.
- To restore a backup from the drive, select **Restore** on the particular backup you wish to restore and click **Apply**.

After saving a local configuration backup, you may choose to use it as the alternate default configuration. When the *console server* is reset to factory defaults, it will then load your alternate default configuration instead of its factory settings.

To set an alternate default configuration:

- check *Load On Erase*
- click **Apply**.

Note: Before selecting **Load On Erase** *ensure you have tested your alternate default configuration by clicking* **Restore.**

If your alternate default configuration causes the *console server* to become unbootable, recover your unit to factory settings.

If the configuration is stored on an external USB storage device, unplug the storage device and reset to factory defaults as per chapter 10.1.

If the configuration is stored on an internal USB storage device, reset to factory defaults using a specially-prepared USB storage device.

This specially-prepared USB storage device:

- must be formatted with a Windows FAT32/VFAT file system on the first partition or the entire disk.

  Most USB thumb drives are sold already formatted this way.

- The file system must have the volume label `OPG_DEFAULT`.

- Insert this USB storage device into an external USB port on the console server and reset to factory defaults as per chapter 10.1.

- After recovering your console server, ensure the problematic configuration is no longer selected for *Load On Erase*.

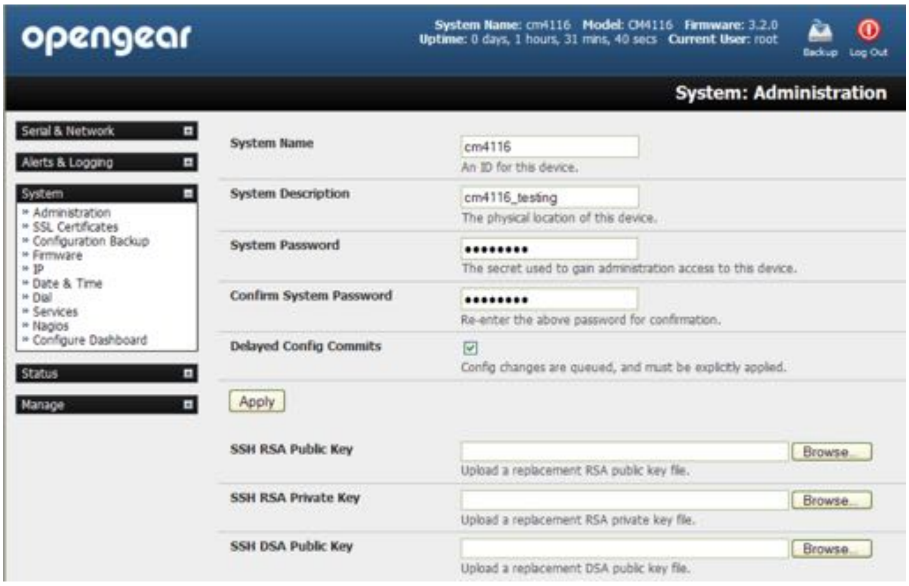
10.5. Delayed configuration commit

This mode allows the grouping or queuing of configuration changes and the simultaneous application of these changes to a specific device. For example, changes to authentication methods or user accounts may be grouped and run once to minimize system downtime. To enable:

- Navigate to **System > Administration**.

- Check the *Delayed Config Commits* checkbox.

- Click **Apply**.



System Name: cm4116 **Model:** CM4116 **Firmware:** 3.2.0
Uptime: 0 days, 1 hours, 31 mins, 40 secs **Current User:** root

System: Administration

System Name: cm4116
An ID for this device.

System Description: cm4116_testing
The physical location of this device.

System Password: ••••••••
The secret used to gain administration access to this device.

Confirm System Password: ••••••••
Re-enter the above password for confirmation.

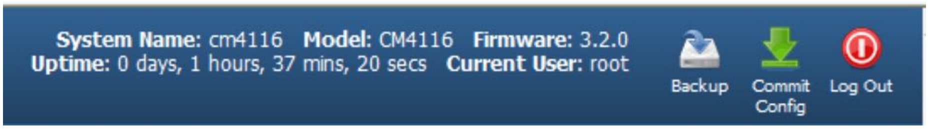
Delayed Config Commits: ☑
Config changes are queued, and must be explicitly applied.

SSH RSA Public Key
Upload a replacement RSA public key file.

SSH RSA Private Key
Upload a replacement RSA private key file.

SSH DSA Public Key
Upload a replacement DSA public key file.

The **Commit Config** icon will present in top right-hand corner of the screen between the **Backup** and **Log Out** icons.



System Name: cm4116 **Model:** CM4116 **Firmware:** 3.2.0
Uptime: 0 days, 1 hours, 37 mins, 20 secs **Current User:** root

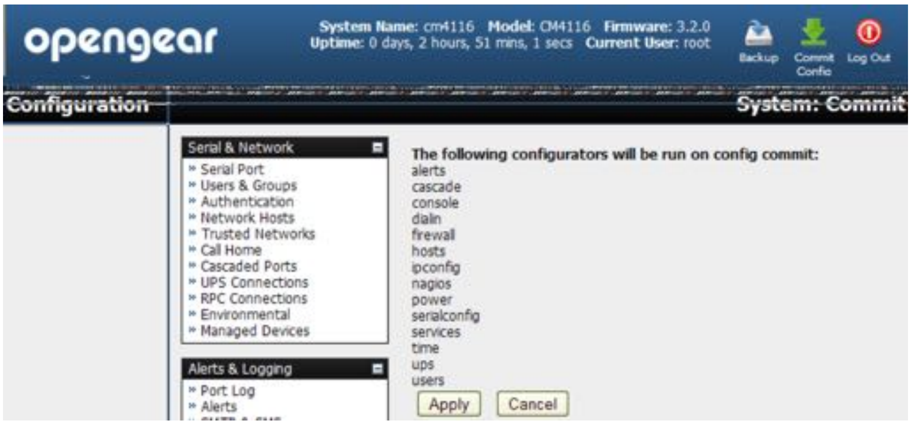
To queue, then run, configuration changes:

- Apply all the required changes to the configuration.

For example, modify user accounts, amend authentication method, enable OpenVPN tunnel or modify system time.

- Click the **Commit Config** button.

  This will generate the **System > Commit Configuration** screen displaying all the configurators to be run.



System Name: cm4116 **Model:** CM4116 **Firmware:** 3.2.0
Uptime: 0 days, 2 hours, 51 mins, 1 secs **Current User:** root

The following configurators will be run on config commit:
alerts
cascade
console
dialin
firewall
hosts
ipconfig
nagios
power
serialconfig
services
time
ups
users

- Click **Apply**.

  All the configurators in the queue will run.

- Alternatively, click **Cancel**.

  All the queued configuration changes will be lost.

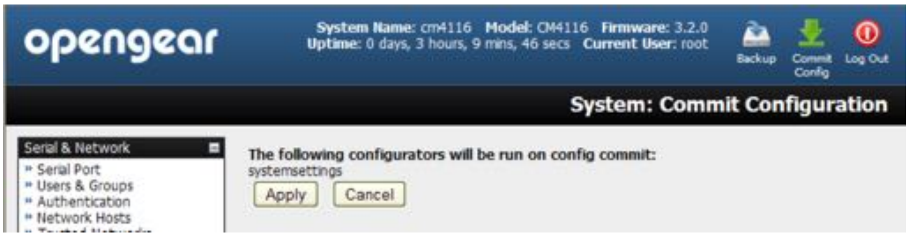
To disable the Delayed Configuration Commits mode:

- uncheck the *Delayed Config Commits* checkbox under **System > Administration**.
- click **Apply**.
- click the **Commit Config** button in top right-hand corner of the screen

  the **System > Commit Configuration** screen displays.

- Click **Apply**.

  The *systemsettings* configurator runs.



System Name: cm4116 **Model:** CM4116 **Firmware:** 3.2.0
Uptime: 0 days, 3 hours, 9 mins, 46 secs **Current User:** root

The following configurators will be run on config commit:
systemsettings

The **Commit Config** button will no longer be displayed in the top right-hand corner of the screen and configurations will no longer be queued.

10.6. FIPS mode

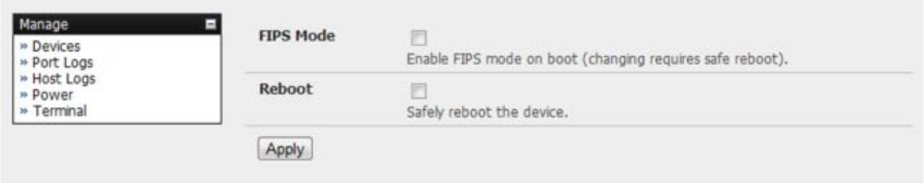
The ACM7000, ACM5500, ACM5000, CM7100, IM7200 and IM4200 family of advanced *console servers* all use a FIPS 140-2 validated embedded cryptographic module.

Note: The US National Institute of Standards and Technology (NIST) publishes the FIPS (Federal Information Processing Standard) standards. FIPS 140-1 and FIPS 140-2 are both technical standards and worldwide de-facto standards for cryptographic module implementation. They are issued by NIST for use government-wide. NIST develops FIPS when there are government requirements, such as for security and interoperability, and no acceptable industry options. Opengear advanced **console servers** *use an embedded OpenSSL cryptographic module validated to FIPS 140-2 standards and in receipt of Certificate #1051.*

When configured in FIPs mode, all SSH, HTTPS and *SDT Connector* access to all services on the *console server* use the embedded FIPS-compliant module. To connect your browser or client must also be using FIPs-approved cryptographic algorithms or the connection will fail.

- Select **System > Administration**.
- Check *FIPS Mode*

  This will enable FIPS mode after a safe reboot
- Check *Reboot* to safely reboot the console server.



FIPS Mode □
Enable FIPS mode on boot (changing requires safe reboot).

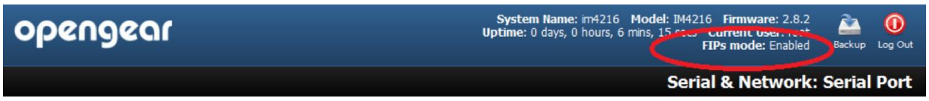
Reboot □
Safely reboot the device.

Apply

- Click **Apply**.

  The *console server* reboots. It will take several minutes to reconnect as secure browser communications are validated.

  When reconnected it will display *FIPs mode: Enabled* in the Management Console banner.



System Name: im4216 Model: IM4216 Firmware: 2.8.2
Uptime: 0 days, 0 hours, 6 mins, 15 secs Current user: root
FIPs mode: Enabled

Serial & Network: Serial Port

To enable FIPS mode from the command line, login and run these commands:

```
config -s config.system.fips=on
touch /etc/config/FIPS
chmod 444 /etc/config/FIPS
flatfsd -b
```

The final command saves to flash and reboots the unit. The unit will take a few minutes to boot into FIPS mode.

To disable FIPS mode from the shell, run these commands:

```
config -d config.system.fips
rm /etc/config/FIPS
flatfsd –b
```

11. Status reports

This chapter documents the Dashboard feature and the status reports that are available:

- Port Access and Active Users
- Statistics.
- Support Reports.
- Syslog.
- Dashboard.

Other status reports that are covered elsewhere include:

- chapter 7.1 RPC Status.
- chapter 7.2 UPS Status.
- chapter 7.3 Environmental Status.

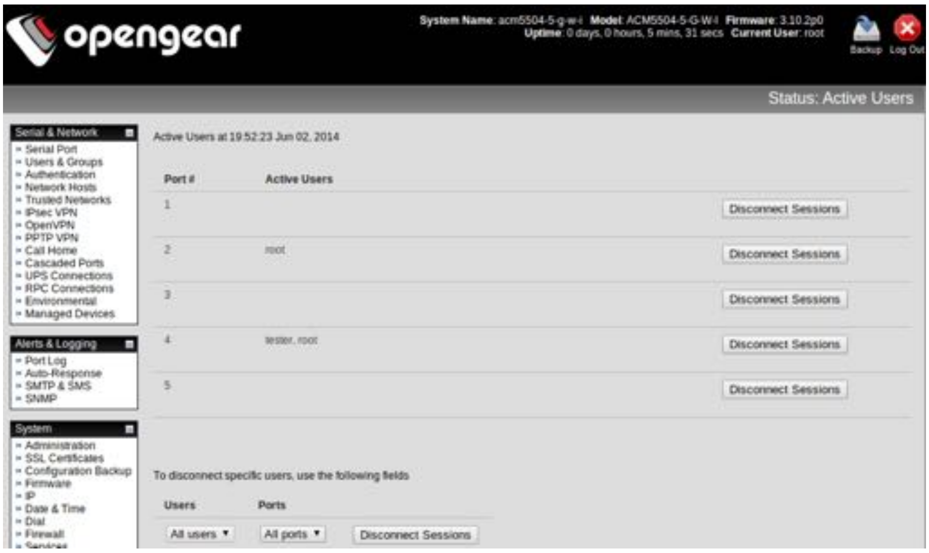
11.1. Port access & active users

The *Administrator* can see which Users have access privileges with which serial ports:

- Select **Status > Port Access**.

The *Administrator* can also see the current status of *Users* who have active sessions on those ports:

- Select **Status > Active Users**.



System Name: acm5504-5-g-w-i Model: ACM5504-5-G-W-I Firmware: 3.10.2p0
Uptime: 0 days, 0 hours, 5 mins, 31 secs Current User: root

Status: Active Users

Active Users at 19:52:23 Jun 02, 2014

Port #	Active Users	
1		Disconnect Sessions
2	root	Disconnect Sessions
3		Disconnect Sessions
4	tester, root	Disconnect Sessions
5		Disconnect Sessions

To disconnect specific users, use the following fields

Users	Ports	
All users ▾	All ports ▾	Disconnect Sessions

With firmware v3.11 and later the **Status > Active Users** menu has been extended to enable *Administrators* to selectively terminate serial sessions. Connection types *telnet*, *SSH*, *raw TCP* and *unauthenticated telnet* can be disconnected. However you cannot disconnect an RFC2217 session

The *root* user, or any user in the admin group, can access the **Active Users** page, which shows a snapshot of the connected sessions, at the time indicated by the timestamp displayed at the top of the page. Note that this page only shows the local console ports, and does not include any cascaded ports.

There are **Disconnect Sessions** buttons along the right hand side of the table listing active users. These buttons disconnect all sessions from the Port they correspond to. If the port is not set up in *Console Server* mode, the user will see a pop up error informing them that they need to configure the port as *Console Server* mode before they can connect and disconnect.

After the buttons have been pressed, the selected sessions will be disconnected, and the number of disconnect sessions will be displayed to the user.

To allow more detailed control of who to disconnect, there is a table at the bottom of the page with drop down lists for all connected users and all connected ports that allow the user to choose who do disconnect.So if you wish to disconnect the user *tester* from all ports, choose *tester* in the **Users** box, and *All ports* in the **Ports** box then click **Disconnect Sessions**.

Note: you can also disconnect serial sessions from the command line using the `--disconnect` *option with the* `pmusers` *command.*

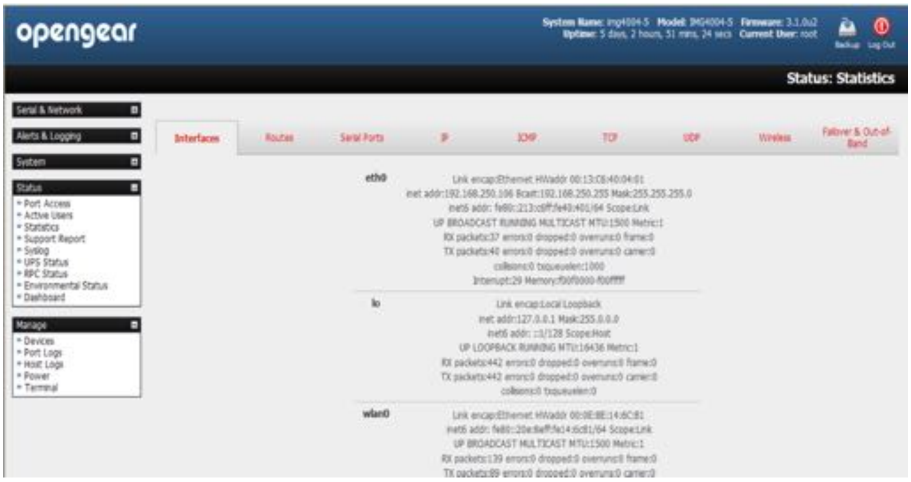
11.2. Statistics

The Statistics report provides a snapshot of the status, current traffic and other activities and operations of your *console server*.

- Select **Status > Statistics**.

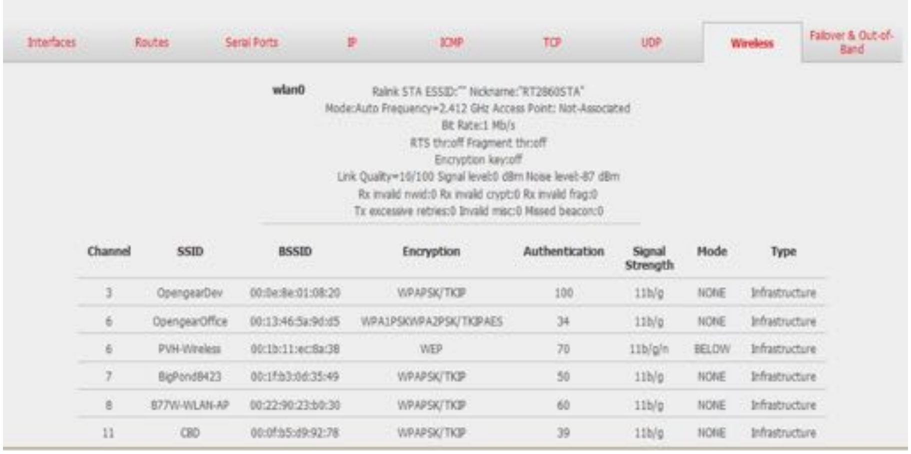
Detailed statistics reports can be found by selecting the various tabs.

For example if you have an ACM5504-5-G-W-I configured with a wireless LAN connection the Wireless screen will display all the locally accessible wireless LANs.



```
eth0     Link encap:Ethernet HWaddr 00:13:C6:40:04:01
         inet addr:192.168.250.106 Bcast:192.168.250.255 Mask:255.255.255.0
         inet6 addr: fe80::213:c6ff:fe40:401/64 Scope:Link
         UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
         RX packets:37 errors:0 dropped:0 overruns:0 frame:0
         TX packets:40 errors:0 dropped:0 overruns:0 carrier:0
         collisions:0 txqueuelen:1000
         Interrupt:29 Memory:f00f0000-f00fffff
lo       Link encap:Local Loopback
         inet addr:127.0.0.1 Mask:255.0.0.0
         inet6 addr: ::1/128 Scope:Host
         UP LOOPBACK RUNNING MTU:16436 Metric:1
         RX packets:442 errors:0 dropped:0 overruns:0 frame:0
         TX packets:442 errors:0 dropped:0 overruns:0 carrier:0
         collisions:0 txqueuelen:0
wlan0    Link encap:Ethernet HWaddr 00:0E:8E:14:6C:81
         inet6 addr: fe80::20e:8eff:fe14:6c81/64 Scope:Link
         UP BROADCAST MULTICAST MTU:1500 Metric:1
         RX packets:139 errors:0 dropped:0 overruns:0 frame:0
         TX packets:89 errors:0 dropped:0 overruns:0 carrier:0
```

You can see the SSID and Encryption/Authentication settings for the desired access point.



```
wlan0    Ralink STA ESSID:"" Nickname:"RT2860STA"
         Mode:Auto Frequency=2.412 GHz Access Point: Not-Associated
         Bit Rate:1 Mb/s
         RTS thr:off Fragment thr:off
         Encryption key:off
         Link Quality=10/100 Signal level:0 dBm Noise level:-87 dBm
         Rx invalid nwid:0 Rx invalid crypt:0 Rx invalid frag:0
         Tx excessive retries:0 Invalid misc:0 Missed beacon:0
```

Channel	SSID	BSSID	Encryption	Authentication	Signal Strength	Mode	Type
3	OpengearDev	00:0e:8e:01:08:20	WPAPSK/TKIP	100	11b/g	NONE	Infrastructure
6	OpengearOffice	00:13:46:5a:9d:d5	WPA1PSKWPA2PSK/TKIPAES	34	11b/g	NONE	Infrastructure
6	PVH-Wireless	00:1b:11:ec:8a:38	WEP	70	11b/g/n	BELOW	Infrastructure
7	BigPond8423	00:1f:b3:0d:35:49	WPAPSK/TKIP	50	11b/g	NONE	Infrastructure
8	877W-WLAN-AP	00:22:90:23:b0:30	WPAPSK/TKIP	60	11b/g	NONE	Infrastructure
11	CBD	00:0f:b5:d9:92:78	WPAPSK/TKIP	39	11b/g	NONE	Infrastructure

Also when you have successfully connected the SSID of this access point will then be shown in the Wireless ESSID filed of ra0 (shows above as “” which is not connected).

11.3. Support reports

The **Support Report** provides status information that assists the Opengear technical support team to solve any problems you may experience with your *console server*. With email support requests, generate a **Support Report** when the issue is occurring, and attach it as text.

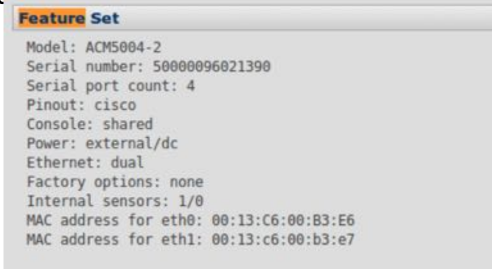
- Select **Status > Support Report**.

  A status snapshot presents.

- Save the file as a text file and attach it to your support email.

Note: For **console servers** *running firmware v3.11 and above, for devices where the serial number can be retrieved, there is now a Feature Set section displaying the serial number. ACM5000, ACM5500, ACM7000, CM7100 and IM7200 can display their serial number. For devices not supporting this feature there is no change to the support report.*

Note: There is also a new cli command on all devices called `showserial` *which does nothing*



```
Feature Set
  Model: ACM5004-2
  Serial number: 50000096021390
  Serial port count: 4
  Pinout: cisco
  Console: shared
  Power: external/dc
  Ethernet: dual
  Factory options: none
  Internal sensors: 1/0
  MAC address for eth0: 00:13:C6:00:B3:E6
  MAC address for eth1: 00:13:c6:00:b3:e7
```

more than return the serial number if it is available or 'No serial number information available'. The command exists on all devices so **Lighthouse** *bulk commands can be run on many* **console servers** *and obtain as many serial numbers as possible in one operation.*

11.4. Syslog

The *console server's* Linux system logger maintains a record of all system messages and errors:

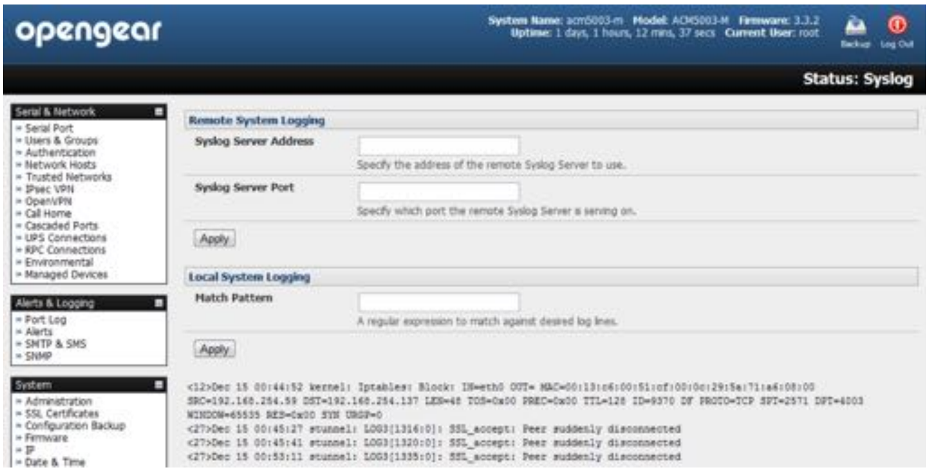
- Select **Status > Syslog**.

The syslog record can be redirected to a remote Syslog Server:

- Enter the remote *Syslog Server Address* and *Syslog Server Port* details.
- click **Apply**.

The console also maintains a local Syslog. To view this local Syslog file:

- Select **Status > Syslog**.



Remote System Logging

Syslog Server Address: Specify the address of the remote Syslog Server to use.

Syslog Server Port: Specify which port the remote Syslog Server is serving on.

Apply

Local System Logging

Match Pattern: A regular expression to match against desired log lines.

Apply

```
<12>Dec 15 00:44:52 kernel: Iptables: Block: IN=eth0 OUT= MAC=00:13:c6:00:51:cf:00:0c:29:5a:71:a6:08:00
SRC=192.168.254.59 DST=192.168.254.137 LEN=48 TOS=0x00 PREC=0x00 TTL=128 ID=9370 DF PROTO=TCP SPT=2571 DPT=4003
WINDOW=65535 RES=0x00 SYN URGP=0
<27>Dec 15 00:45:27 stunnel: LOG3[1316:0]: SSL_accept: Peer suddenly disconnected
<27>Dec 15 00:45:41 stunnel: LOG3[1320:0]: SSL_accept: Peer suddenly disconnected
<27>Dec 15 00:53:11 stunnel: LOG3[1335:0]: SSL_accept: Peer suddenly disconnected
```

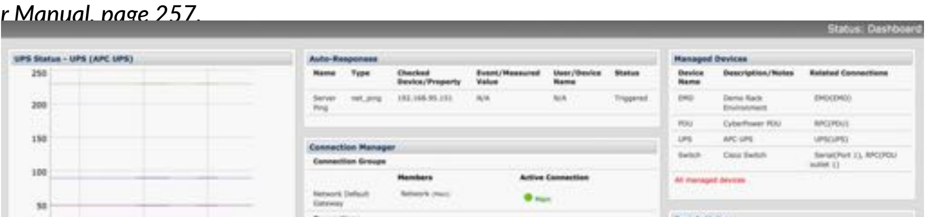
To find specific information in the local Syslog file, a pattern matching filter tool is provided.

- Specify the **Match Pattern** that is to be searched for
- Click **Apply**.

  The Syslog will present with only those entries that include the specified pattern.

11.5. Dashboard

The Dashboard provides the administrator with a summary of the status of the console server



Auto-Responses

Name	Type	Checked Device/Property	Event/Measured Value	User/Device Name	Status
Server Ping	net_ping	192.168.95.131	N/A	N/A	Triggered

Connection Manager

Connection Groups

	Members	Active Connection
Network Default Gateway	Network (nsc)	● Main

Managed Devices

Device Name	Description/Notes	Related Connections
EMD	Demo Rack Environment	EMD(EMD)
PDU	CyberPower PDU	RPC(PDU)
UPS	APC UPS	UPS(UPS)
Switch	Cisco Switch	Serial(Port 1), RPC(PDU outlet 1)

All managed devices

	IP Address	Status
Network	192.168.95.3 fe80::213:c6ff:fe00:a5ae	Connected
Internal Cellular Modem	10.144.188.39	Connected

Port	Active Users
Port 2 (Router)	robertw

To disconnect users, go to Active Users

Cellular Statistics - Internal Cellular Modem

IMEI	353310030026391
Network Status	Normal
Current Service	HSDPA + HSUPA
RSSI	-82
Ec\Io (UMTS Only)	-5.00
Roaming Mode	Not Roaming
SIM State	SIM is ready
IMSI	234101376185818

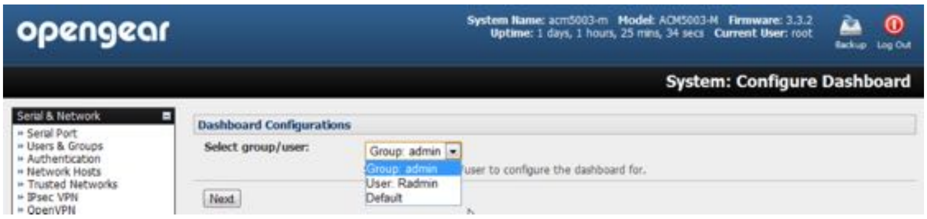
and its Managed Devices.

Custom dashboards can be configured for each user group.

11.5.1. Configuring the Dashboard

Only the *root* user and users who are members of the *admin* group can configure and access the dashboard. To configure a custom dashboard:

- Select **System > Configure Dashboard**.
- Select the user (or group) you are configuring this custom dashboard layout for.



System Name: acm5003-m Model: ACM5003-M Firmware: 3.3.2
Uptime: 1 days, 1 hours, 25 mins, 34 secs Current User: root

System: Configure Dashboard

Dashboard Configurations

Select group/user: Group: admin
user to configure the dashboard for.

You can configure a custom dashboard for any admin user or for the admin group or you can reconfigure the default dashboard.

The **Status > Dashboard** screen is the first screen displayed when admin users (other than *root*) log into the console manager.

If you log in as *john*, and *john* is member of the *admin* group and there is a dashboard layout configured for *john*, then you will see the dashboard for *john* on log-in and each time you click on the **Status > Dashboard** menu item.

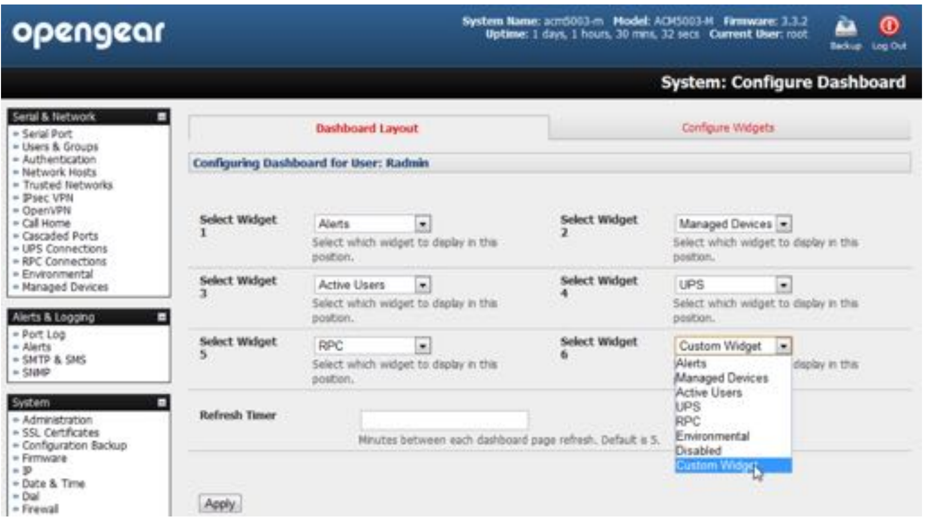
If there is no dashboard layout configured for *john* but there is an *admin* group dashboard configured then you will see the *admin* group dashboard instead. If there is no user-specific dashboard or *admin* group dashboard configured, the default dashboard is displayed.

Note: The **root** *user does not have its own dashboard.*

The Dashboard displays a configurable number of widgets. These widgets include status for major subsystems such as *conma*, *Auto-Response*, *Managed Devices* and *cellular*.

The *admin* user can configure which of these widgets is to be displayed where:

- Go to the **Dashboard layout** panel and select the widgets to display in each *Widget Slot*.
- Click **Apply**.



System Name: acm5003-m Model: ACM5003-M Firmware: 3.3.2
Uptime: 1 days, 1 hours, 30 mins, 32 secs Current User: root

System: Configure Dashboard

Configuring Dashboard for User: Radmin

Select Widget 1: Alerts
Select which widget to deplay in this position.

Select Widget 2: Managed Devices
Select which widget to deplay in this position.

Select Widget 3: Active Users
Select which widget to deplay in this position.

Select Widget 4: UPS
Select which widget to deplay in this position.

Select Widget 5: RPC
Select which widget to deplay in this position.

Select Widget 6: Custom Widget
deplay in this

Refresh Timer:
Minutes between each dashboard page refresh. Default is 5.

Note: Dashboard configuration is stored in `/etc/config/config.xml`*. Each configured dashboard will increase the size of this file. If this file gets too big, you can run out of memory space on the* **console server**.

11.5.2. Creating custom widgets for the Dashboard

To run a custom script in a dashboard widget create a file called `widget-<name>.sh` in the folder `/etc/config/scripts/`. You can have as many custom dashboard files as you want.

Put any code inside this file. When configuring the dashboard, choose `widget-<name>.sh` from the dropdown list. The dashboard runs and displays the script's output inside the widget.

The best way to format the output is to send HTML back to the browser using `echo`:

```
echo '<table>'
```

You can run any command and its output will be displayed in the widget window directly.

Below is an example script. It writes the current date to a file, and then echo's HTML code back to the browser. The HTML code gets an image from a URL and displays it in the widget.

```
#!/bin/sh
date >> /tmp/test
echo '<table>'
echo '<tr><td> This is my custom script running </td></tr>'
echo '<tr><td>'
echo '<img src="http://vinras.com/images/linux-online-inc.jpg">'
echo '</td></tr>'
echo '</table>'
exit 0
```

12. Management

The console server has a small number of **Manage** reports and tools that are available to both *Administrators* and *Users*:

- Access and control authorized devices.
- View serial port logs and host logs for those devices.
- Use SSH or the Web Terminal to access serially attached consoles.
- Control of power devices (where authorized).

All other Management Console menu items are available to *Administrators* only.

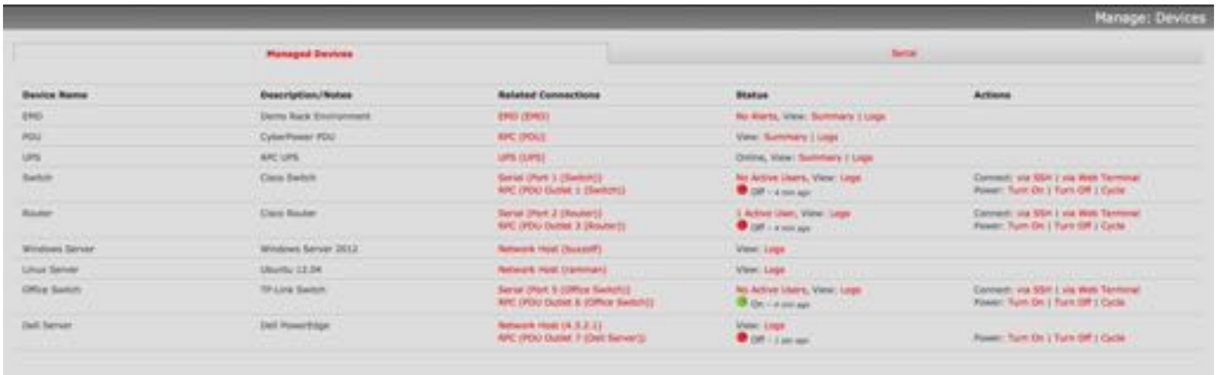
12.1. Device management

Note: The Manage Devices UI has been significantly updated as of firmware version 3.12.

To display Managed Devices and their grouped serial, network and power connections:

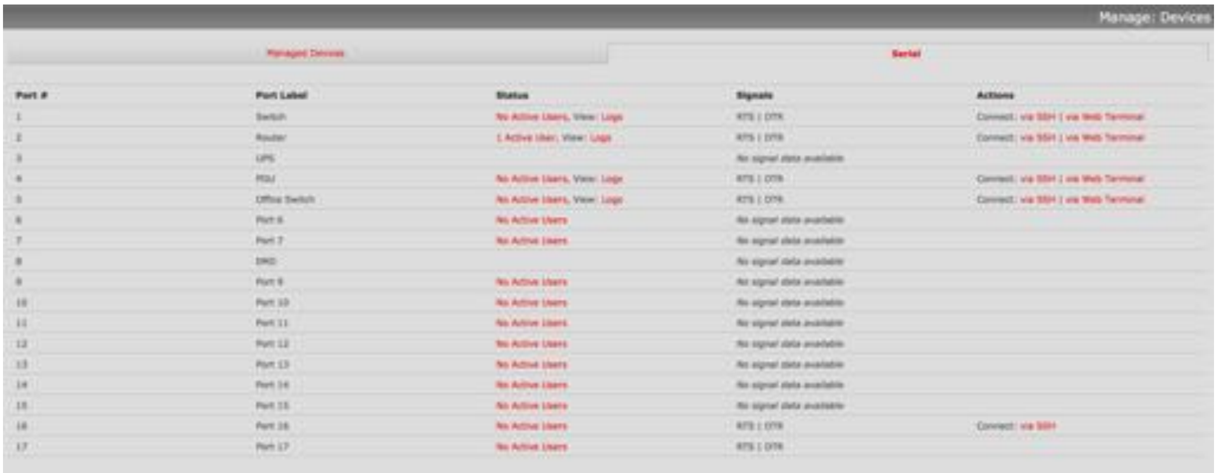
- select **Manage > Devices** or click the **Manage Devices** icon in the top right of the UI.
- *admin*-group users are presented with a list of all configured Managed Devices and their constituent connections. *user*-group users only see the Managed Devices where, for each Related Connection, they have been explicitly permitted access.

  The *Status* column displays the current most salient status for each Related Connection (for example, Active Users for serial connections, and power status for RPC outlet connections) with links to detailed status.



Device Name	Description/Notes	Related Connections	Status	Actions
EMD	Demo Rack Environment	EMD (EMD)	No Alerts, View: Summary | Logs	
PDU	CyberPower PDU	APC (PDU)	View: Summary | Logs	
UPS	APC UPS	UPS (UPS)	Online, View: Summary | Logs	
Switch	Cisco Switch	Serial (Port 1 (Switch)) APC (PDU Outlet 1 (Switch))	No Active Users, View: Logs ● Off - 4 min ago	Connect: via SSH | via Web Terminal Power: Turn On | Turn Off | Cycle
Router	Cisco Router	Serial (Port 2 (Router)) APC (PDU Outlet 3 (Router))	1 Active User, View: Logs ● Off - 4 min ago	Connect: via SSH | via Web Terminal Power: Turn On | Turn Off | Cycle
Windows Server	Windows Server 2012	Network Host (buzzoff)	View: Logs	
Linux Server	Ubuntu 12.04	Network Host (ramman)	View: Logs	
Office Switch	TP-Link Switch	Serial (Port 5 (Office Switch)) APC (PDU Outlet 6 (Office Switch))	No Active Users, View: Logs ● On - 4 min ago	Connect: via SSH | via Web Terminal Power: Turn On | Turn Off | Cycle
Dell Server	Dell PowerEdge	Network Host (4.3.2.1) APC (PDU Outlet 7 (Dell Server))	View: Logs ● Off - 1 sec ago	Power: Turn On | Turn Off | Cycle

- The links in the *Actions* column are used to control the Managed Device (for example, to connect to a console session or power cycle. Power actions are not performed until the action has been confirmed via pop-up message.)
- alternatively, select the **Serial** tab for an ungrouped view of permitted serial port connections for the current user.
- An additional **Signals** column displays the current state of the serial pins.



Port #	Port Label	Status	Signals	Actions
1	Switch	No Active Users, View: Logs	RTS | DTR	Connect: via SSH | via Web Terminal
2	Router	1 Active User, View: Logs	RTS | DTR	Connect: via SSH | via Web Terminal
3	UPS		No signal data available	
4	PDU	No Active Users, View: Logs	RTS | DTR	Connect: via SSH | via Web Terminal
5	Office Switch	No Active Users, View: Logs	RTS | DTR	Connect: via SSH | via Web Terminal
6	Port 6	No Active Users	No signal data available	
7	Port 7	No Active Users	No signal data available	
8	EMD		No signal data available	
9	Port 9	No Active Users	No signal data available	
10	Port 10	No Active Users	No signal data available	
11	Port 11	No Active Users	No signal data available	
12	Port 12	No Active Users	No signal data available	
13	Port 13	No Active Users	No signal data available	
14	Port 14	No Active Users	No signal data available	
15	Port 15	No Active Users	No signal data available	
16	Port 16	No Active Users	RTS | DTR	Connect: via SSH
17	Port 17	No Active Users	RTS | DTR	

Note: To use the **Connect > via SSH** *links, your computer's operating system must recognize the* **ssh://** *URI scheme and have a protocol handler configured (for example, an SSH client like SecureCRT).*

12.2. Port & host logs

Administrators and *Users* can view and download logs of data transferred to and from connected devices.

- Select **Manage > Port Logs**.
- Select the *serial Port #* to be displayed.

To display Host logs:

- select **Manage > Host Logs**.
- Select the *Host* to be displayed.

12.3. Terminal connection

There are two methods for accessing the *console server* command line and devices attached to the console server serial ports from a web browser.

The *Web Terminal* service uses AJAX to enable the browser to connect to the console server using HTTP or HTTPS, as a terminal without additional client installation on the user's PC. Browser access is available to users who are a member of the *admin* or *users* groups.

The *SDT Connector* service launches a pre-installed *SDT Connector* client on the user's PC to establish SSH access, then uses pre-installed client software on the client PC to connect to the *console server*.

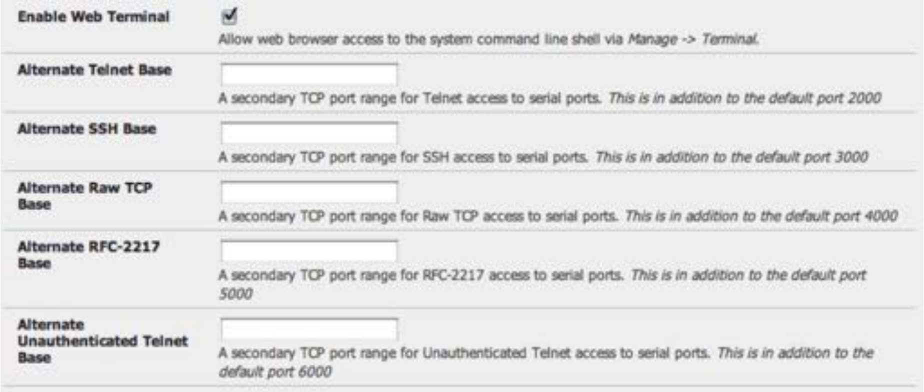
12.3.1. Web terminal

The AJAX based *Web Terminal* service may be used to access the console server command line or attached serial devices.

Note: Any communication using the Web Terminal service using **HTTP** *is unencrypted and not secure. The* **Web Terminal** *connects to the command line or serial device using the same protocol that is being used to browse to the Opengear Management Console. If you browse using an* `https://` *URL (this is the default), the Web Terminal connects using* **HTTPS**.

To enable the *Web Terminal* service for the *console server*:

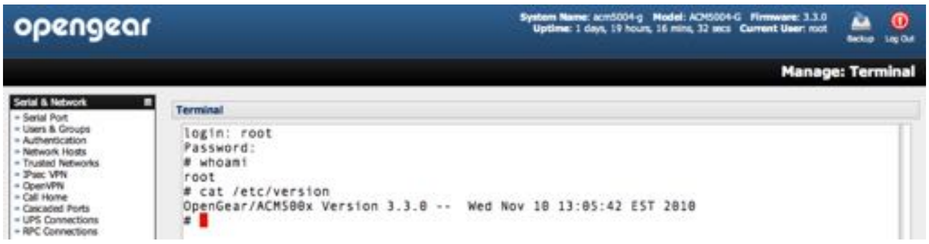
- Select **System > Firewall**.
- Check **Enable Web Terminal**.
- Click **Apply.**



Enable Web Terminal	☑ Allow web browser access to the system command line shell via *Manage -> Terminal.*
Alternate Telnet Base	A secondary TCP port range for Telnet access to serial ports. *This is in addition to the default port 2000*
Alternate SSH Base	A secondary TCP port range for SSH access to serial ports. *This is in addition to the default port 3000*
Alternate Raw TCP Base	A secondary TCP port range for Raw TCP access to serial ports. *This is in addition to the default port 4000*
Alternate RFC-2217 Base	A secondary TCP port range for RFC-2217 access to serial ports. *This is in addition to the default port 5000*
Alternate Unauthenticated Telnet Base	A secondary TCP port range for Unauthenticated Telnet access to serial ports. *This is in addition to the default port 6000*

Administrators can now communicate with the console server shell from their browser.

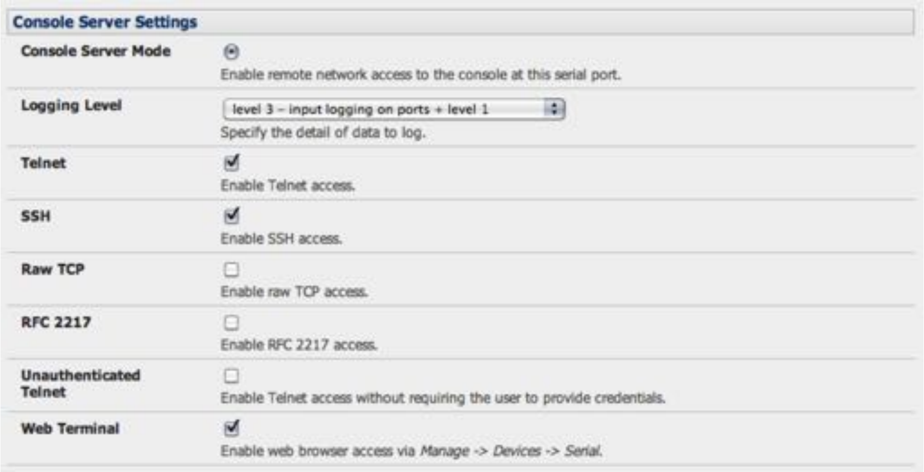
- Select **Manage > Terminal** to display the *Web Terminal* from which you can log in to the console server command line.



```
login: root
Password:
# whoami
root
# cat /etc/version
OpenGear/ACM500x Version 3.3.0 --  Wed Nov 10 13:05:42 EST 2010
#
```

To enable the Web Terminal service for each serial port you want to access:

- Select **Serial & Network > Serial Port**.
- click **Edit**.
- Ensure the serial port is in *Console Server Mode*.
- Check *Web Terminal*.
- Click **Apply**.

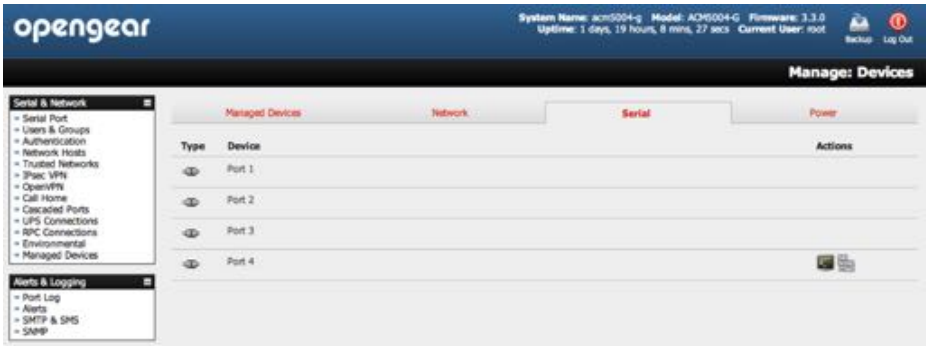


Console Server Settings

Console Server Mode	● Enable remote network access to the console at this serial port.
Logging Level	level 3 – input logging on ports + level 1 Specify the detail of data to log.
Telnet	☑ Enable Telnet access.
SSH	☑ Enable SSH access.
Raw TCP	☐ Enable raw TCP access.
RFC 2217	☐ Enable RFC 2217 access.
Unauthenticated Telnet	☐ Enable Telnet access without requiring the user to provide credentials.
Web Terminal	☑ Enable web browser access via *Manage -> Devices -> Serial*.

Administrator and *Users* can communicate directly with serial port attached devices from their browser:

- Select **Manage > Devices**.
- Select the **Serial** tab.
- Under the *Action* column, click the **Web Terminal** icon to display the Web Terminal, connected directly to the attached serial device.



System Name: acm5004-g **Model:** ACM5004-G **Firmware:** 3.3.0
Uptime: 1 days, 19 hours, 8 mins, 27 secs **Current User:** root

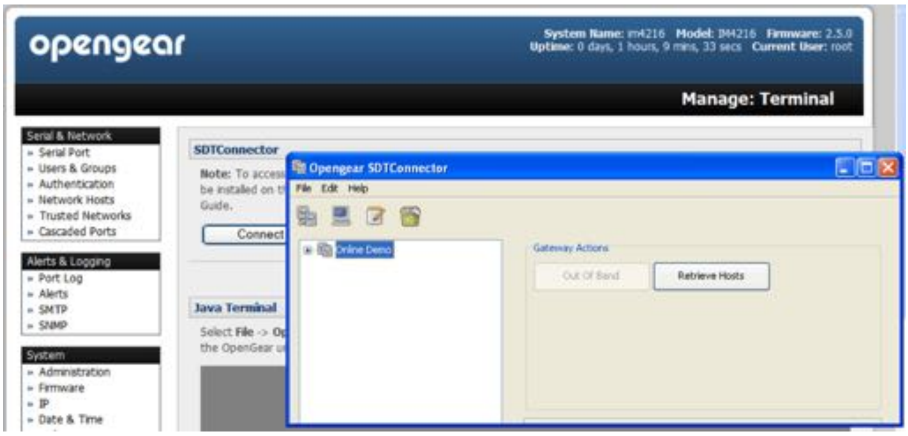
Type	Device	Actions
	Port 1	
	Port 2	
	Port 3	
	Port 4	

Note: *The* **Web Terminal** *feature was introduced in firmware v3.3. Earlier releases had an open source* `jcterm` *java terminal applet which could be downloaded into your browser to connect to the console server and attached serial port devices. However* `jcterm` *had some JRE compatibility issues and is no longer supported.*

12.3.2. SDT connector access

Administrators and *Users* can communicate directly with the *console server* command line and with devices attached to the *console server* serial ports using *SDT Connector* and their local telnet client.

- Select **Manage > Terminal**.
- Click **Connect to SDT Connector**.



System Name: im4216 Model: IM4216 Firmware: 2.5.0
Uptime: 0 days, 1 hours, 9 mins, 33 secs Current User: root

Manage: Terminal

SDTConnector

Note: To access … be installed on th… Guide.

Java Terminal

Select File -> Op… the OpenGear u…

This activates the *SDT Connector* client on the computer you are browsing and loads your local telnet client to connect to the command line or serial port using SSH.

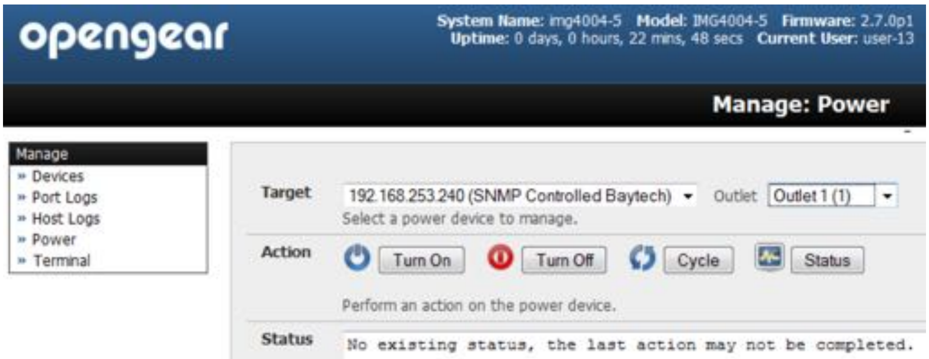
Note: **SDT Connector** *must be installed on the computer you are browsing from and the* **console server** *must be added as a gateway, as detailed in chapter 5*.

12.4. Power management

Administrators and *Users* can access and manage the connected power devices.

- Select **Manage > Power**.

This enables the user to **Turn On**, **Turn Off**, or **Cycle** the power on any power outlet on any PDU the user has been given access privileges to.



System Name: img4004-5 Model: IMG4004-5 Firmware: 2.7.0p1
Uptime: 0 days, 0 hours, 22 mins, 48 secs Current User: user-13

Manage: Power

Target: 192.168.253.240 (SNMP Controlled Baytech) Outlet: Outlet 1 (1)
Select a power device to manage.

Action
Perform an action on the power device.

Status: No existing status, the last action may not be completed.

See chapter 7 for details.

13. Configuration from the command line

For those who prefer to configure their *console server* at the Linux command line level, rather than use a browser and the Management Console, this chapter describes using command line access and the config tool to manage the *console server*, configure the ports and so on.

This chapter walks thru command line configuration to deliver the functions provided otherwise using the Management Console GUI.

For advanced and custom configurations and for details using other tools and commands see chapter 14.

When displaying a command, the convention used in the rest of this chapter is to use single quotes ('') for user-defined values (for example, descriptions and names). Element values without single quotes should be typed exactly as shown.

After the initial section on accessing the config command the menu items in this document follow the same structure as the menu items in the web GUI.

13.1. Accessing config from the command line

The *console server* runs a standard Linux kernel and embeds a suite of open source applications. So if you do not want to use a browser and the Management Console tools, you are free to configure the console server and to manage connected devices from the command line using standard Linux and Busybox commands and applications such as `ifconfig`, `gettyd`, `stty`, `powerman`, `nut` etc. However without care these configurations may not withstand a *power-cycle-reset* or *reconfigure*.

So Opengear provides a number of custom command line utilities and scripts to make it simple to configure the *console server* and ensure the changes are stored in the console server's flash memory etc.

In particular the `config` utility allows manipulation of the system configuration from the command line. With `config` a new configuration can be activated by running the relevant configurator, which performs the action necessary to make the configuration changes live.

To access `config` from the command line:

- Power up the *console server* and connect the “terminal” device.

  If you are connecting using the serial line, plug a serial cable between the console server local DB-9 console port and terminal device. Configure the serial connection of the terminal device you are using to 115200bps, 8 data bits, no parity and one stop bit.

  If you are connecting over the LAN, interconnect the Ethernet ports and direct your terminal emulator program to the IP address of the console server (192.168.0.1 by default).

- Log on to the *console server* by pressing **Return** a few times.

  The console server will request a username and password.

- Enter the username *root* and the password *default*.

  The command line prompt appears:

  #

Note: This chapter is not intended to teach you Linux. We assume you already have a certain level of understanding before you execute kernel-level Linux commands.

The config tool

```
config [-ahv] [-d id] [-g id] [-p path] [-r configurator] [-s
id=value] [-P id]
```

The `config` tool is designed to perform multiple actions from one command if need be, so if necessary options can be chained together.

The `config` tool allows manipulation and querying of the system configuration from the command line. Using `config` the new configuration can be activated by running the relevant configurator which performs the action necessary to make the configuration changes live.

The custom user configuration is saved in the `/etc/config/config.xml` file. This file is transparently accessed and edited when configuring the device using the Management Console browser GUI. Only the `root` user can configure from the shell.

By default, the `config` elements are separated by a **.** character (a full-stop or period). The root of the `config` tree is called <`config`>. To address a specific element place a **.** between each node or branch. For example, to access and display the description of user1 type:

```
# config -g config.users.user1.description
```

The root node of the config tree is <`config`>. To display the entire `config` tree, type:

```
# config -g config
```

To display the help text for the `config` command, type:

```
# config -h
```

The `config` application resides in the `/bin` directory. The environmental variable called PATH contains a route to the `/bin` directory. This allows a user to simply type `config` at the command prompt instead of the full `/bin/config` path.

options	description
-a --run-all	Run all registered configurators. This performs every configuration synchronization action pushing all changes to the live system
-h --help	Display a brief usage message.
-v --verbose	Log extra debug information.
-d --del=id	Remove the given configuration element specified by a `.` separated identifier.
-g --get=id	Display the value of a configuration element
-p --path=file	Specify an alternate configuration file to use. The default file is located at `/etc/config/config.xml`.
-r --run=configurator	Run the specified registered configurator. Registered configurators are listed below.
-s --set=id=value	Change the value of configuration element specified by a `.` separated identifier.
-e --export=file	Save active configuration to file.
-i --import=file	Load configuration from file.
-t --test-import=file	Pretend to load configuration from file.
-S --separator=char	The pattern to separate fields with. The default is `.`
-P --password=id	Prompt user for a value. Hash the value, then save it in id.

The registered configurators are:

alerts
auth
cascade
console
dhcp
dialin
eventlog
hosts
ipaccess
ipconfig
nagios
power
serialconfig
services
slave
systemsettings
time
ups
users

There are three ways to delete a `config` element value. The simplest way is use the `delete-node` script detailed later in chapter 14. You can also assign the config element to "" (null), or delete the entire `config` node using `-d`:

```
# /bin/config -d 'element name'
```

Passwords are saved as plaintext except the user passwords and the system passwords, which are encrypted. As of firmware 3.16.6u1, however, password obfuscation is supported.

The config command does not verify whether the nodes edited/added by the user are valid. This means that any node may be added to the tree. If a user were to run the following command:

```
# /bin/config -s config.fruit.apple=sweet
```

the configurator will not complain, but this command is clearly useless. When the configurators are run (to turn the `config.xml` file into live config) they will simply ignore this `<fruit>` node. *Administrators* must make sure of the spelling when typing config commands. Incorrect spelling for a node will not be flagged.

Most configurations made to the XML file will be immediately active. To make sure that all configuration changes are active, especially when editing user passwords, run all the configurators:

```
# /bin/config -a
```

For information on backing up and restoring the configuration file see chapter 14.

13.1.1. Serial port configuration

The first set of configurations that needs to be made to any serial port are the RS232 common settings. For example to setup serial port 5 to use the following properties:

Baud Rate	9600
Parity	None
Data Bits	8
Stop Bits	1
Label	Myport
Log level	0
Protocol	RS232
Flow control	None

To do this use the following commands:

```
# config -s config.ports.port5.speed=9600
# config -s config.ports.port5.parity=None
# config -s config.ports.port5.charsize=8
# config -s config.ports.port5.stop=1
# config -s config.ports.port5.label=myport
# config -s config.ports.port5.loglevel=0
# config -s config.ports.port5.protocol=RS232
# config -s config.ports.port5.flowcontrol=None
```

The following command will synchronise the live system with the new configuration:

```
# config -r serialconfig
```

property	supported values
baud rates	50 75 110 134 150 200 300 600 1200 1800 2400 4800 9600 19200 38400 57600 115200 230400
parity values	None Odd Even Mark Space
data-bits	8 7 6 5
stop-bits	1 1.5 2
flow-control	Hardware Software None

Additionally, before any port can function properly, the mode of the port needs to be set. Any port can be set to run in one of the five possible modes (see chapter 3 for details):

Console Server mode
Device mode
SDT mode
Terminal server mode
Serial bridge mode

All these modes are mutually exclusive.

Console Server mode

The command to set the port in portmanager mode:

```
# config -s config.ports.port5.mode=portmanager
```

To set the following optional config elements for this mode:

Data accumulation period	100 ms
Escape character	% (default is ~)
log level	2 (default is 0)
Shell power command menu	Enabled
RFC2217 access	Enabled
Limit port to 1 connection	Enabled
SSH access	Enabled
TCP access	Enabled
telnet access	Disabled
Unauthorized telnet access	Disabled

Run the following commands.

```
# config -s config.ports.port5.delay=100
# config -s config.ports.port5.escapechar=%
# config -s config.ports.port5.loglevel=2
# config -s config.ports.port5.powermenu=on
# config -s config.ports.port5.rfc2217=on
# config -s config.ports.port5.singleconn=on
# config -s config.ports.port5.ssh=on
# config -s config.ports.port5.tcp=on
# config -d config.ports.port5.telnet
# config -d config.ports.port5.unauthtel
```

Device mode

For a device mode port, set the port type to either ups, rpc, or enviro:

```
# config -s config.ports.port5.device.type=[ups | rpc | enviro]
```

For port 5 as a UPS port:

```
# config -s config.ports.port5.mode=reserved
```

For port 5 as an RPC port:

```
# config -s config.ports.port5.mode=powerman
```

For port 5 as an Environmental port:

```
# config -s config.ports.port5.mode=reserved
```

SDT mode

To enable access over SSH to a host connected to serial port 5:

```
# config -s config.ports.port5.mode=sdt
# config -s config.ports.port5.sdt.ssh=on
```

To configure a username and password when accessing this port with Username = user1 and Password = secret:

```
# config -s config.ports.port#.sdt.username=user1
# config -s config.ports.port#.sdt.password=secret
```

Terminal server mode

Enable a TTY login for a local terminal attached to serial port 5:

```
# config -s config.ports.port5.mode=terminal
# config -s config.ports.port5.terminal=\
[vt220 | vt102 | vt100 | linux | ansi]
```

The default terminal is vt220.

Serial bridge mode

Create a network connection to a remote serial port via RFC-2217 on port 5:

```
# config -s config.ports.port5.mode=bridge
```

Optional configurations for the network address of RFC-2217 server of 192.168.3.3 and TCP port used by the RFC-2217 service = 2500:

```
# config -s config.ports.port5.bridge.address=192.168.3.3
# config -s config.ports.port5.bridge.port=2500
```

To enable RFC-2217 access:

```
# config -s config.ports.port5.bridge.rfc2217=on
```

To redirect the serial bridge over an SSH tunnel to the server: #

```
config -s config.ports.port5.bridge.ssh.enabled=on
```

Syslog settings

Additionally, the global system log settings can be set for any specific port, in any mode:

```
# config -s config.ports.port#.syslog.facility='facility'
# config -s config.ports.port#.syslog.priority='priority'
```

argument	supported values
facility	Default local 0-7 auth authpriv cron daemon ftp kern lpr mail news user uucp

priority	Default warning notice Info error emergency debug critical alert

13.1.2. Adding and removing users

First, determine the total number of existing *Users*:

```
# config -g config.users.total
```

This command should display

```
config.users.total 1.
```

Note: if you see `config.users.total` *this means you have 0 Users configured.*

Your new *User* will be the existing total plus 1. So if the previous command gave you 0 then you start with user number 1, if you already have 1 user your new user will be number 2 etc.

Assuming the previous command did return `config.users.total 1.`, to add a user with Username=John, Password=secret and Description=mySecondUser issue the commands:

```
# config -s config.users.total=2
# config -s config.users.user2.username=John
# config -s config.users.user2.description=mySecondUser
# config -P config.users.user2.password
```

Note: the -P parameter will prompt the user for a password, and encrypt it. In fact, the value of any config element can be encrypted using the -P parameter, but only encrypted user passwords and system passwords are supported. If any other element value were to be encrypted, the value will become inaccessible and will have to be re-set.

To add this user to specific groups (admin/users):

```
# config -s config.users.user2.groups.group1='groupname'
# config -s config.users.user2.groups.group2='groupname2'
# [etc...]
```

To give this user access to a specific port:

```
# config -s config.users.user2.port1=on
# config -s config.users.user2.port2=on
# config -s config.users.user2.port5=on
# [etc...]
```

To remove port access:

```
# config -s config.users.user2.port1=''
```

Note: the `port1` *value is left blank.*

or simply:

```
# config -d config.users.user2.port1
```

The port number can be anything from 1 to 48, depending on the available ports on the specific console server.

For example, assume we have an RPC device connected to port 1 on the console server and the RPC is configured. To give this user access to RPC outlet number 3 on the RPC device, run the 2 commands below:

```
# config -s config.ports.port1.power.outlet3.users.user2=John
# config -s config.ports.port1.power.outlet3.users.total=2
```

The last command sets the total number of users with access to this outlet. If more users are given access, increment `config.ports.port1.power.outlet3.users.total` accordingly.

To give this user access to network host 5 (assuming the host is configured):

```
# config -s config.sdt.hosts.host5.users.user1=John
# config -s config.sdt.hosts.host5.users.total=1
```

The last command sets the total number of users having access to host.

To give another user called *Peter* access to the same host:

```
# config -s config.sdt.hosts.host5.users.user2=Peter
# config -s config.sdt.hosts.host5.users.total=2
```

The last command sets the total number of users having access to host.

To edit any of the user element values, use the same approach as when adding user elements. That is, use the `-s` parameter. If any of the config elements do not exist, they will automatically be created.

To delete the user called John, use the delete-node script:

```
# /etc/scripts/delete-node config.users.user2
```

The following command will synchronize the live system with the new configuration:

```
# config -r users
```

13.1.3. Adding and removing user groups

The console server is configured with a few default user groups (only two of these groups are visible in the Management Console GUI). To find out how many groups are already present:

```
# config -g config.groups.total
```

Assume this value is six. Make sure to number any new groups you create from seven onwards.

To add a custom group to the configuration with Group name=Group7, Group description=MyGroup and Port access= 1,5 issue the commands:

```
# config -s config.groups.group7.name=Group7
# config -s config.groups.group7.description=MyGroup
# config -s config.groups.total=7
# config -s config.groups.group7.port1=on
# config -s config.groups.group7.port5=on
```

Assume we have an RPC device connected to port 1 on the *console server*, and the RPC is configured. To give this group access to RPC outlet number 3 on the RPC device, run the two commands below:

```
# config -s config.ports.port1.power.outlet3.groups.group1=Group7
# config -s config.ports.port1.power.outlet3.groups.total=1
```

The second command sets the total number of groups that have access to this outlet. If more groups are given access to this power outlet, then increment the `config.ports.port1.power.outlet3.groups.total` element accordingly.

To give this group access to network host 5:

```
# config -s config.sdt.hosts.host5.groups.group1=Group7
# config -s config.sdt.hosts.host5.groups.total=1
```

The second command sets the total number of groups with access to host.

To give another group called Group8 access to the same host:

```
# config -s config.sdt.hosts.host5.groups.group2=Group8
# config -s config.sdt.hosts.host5.groups.total=2
```

The second command sets the total number of groups with access to host.

To delete the group called Group7, use the following command:

```
# rmuser Group7
```

Note: the **rmuser** *script is a generic script to remove any config element from config.xml correctly. However, any dependencies or references to this group will not be affected. Only the group details are deleted. The administrator is responsible for going through config.xml and removing group dependencies and references manually, specifically if the group had access to a host or RPC device.*

The following command will synchronize the live system with the new configuration:

```
# config -a
```

13.1.4. Authentication

To change the type of authentication for the console server:

```
# config -s config.auth.type='authtype'
```

'authtype' can be:

```
Local
LocalTACACS
TACACS
TACACSLocal
TACACSDownLocal
```

```
LocalRADIUS
RADIUS
RADIUSLocal
RADIUSDownLocal
LocalLDAP
LDAP
LDAPLocal
LDAPDownLocal
```

To configure TACACS authentication:

```
# config -s config.auth.tacacs.auth_server='comma-separated-list'
```

`comma-separated-list` is a list of remote authentiction and authorization servers.

```
# config -s config.auth.tacacs.acct_server='comma-separated-list'
# config -s config.auth.tacacs.password='password'
```

`comma-separated-list` is a list of remote accounting servers. If unset, the Authentication and Authorization Server Address will be used.

To configure RADIUS authentication:

```
# config -s config.auth.radius.auth_server='comma-separated-list'
# config -s config.auth.radius.acct_server='comma-separated-list'
# config -s config.auth.radius.password='password'
```

In the first command, `comma-separated-list` is a list of remote authentiction and authorization servers.

In the second command, `comma-separated-list` is a list of remote accounting servers. If unset, Authentication and Authorization Server Address will be used.

To configure LDAP authentication:

```
# config -s config.auth.ldap.server='comma separated list'
# config -s config.auth.ldap.basedn='name'
# config -s config.auth.ldap.binddn='name'
# config -s config.auth.radius.password='password'
```

In the first command, `comma-separated-list` is a list of remote servers

In the second command `name` is the distinguished name of the search base. For example: `dc=my-company,dc=com`.

In the third command `name` is the distinguished name to bind to the server with. The default is to bind anonymously.

The following command will synchronize the live system with the new configuration:

```
# config -r auth
```

13.1.5. Network hosts

To determine the total number of currently configured hosts:

```
# config -g config.sdt.hosts.total
```

Assume the value returned is 3. If you add another host, increment the total number of hosts from 3 to 4:

```
  # config -s config.sdt.hosts.total=4
```

If the output is `config.sdt.hosts.total`, 0 hosts are configured.

Add power device host

To add a UPS/RPC network host with the following details:

setting	value
IP address or DNS name	192.168.2.5
Host name	remoteUPS
Description	UPSroom3
Type	UPS
Allowed services	ssh port 22 and https port 443
Log level for services	0

Issue the following commands:

```
  # config -s config.sdt.hosts.host4.address=192.168.2.5
  # config -s config.sdt.hosts.host4.name=remoteUPS
  # config -s config.sdt.hosts.host4.description=UPSroom3
  # config -s config.sdt.hosts.host4.device.type=ups
  # config -s config.sdt.hosts.host4.tcpports.tcpport1=22
  # config -s config.sdt.hosts.host4.tcpports.tcpport1.loglevel=0
  # config -s config.sdt.hosts.host4.udpports.udpport2=443
  # config -s config.sdt.hosts.host4.udpports.udpport2.loglevel=0
```

`loglevel` can have a value of 0 or 1.

The default services that should be configured are: 22/tcp (ssh), 23/tcp (telnet), 80/tcp (http), 443/tcp (https), 1494/tcp (ica), 3389/tcp (rdp), 5900/tcp (vnc).

Add other network host

To add any other type of network host with the following details:

setting	value
IP address or DNS name	192.168.3.10
Host name	OfficePC
Description	MyPC
Allowed services	ssh port 22 and https port 443
Log level for services	1

Issue the commands below. If the Host is not a PDU or UPS power device or a server with IPMI power control then leave the device type blank:

```
  # config -s config.sdt.hosts.host4.address=192.168.3.10
  # config -s config.sdt.hosts.host4.description=MyPC
  # config -s config.sdt.hosts.host4.name=OfficePC
  # config -s config.sdt.hosts.host4.device.type=''
  # config -s config.sdt.hosts.host4.tcpports.tcpport1=22
```

```
# config -s config.sdt.hosts.host4.tcpports.tcpport1.loglevel=1
# config -s config.sdt.hosts.host4.udpports.tcppport2=443
# config -s config.sdt.hosts.host4.udpports.tcpport2.loglevel=1
```

Note: `type` *should be left blank.*

If you want to add the new host as a managed device, make sure to use the current total number of managed devices + 1, for the new device number.

To get the current number of managed devices:

```
# config -g config.devices.total
```

Assuming we already have one managed device, our new device will be device 2. Issue the following commands:

```
# config -s config.
devices.device2.connections.connection1.name=192.168.3.10
# config -s config.
devices.device2.connections.connection1.type=Host
# config -s config. devices.device2.name=OfficePC
# config -s config. devices.device2.description=MyPC
# config -s config.devices.total=2
```

The following command will synchronize the live system with the new configuration:

```
# config -r hosts
```

13.1.6. Trusted networks

You can further restrict remote access to serial ports based on the source IP address. To configure this via the command line you need to do the following:

Determine the total number of existing trusted network rules (if you have no existing rules) you can assume this is 0

```
# config -g config.portaccess.total
```

This command should display

```
config.portaccess.total 1
```

If you see `config.portaccess.total` you have 0 rules configured.

Your new rule will be the existing total plus 1. If the previous command gave you 0 start with rule number 1. If you already have 1 rule your new rule will be number 2. And so on.

Assuming you have a previous rule in place, if you want to restrict access to serial port 5 to computers from a single class C network (for example, 192.168.5.0) issue the following commands to add a trusted network:

```
# config -s config.portaccess.rule2.address=192.168.5.0
# config -s "config.portaccess.rule2.description=foo bar"
# config -s config.portaccess.rule2.netmask=255.255.255.0
# config -s config.portaccess.rule2.port5=on
# config -s config.portaccess.total=2
```

The following command will synchronize the live system with the new configuration:

```
  # config -r serialconfig
```

13.1.7. Cascaded ports

To add a new slave device with the following settings:

setting	value
IP address or DNS name	192.168.0.153
Description	Office 42
Label	cm7116-5
Number of ports	16

Issue the following commands:

```
# config -s config.cascade.slaves.slave1.address=192.168.0.153
# config -s "config.cascade.slaves.slave1.description=Office 42"
# config -s config.cascade.slaves.slave1.label=cm7116-5
# config -s config.cascade.slaves.slave1.ports=16
```

The total number of slaves must also be incremented. If this is the first slave being added, type:

```
  # config -s config.cascade.slaves.total=1
```

Increment this value when adding more slaves.

Note: if a slave is added using the CLI, the master SSH public key will need to be manually copied to every slave device before cascaded ports will work (see chapter 3).

The following command will synchronize the live system with the new configuration:

```
  # config -r cascade
```

13.1.8. UPS connections

Managed UPSes

Before adding a managed UPS, make sure that at least 1 port has been configured to run in 'device mode', and that the device is set to 'ups'.

To add a managed UPS with the following values:

setting	value
Connected via	Port 1
UPS name	My UPS
Description	Room 5 UPS
Username to connect to UPS	user2
Password to connect to UPS	A-secret-for-2.
shutdown order	2 (0 shuts down first
Driver	genericups
Driver option	option

Driver argument	argument
Logging	Enabled
Log interval	2 minutes
Run script when power is critical	Enabled

Run the following commands

```
# config -s config.ups.monitors.monitor1.port=/dev/port01
# config -s "config.ups.monitors.monitor1.name=My UPS"
# config -s "config.ups.monitors.monitor1.description=Room 5 UPS"
# config -s config.ups.monitors.monitor1.username=user2
# config -s config.ups.monitors.monitor1.password=A-secret-for-2.
# config -s config.ups.monitors.monitor1.sdorder=2
# config -s config.ups.monitors.monitor1.driver=genericups
# config -s \
config.ups.monitors.monitor1.options.option1.opt=option
# config -s \
config.ups.monitors.monitor1.options.option1.arg=argument
# config -s config.ups.monitors.monitor1.options.total=1
# config -s config.ups.monitors.monitor1.log.enabled=on
# config -s config.ups.monitors.monitor1.log.interval=2
# config -s config.ups.monitors.monitor1.script.enabled=on
```

With regards the first command above, if the port number is higher than 9 (eg port 13) enter the command as follows:

```
# config -s config.ups.monitors.monitor1.port=/dev/port13
```

Also, make sure to increment the total monitors:

```
# config -s config.ups.monitors.total=1
```

Assuming there are already 2 managed devices configured, the 5 commands below will add the UPS to Managed Devices.

```
# config -s \
"config.devices.device3.connections.connection1.name=My UPS"
# config -s \
"config.devices.device3.connections.connection1.type=UPS Unit"
# config -s "config.devices.device3.name=My UPS"
# config -s "config.devices.device3.description=Room 5 UPS"
# config -s config.devices.total=3
```

To delete this managed UPS:

```
# config -d config.ups.monitors.monitor1
```

Note: decrement monitors.total when deleting a managed UPS.

Remote UPSes

To add a remote UPS with the following details (assuming this is our first remote UPS):

setting	value
UPS name	oldUPS

Description	Room 2 UPS
Address	192.168.50.50
Log status	Disabled
Log rate	240 seconds
Run shutdown script	Enabled

```
# config -s config.ups.remotes.remote1.name=oldUPS
# config -s "config.ups.remotes.remote1.description=Room 2 UPS"
# config -s config.ups.remotes.remote1.address=192.168.50.50
# config -d config.ups.remotes.remote1.log.enabled
# config -s config.ups.remotes.remote1.log.interval=240
# config -s config.ups.remotes.remote1.script.enabled=on
# config -s config.ups.remotes.total=1
```

The following command will synchronize the live system with the new configuration:

```
# config -a
```

13.1.9. RPC connections

You can add an RPC connection from the command line but it is not recommended because of dependency issues.

Before adding an RPC, the Management Console GUI code makes sure that at least 1 port has been configured to run in *device mode*, and that the device is set to `rpc`. The CLI-based approach does not do this.

To add an RPC with the following values:

setting	value
RPC type	APC 7900
Connected via	Port 2
UPS name	MyRPC
Description	Room 5 RPC
Login name for device	rpclogin
Login password for device	A-secret-for-2.
SNMP community	v1 or v2c
Logging	enabled
Log interval	600 seconds
Number of power outlets	4

Run the following commands:

```
# config -s config.ports.port2.power.type=APC 7900
# config -s config.ports.port2.power.name=MyRPC
# config -s "config.ports.port2.power.description=Room 5 RPC"
# config -s config.ports.port2.power.username=rpclogin
# config -s config.ports.port2.power.password=A-secret-for-2.
# config -s config.ports.port2.power.snmp.community=v1
# config -s config.ports.port2.power.log.enabled=on
# config -s config.ports.port2.power.log.interval=600
# config -s config.ports.port2.power.outlets=4
```

The following five commands are used by the Management Console to add the RPC to Managed Devices:

```
# config -s \
config.devices.device3.connections.connection1.name=myRPC
# config -s \
"config.devices.device3.connections.connection1.type=RPC Unit"
# config -s config.devices.device3.name=myRPC
# config -s "config.devices.device3.description=Room 5 RPC"
# config -s config.devices.total=3
```

The following command will synchronize the live system with the new configuration:

```
# config -a
```

13.1.10.Environmental

To configure an environmental monitor with the following details:

setting	value
Monitor name	Envi4
Monitor description	Room 5 monitor
Temperature offset	2
Humidity offset	5
Enable alarm 1?	yes
Alarm 1 label	door alarm
Enable alarm 2?	yes
Alarm 2 label	window alarm
Logging enabled?	yes
Log interval	120 seconds

Run the following commands:

```
# config -s config.ports.port3.enviro.name=Envi4
# config -s "config.ports.port3.enviro.description=Room 5 monitor"
# config -s config.ports.port3.enviro.offsets.temp=2
# config -s config.ports.port3.enviro.offsets.humid=5
# config -s config.ports.port3.enviro.alarms.alarm1.alarmstate=on
# config -s \
config.ports.port3.enviro.alarms.alarm1.label=door alarm
# config -s config.ports.port3.enviro.alarms.alarm2.alarmstate=on
# config -s \
config.ports.port3.enviro.alarms.alarm2.label=window alarm
# config -s config.ports.port3.enviro.alarms.total=2
# config -s config.ports.port3.enviro.log.enabled=on
# config -s config.ports.port3.enviro.log.interval=120
```

It is important to assign alarms.total=2 even if they are off.

To get the total number of managed devices:

```
# config -g config.devices.total
```

Use the returned total +1 for the new device when adding this environmental monitor to Managed devices as per the following:

```
# config -s \
config. devices.device5.connections.connection1.name=Envi4
# config -s \
"config. devices.device5.connections.connection1.type=EMD Unit"
# config -s config. devices.device5.name=Envi4
# config -s "config. devices.device5.description=Room 5 monitor"
# config -s config.devices.total=5
```

The following command will synchronize the live system with the new configuration:

```
# config -a
```

13.1.11.Managed devices

To add a managed device: (see chapter 7 for more):

```
# config -s "config.devices.device8.name=8"
# config -s "config.devices.device8.description=the-8th-device"
# config -s \
"config.devices.device8.connections.connection1.name=8"
# config -s \
config.devices.device8.connections.connection1.type=type
# config -s config.devices.total=8
```

`type` can be serial, Host, UPS, or RPC.

To delete the above managed device:

```
# config -d config.devices.device8
```

Note: the `config.devices.total` *total must also be decremented when deleting a managed device.*

The following command will synchronize the live system with the new configuration:

```
# config -a
```

13.1.12.Port log

To configure serial/network port logging:

```
# config -s config.eventlog.server.address=remote-server-ip
# config -s config.eventlog.server.logfacility=facility
# config -s config.eventlog.server.logpriority=priority
```

`facility` and `priority` can take a specific range of values:

variable	allowed values
facility	Daemon Local 0-7 Authentication Kernel User Syslog Mail News UUCP
priority	Info Alert Critical Debug Emergency Error Notice Warning

Assume the remote log server needs a username `name1` and password `A-secret-for-2.`

```
# config -s config.eventlog.server.username=name1
# config -s config.eventlog.server.password=A-secret-for-2.
```

To set the remote path as `/opengear/logs` to save logged data:

```
# config -s config.eventlog.server.path=/opengear/logs
# config -s config.eventlog.server.type=[none|syslog|nfs|cifs|usb]
```

If the server type is set to usb, none of the other values need to be set. The mount point for storing on a remote USB device is `/var/run/portmanager/logdir`.

The following command will synchronize the live system with the new configuration:

```
# config -a
```

13.1.13.Alerts

You can add an email, SNMP or NAGIOS alert by following the steps below.

The general setting for all alerts

Assume this is our second alert, and we want to send email alerts to john@opengear.com and sms alerts to peter@opengear.com:

```
# config -s config.alerts.alert2.description=MySecondAlert
# config -s config.alerts.alert2.email=john@opengear.com
# config -s config.alerts.alert2.email2=peter@opengear.com
```

To use NAGIOS to notify of this alert

```
# config -s config.alerts.alert2.nsca.enabled=on
```

To use SNMP to notify of this alert

```
# config -s config.alerts.alert2.snmp.enabled=on
```

To increment the total alerts:

```
# config -s config.alerts.total=2
```

Below are the specific settings depending on the type of alert required.

Connection alert

To trigger an alert when a user connects to serial port 5 or network host 3:

```
# config -s config.alerts.alert2.host3=hostname
# config -s config.alerts.alert2.port5=on
# config -s config.alerts.alert2.sensor=temp
# config -s config.alerts.alert2.signal=DSR
# config -s config.alerts.alert2.type=login
```

Signal alert

To trigger an alert when a signal changes state on port 1:

```
# config -s config.alerts.alert2.port1=on
# config -s config.alerts.alert2.sensor=temp
# config -s config.alerts.alert2.signal=[DSR | DCD | CTS]
# config -s config.alerts.alert2.type=signal
```

Pattern match alert

To trigger an alert if the regular expression `.*0.0% id` is found in serial port 10’s character stream.

```
# config -s "config.alerts.alert2.pattern=.*0.0% id"
# config -s config.alerts.alert2.port10=on
# config -s config.alerts.alert2.sensor=temp
# config -s config.alerts.alert2.signal=DSR
# config -s config.alerts.alert2.type=pattern
```

UPS power status alert

To trigger an alert when myUPS (on localhost) or thatUPS (on remote host 192.168.0.50) power status changes between on line, on battery and low battery.

```
# config -s config.alerts.alert2.sensor=temp
# config -s config.alerts.alert2.signal=DSR
# config -s config.alerts.alert2.type=ups
# config -s config.alerts.alert2.ups1=myUPS@localhost
# config -s config.alerts.alert2.ups2=thatUPS@192.168.0.50
```

Environmental and power sensor alert

```
# config -s \
config.alerts.alert2.enviro.high.critical=critical-value
# config -s config.alerts.alert2.enviro.high.warning=warning-value
# config -s config.alerts.alert2.enviro.hysteresis=value
# config -s config.alerts.alert2.enviro.low.critical=critical-
value
```

```
# config -s config.alerts.alert2.enviro.low.warning=warning-value
# config -s config.alerts.alert2.enviro1=Enviro-sensor-name
# config -s config.alerts.alert2.outlet#=RPCname.outlet#
# config -s config.alerts.alert2.rpc#=RPC-name
# config -s config.alerts.alert2.sensor=[temp|humid|load|charge]
# config -s config.alerts.alert2.signal=DSR
# config -s config.alerts.alert2.type=enviro
# config -s config.alerts.alert2.ups1=UPSname@hostname
```

`alert2.outlet#` increments sequentially with each added outlet. The second `outlet#` refers to the specific RPC power outlets.

Example 1: to configure a temperature sensor alert for a sensor called `SensorInRoom42`.

```
# config -s config.alerts.alert2.sensor=temp
# config -s config.alerts.alert2.enviro.high.critical=60
# config -s config.alerts.alert2.enviro.high.warning=50
# config -s config.alerts.alert2.enviro.hysteresis=2
# config -s config.alerts.alert2.enviro.low.critical=5
# config -s config.alerts.alert2.enviro.low.warning=10
# config -s config.alerts.alert2.enviro1=SensorInRoom42
# config -s config.alerts.alert2.signal=DSR
# config -s config.alerts.alert2.type=enviro
```

Example2: to configure a load sensor alert for outlets 2 and 4 for an RPC called `RPCInRoom20`:

```
# config -s config.alerts.alert2.outlet1=RPCInRoom20.outlet2
# config -s config.alerts.alert2.outlet2=RPCInRoom20.outlet4
# config -s config.alerts.alert2.enviro.high.critical=300
# config -s config.alerts.alert2.enviro.high.warning=280
# config -s config.alerts.alert2.enviro.hysteresis=20
# config -s config.alerts.alert2.enviro.low.critical=50
# config -s config.alerts.alert2.enviro.low.warning=70
# config -s config.alerts.alert2.rpc1=RPCInRoom20
# config -s config.alerts.alert2.sensor=load
# config -s config.alerts.alert2.signal=DSR
# config -s config.alerts.alert2.type=enviro
```

Alarm sensor alert

The commands below set an alert for `doorAlarm` and `windowAlarm`, two alarms connected to an environmental sensor called `SensorInRoom3`. Both alarms are disabled on Mondays from 08:15 to 14:30.

```
# config -s \
config.alerts.alert2.alarm1=SensorInRoom3.alarm1 (doorAlarm)
# config -s \
config.alerts.alert2.alarm1=SensorInRoom3.alarm2 (windowAlarm)
# config -s config.alerts.alert2.alarmrange.mon.from.hour=8
# config -s config.alerts.alert2.alarmrange.mon.from.min=15
# config -s config.alerts.alert2.alarmrange.mon.until.hour=14
# config -s config.alerts.alert2.alarmrange.mon.until.min=30
# config -s config.alerts.alert2.description='description'
# config -s config.alerts.alert2.sensor=temp
# config -s config.alerts.alert2.signal=DSR
# config -s config.alerts.alert2.type=alarm
```

To enable an alarm for the entire day:

```
# config -s config.alerts.alert2.alarmrange.mon.from.hour=0
# config -s config.alerts.alert2.alarmrange.mon.from.min=0
# config -s config.alerts.alert2.alarmrange.mon.until.hour=0
# config -s config.alerts.alert2.alarmrange.mon.until.min=0
```

The following command will synchronize the live system with the new configuration:

```
# config -r alerts
```

13.1.14.SMTP & SMS

To set-up an SMTP mail or SMS server with the following details:

smtp or sms server setting	value
Outgoing server address	mail.opengear.com
Secure conection type	SSL
Sender	john@opengear.com
Server username	john
Server password	A-little-secret-for-2.
Subject line	SMTP alerts

Run the following commands:

```
# config -s config.system.smtp.server=mail.opengear.com
# config -s config.system.smtp.encryption=SSL
# config -s config.system.smtp.sender=John@opengear.com
# config -s config.system.smtp.username=john
# config -s config.system.smtp.password=A-little-secret-for-2.
# config -s config.system.smtp.subject=SMTP alerts
```

To set-up an SMTP SMS server with the same details as above:

```
# config -s config.system.smtp.server2=mail.opengear.com
# config -s config.system.smtp.encryption2=SSL
# config -s config.system.smtp.sender2=john@opengear.com
# config -s config.system.smtp.username2=john
# config -s config.system.smtp.password2=A-little-secret-for-2.
# config -s config.system.smtp.subject2=SMTP alerts
```

In both setups, the value for `encryption` can be SSL, TLS or None.

The following command will synchronize the live system with the new configuration:

```
# config -a
```

13.1.15.SNMP

To set-up the SNMP agent on the device:

```
# config -s config.system.snmp.protocol=[UDP | TCP]
# config -s config.system.snmp.trapport=port-number
# config -s config.system.snmp.address=NMS-IP-network-address
# config -s config.system.snmp.community=community-name
# config -s config.system.snmp.engineid=ID
# config -s config.system.snmp.username=username
# config -s config.system.snmp.password=password
# config -s config.system.snmp.version=[1 | 2c | 3]
```

The default port number is 162.

The `community` value can only be set on v1 and v2c.

The `engineid`, `username`, and `password` values can only be set on v3.

The following command will synchronize the live system with the new configuration:

```
# config -r auth
```

13.1.16.Administration

To change the administration settings to:

system setting	value
System name	og.example.com
System password (root account password)	A-simple-little-secret-for-2.
Description	Device in office 2

Run the following commands:

```
# config -s config.system.name=og.example.com:
# config -P config.users.user1.password
# config -s "config.system.location="Device in office 2"
```

The second command has an interactive aspect. The -P parameter will prompt the user for a password. Enter the desired string and press Return: `config` will accept and encrypt the string.

Note: any config element value can be encrypted using the -P parameter. Only encrypted user passwords and system passwords are supported, however. If any other element value is encrypted, the value becomes inaccessible and will have to be re-set.

An alternative to the second command above is:

```
# /etc/scripts/user-mod -P root
```

The following command will synchronize the live system with the new configuration:

```
# config -r auth
```

13.1.17.IP settings

To configure the primary network interface with the following static settings:

Network interface setting	value
IP address	192.168.0.23
Netmask	255.255.255.0
Default gateway	192.168.0.1
DNS server 1	192.168.0.1
DNS server 2	192.168.0.2

```
# config -s config.interfaces.wan.address=192.168.0.23
# config -s config.interfaces.wan.netmask=255.255.255.0
# config -s config.interfaces.wan.gateway=192.168.0.1
# config -s config.interfaces.wan.dns1=192.168.0.1
# config -s config.interfaces.wan.dns2=192.168.0.2
# config -s config.interfaces.wan.mode=static
# config -s config.interfaces.wan.media=<value>
```

In the last command, the available options for `<value>` are: Auto, 100baseTx-FD, 100baseTx-HD, 10baseT-HD, and 10baseT-FD.

To configure the management LAN interface, use the same commands as above but replace `config.interfaces.wan` with `config.interfaces.lan`.

To enable bridging between all interfaces:

```
# config -s config.system.bridge.enabled=on
```

To enable IPv6 for all interfaces:

```
# config -s config.system.ipv6.enabled=on
```

To enable the management LAN interface run the following command:

```
# config -d config.interfaces.lan.disabled
# config -r ipconfig
```

Note: not all devices have a management LAN interface.

To configure a failover device in case of an outage:

```
# config -s config.interfaces.wan.failover.address1=ip-address
# config -s config.interfaces.wan.failover.address2=ip-address
# config -s config.interfaces.wan.failover.interface=<interface>
```

In the last command, the available options for `<interface>` are: eth1, console, modem

Network interfaces can also be configured automatically:

```
# config -s config.interfaces.wan.mode=dhcp
# config -s config.interfaces.lan.mode=dhcp
```

Either of the following commands will synchronize the live system with the new configuration:

```
# /bin/config —-run=ipconfig
# config -r ipconfig
```

13.1.18.Date & time settings

To enable NTP using a server at pool.ntp.org issue the following commands:

```
# config -s config.ntp.enabled=on
# config -s config.ntp.server=pool.ntp.org
```

Alternatively, you can manually change the clock settings.

To change running system time:

```
# date MMDDhhmm[CC]YY.ss
# /bin/hwclock --systohc
```

The first command sets a new system time.

Note: the `date` *command uses a US-style order with month (MM) listed before day (DD). Also, although the thousands and hundreds column in the Gregorian Year are theoretically optional, it is strongly recommended that these values be set explicitly.*

The second command saves this new system time to the hardware clock.

Alternatively, to first change the hardware clock and then set the system time to the newly set hardware time :

```
# /bin/hwclock --set --date=MMDDhhmm[CC]YY.ss
# /bin/hwclock --hctosys
```

To change the timezone:

```
# config -s config.system.timezone=US/Eastern
```

The following command will synchronize the live system with the new configuration:

```
# config -r time
```

13.1.19.Dial-in settings

To enable dial-in access on the DB9 serial port from the command line with the following attributes:

setting	value
Local IP address	172.24.1.1
Remote IP address	172.24.1.2
Authentication type	MSCHAPv2
Serial port baud rate	115200
Serial port flow control	Hardware
Custom modem initialization	ATQ0V1H0
Callback phone number	0800223665
User to dial as	user1
Password for user	A-little-secret-for-2.

Run the following commands:

```
# config -s config.console.ppp.localip=172.24.1.1
# config -s config.console.ppp.remoteip=172.24.1.2
# config -s config.console.ppp.auth=MSCHAPv2
# config -s config.console.speed=115200
# config -s config.console.flow=Hardware
# config -s config.console.initstring=ATQ0V1H0
# config -s config.console.ppp.enabled=on
# config -s config.console.ppp.callback.enabled=on
# config -s config.console.ppp.callback.phone1=0800223665
# config -s config.console.ppp.username=user1
# config -s config.console.ppp.password=A-little-secret-for-2.
```

To make the dialed connection the default route:

```
# config -s config.console.ppp.defaultroute=on
```

Supported values for settings that are not fixed or user-created are as follows:

setting	supported values
Authentication type	None, PAP, CHAP, and MSCHAPv2.
Serial port baud rate	9600, 19200, 38400, 57600, 115200, and 230400
Parity values	None, Odd, Even, Mark, and Space
Data bits values	5, 6, 7, and 8
Stop-bit values	1, 1.5, and 2
Serial port flow control	Hardware, Software, and None

If you do not wish to use out-of-band dial-in access the procedure for enabling start-up messages on the console port is documented in chapter 14.3.2.

The following command will synchronize the live system with the new configuration:

```
# config —a
```

13.1.20.DHCP server

To enable the DHCP server on the console management LAN, with the following settings:

DHCP server setting	value
Default lease time	200000 seconds
Maximum lease time	300000 seconds
DNS server 1	192.168.2.3
DNS server 2	192.168.2.4
Domain name	company.com
Default gateway	192.168.0.1
IP pool 1 start address	192.168.0.20
IP pool 1 end address	192.168.0.100
Reserved IP address	192.168.0.50
MAC to reserve IP for	00:1e:67:82:72:d9
Name to identify this host	John-PC

Run the following commands:

```
# config -s config.interfaces.lan.dhcpd.enabled=on
# config -s config.interfaces.lan.dhcpd.defaultlease=200000
# config -s config.interfaces.lan.dhcpd.maxlease=300000
# config -s config.interfaces.lan.dhcpd.dns1=192.168.2.3
# config -s config.interfaces.lan.dhcpd.dns2=192.168.2.4
# config -s config.interfaces.lan.dhcpd.domain=company.com
# config -s config.interfaces.lan.dhcpd.gateway=192.168.0.1
# config -s \
config.interfaces.lan.dhcpd.pools.pool1.start=192.168.0.20
# config -s \
config.interfaces.lan.dhcpd.pools.pool1.end=192.168.0.100
# config -s config.interfaces.lan.dhcpd.pools.total=1
# config -s \
config.interfaces.lan.dhcpd.staticips.staticip1.ip=192.168.0.50
# config -s \
config.interfaces.lan.dhcpd.staticips.staticip1.mac=00:1e:
67:82:72:d9
# config -s \
config.interfaces.lan.dhcpd.staticips.staticip1.host=John-PC
# config -s config.interfaces.lan.dhcpd.staticips.total=1
```

The following command will synchronize the live system with the new configuration:

```
# config -r auth
```

13.1.21.Services

You can manually enable or disable network servers from the command line. For example, if you wanted to guarantee the following server configuration:

service	state
HTTP server	enabled
HTTPS server	disabled
Telnet server	disabled
SSH server	enabled
SNMP server	disabled
Respond to ICMP echo requests (Ping replies)	disabled
TFTP server	enabled

Run the following commands:

```
# config -s config.services.http.enabled=on
# config -d config.services.https.enabled
# config -d config.services.telnet.enabled
# config -s config.services.ssh.enabled=on
# config -d config.services.snmp.enabled
# config -d config.services.pingreply.enabled
# config -s config.services.tftp.enabled=on
```

These services run on default port numbers as follows:

service	default port number
Telnet	2000
SSH	3000
TCP	4000
RFC2217	5000
unauthtel (Unauthorised Telnet)	6000

To set secondary port ranges for any service the following syntax applies:

```
# config -s config.services.<service>.portbase=<number>
```

For example: to set all these services to run on a port number that is ten higher than their default, run the following commands:

```
# config -s config.services.telnet.portbase=2010
# config -s config.services.ssh.portbase=3010
# config -s config.services.tcp.portbase=4010
# config -s config.services.rfc2217.portbase=5010
# config -s config.services.unauthtel.portbase=6010
```

The following command will synchronize the live system with the new configuration:

```
# config -r auth
```

13.1.22.Nagios

To configure NAGIOS with the following settings:

setting	value	notes
NAGIOS host name	cm7116	Name of this system.
NAGIOS host address	192.168.0.1	Address of this system.
NAGIOS server address	192.168.0.10	Address of upstream NAGIOS server
Enable SDT for NAGIOS ext	Enabled	
SDT gateway address	192.168.0.1	Defaults to host address.
Prefer NRPE over NSCA	Disabled	Defaults to disabled.

Run the following commands:

```
# config -s config.system.nagios.enabled=on
# config -s config.system.nagios.name=cm7116
# config -s config.system.nagios.address=192.168.0.1
# config -s config.system.nagios.server.address=192.168.0.10
# config -s config.system.nagios.sdt.disabled=on
# config -s config.system.nagios.sdt.address=192.168.0.1
# config -s config.system.nagios.nrpe.prefer=''
```

The fifth command disables SDT for Nagios extensions.

To configure NRPE with following settings:

setting	value	notes
NRPE port	5600	Port to listen on for nrpe. Defaults to 5666.
NRPE user	user1	User to run as. Defaults to nrpe.
NRPE group	group1	Group to run as. Defaults to nobody.
Allow command arguments	Enabled	

Run the following commands:

```
# config -s config.system.nagios.nrpe.enabled=on
# config -s config.system.nagios.nrpe.port=5600
# config -s config.system.nagios.user=user1
# config -s config.system.nagios.nrpe.group=group1
# config -s config.system.nagios.nrpe.cmdargs=on
```

To configure NSCA with the following settings:

setting	value	notes
NSCA encryption	BLOWFISH	can be None, XOR, DES, TRPLEDES, CAST-256, BLOWFISH, TWOFISH, RIJNDAEL-256, SERPENT, GOST
NSCA password	secret	
NSCA check-in interval	2 minutes	
NSCA port	5650	Defaults to 5667
User to run as	user1	Defaults to nsca
Group to run as	group1	Defaults to nobody

Run the following commands

```
# config -s config.system.nagios.nsca.enabled=on
# config -s config.system.nagios.nsca.encryption=BLOWFISH
# config -s config.system.nagios.nsca.secret=secret
# config -s config.system.nagios.nsca.interval=2
# config -s config.system.nagios.nsca.port=5650
# config -s config.system.nagios.nsca.user=user1
# config -s config.system.nagios.nsca.group=group1
```

The following command will synchronize the live system with the new configuration:

```
# config -r auth
```

14. Advanced configuration

Opengear *console servers* run the embedded Linux operating system. *Administrator* class users can configure the *console server* and monitor and manage attached serial console and host devices from the command line using Linux commands and the config utility (as described in chapter 13).

The Linux kernel in the console server also supports GNU bash shell scripts, enabling the *Administrator* to run custom scripts. This chapter presents a number of useful scripts and scripting tools including

- `delete-node`, which is a general script for deleting users, groups, hosts, UPS's etc.
- `ping-detect`, which will run specified commands when a specific host stops responding to ping requests.

This chapter then details how to perform advanced and custom management tasks using Opengear commands, Linux commands and the open source tools embedded in the console server:

- `portmanager` serial port management.
- raw data access to the ports and modems.
- `iptables` modifications and updating IP filtering rules.
- retrieving status information using SNMP and modifying SNMP with net-snmpd.
- public key authenticated SSH communications.

- SSL, configuring HTTPS and issuing certificates.
- using `pmpower` for NUT and `PowerMan` power device management.
- using `IPMItools`.
- CDK custom development kit.
- sms server tools.
- disabling multicasting.

14.1. Custom scripting

The *console server* supports GNU bash shell commands (see appendix 1) enabling the Administrator to run custom scripts.

14.1.1. Custom script to run when booting

The `/etc/config/rc.local` script runs whenever the system boots. By default this script file is empty. You can add any commands to this file if you want them to be run at boot time. For example, if you want to display hello world, add the following to `rc.local`:

```
#!/bin/sh
echo "Hello World!"
```

If this script has been copied from a Windows machine you may need to run the following command on the script before bash can run it successfully:

```
# dos2unix /etc/config/rc.local
```

Another scenario would be to call another custom script from the `/etc/config/rc.local` file, ensuring that your custom script will run whenever the system is booted.

14.1.2. Running custom scripts when alerts are triggered

Whenever an alert gets triggered, specific scripts get called. These scripts all reside in `/etc/scripts/`. Below is a list of the default scripts that get run for each applicable alert.

- For a connection alert (when a user connects or disconnects from a port or network host):

  `/etc/scripts/portmanager-user-alert` (for port connections).
  `/etc/scripts/sdt-user-alert` (for host connections).

- For a signal alert (when a signal on a port changes state):

  `/etc/scripts/portmanager-signal-alert`

- For a pattern match alert (when a specific regular expression is found in the serial ports character stream):

  `/etc/scripts/portmanager-pattern-alert`

- For a UPS status alert (when the UPS power status changes between on line, on battery, and low battery):

  `/etc/scripts/ups-status-alert`

- For an environmental, power and alarm sensor alerts (temperature, humidity, power load and battery charge alerts):

  `/etc/scripts/environmental-alert`

- For an interface failover alert:

  `/etc/scripts/interface-failover-alert`

All these scripts do a check to see whether you have created a custom script to run instead. The code that does this check is shown below (an extract from the file `/etc/scripts/portmanager-pattern-alert`):

```
# If there's a user-configured script, run it instead
scripts[0]="/etc/config/scripts/pattern-alert.${ALERT_PORTNAME}"
scripts[1]="/etc/config/scripts/portmanager-pattern-alert"
for (( i=0 ; i < ${#scripts[@]} ; i++ )); do
    if [ -f "${scripts[$i]}" ]; then
        exec /bin/sh "${scripts[$i]}"
    fi
done
```

This code shows that there are two alternative scripts that can be run instead of the default one. This code first checks whether a file — `/etc/config/scripts/pattern-alert.${ALERT_PORTNAME}` — exists.

Note: The variable `${ALERT_PORTNAME}` *must be replaced with* `port01` *or* `port13` *or whichever port the alert should run for.*

If this file cannot be found, the script checks whether the file `/etc/config/scripts/portmanager-pattern-alert` exists.

If either of these files exists, the script calls the exec command on the first file that it finds and runs that custom file/script instead.

As an example, you can copy the `/etc/scripts/portmanager-pattern-alert` script file to `/etc/config/scripts/portmanager-pattern-alert`:

- `# cd /`

- `# mkdir /etc/config/scripts`

Note: this command assumes the directory created does not already exist.

-
  ```
  # cp /etc/scripts/portmanager-pattern-alert \
  /etc/config/scripts/portmanager-pattern-alert
  ```

The next step is to edit the new script file.

- Open the file `/etc/config/scripts/portmanager-pattern-alert` using `vi` (or other text editor).

- remove the lines that check for a custom script (the code from above).

This will prevent the new custom script from repeatedly calling itself.

After these lines have been removed, edit the file, or add any additional scripting to the file.

14.1.3. Example script: power cycling on pattern match

If for example we had an RPC (PDU) connected to port 1 on a *console server* and also have some telecommunications device connected to port 2 and which is powered by the RPC outlet 3. Now assume the telecom device transmits a character stream *Emergency* out on its serial console port every time that it encounters some specific error, and the only way to fix this error is to power cycle the telecom device.

The first step is to setup a pattern-match alert on port 2 to check for the pattern *Emergency*.

Next we need to create a custom script to deal with this alert:

```
# cd /
# mkdir /etc/config/scripts
/* if the directory does not already exist */
# cp /etc/scripts/portmanager-pattern-alert \
     /etc/config/scripts/portmanager-pattern-alert
```

Note: make sure to remove the if statement (which checks for a custom script) from the new script, in order to prevent an infinite loop.

The `pmpower` utility is used to send power commands to RPC device in order to power cycle our telecom device:

```
# pmpower -l port01 -o 3 cycle
```

The RPC is on serial port 1. The telecom device is powered by RPC outlet 3.

We can now append this command to our custom script. This will guarantee that our telecom device will be power cycled every time the console reads the *Emergency* character stream on port 2.

14.1.4. Example script: multiple e-mail notifications on each alert

If you desire to send more than one email when an alert triggers, you have to create a replacement script using the method described above and add the appropriate lines to your new script.

Currently, there is a script `/etc/scripts/alert-email` which gets run from within all the alert scripts (for example `portmanager-user-alert` or `environmental-alert`). The `alert-email` script is responsible for sending the email. The line which invokes the email script looks as follows:

```
/bin/sh /etc/scripts/alert-email $suffix &
```

If you wish to send another email to a single address or the same email to many recipients, edit the custom script appropriately. You can follow the examples in any of the seven alert scripts listed above. Consider the `portmanager-user-alert` script. If you need to send the same alert email to more than one email address, find the lines in the script responsible for invoking the alert-email script, then add the following lines below the existing lines:

```
export TOADDR="emailaddress@domain.com"
/bin/sh /etc/scripts/alert-email $suffix &
```

These two lines assign a new email address to `TOADDR` and invoke the alert-email script in the background.

14.1.5. Deleting configuration values from the CLI

The `delete-node` script is provided to help with deleting nodes from the command line. The `delete-node` script takes one argument, the node name you want to delete (for example `config.users.user1` or `config.sdt.hosts.host1`).

`delete-node` is a general script for deleting any node you desire (users, groups, hosts, UPS's etc) from the command line. The script deletes the specified node and shuffles the remainder of the node values.

For example if we have five users configured and we use the script to delete user 3, then user 4 will become user 3, and user 5 will become user 4.

This creates an obvious complication as this script does **not** check for any other dependencies that the node being deleted may have had. So you are responsible for making sure that any references and dependencies connected to the deleted node are removed or corrected in the `config.xml` file.

The script treats all nodes the same. The syntax to run the script is

```
# ./delete-node {node name}
```

so to remove, for example, user 3:

```
# ./delete-node config.users.user3
```

The delete-note script

```
# !/bin/bash
# User must provide the node to be removed. eg "config.users.user1"
# Usage: delete-node {full node path}

if [ $# != 1 ]
then
    echo "Wrong number of arguments"
    echo "Usage: delnode {full '.' delimited node path}"
    exit 2
fi

# test for spaces
TEMP=`echo "$1" | sed 's/.* .*/N/'`
if [ "$TEMP" = "N" ]
then
    echo "Wrong input format"
    echo "Usage: delnode {full '.' delimited node path}"
    exit 2
fi

# testing if node exists
TEMP=`config -g config | grep "$1"`
if [ -z "$TEMP" ]
then
    echo "Node $1 not found"
    exit 0
fi
```

```
# LASTFIELD: last field in the node path. eg "user1"
# ROOTNODE: upper level of the node. eg "config.users"
# NUMBER: integer value extracted from LASTFIELD e.g. "1"
# TOTALNODE: node name for the total e.g. "config.users.total"
# TOTAL: value of the total number of items before deleting eg "3"
# NEWTOTAL: modified total i.e. TOTAL-1
# CHECKTOTAL checks if TOTAL is the actual total items in .xml

LASTFIELD=${1##*.}
ROOTNODE=${1%.*}
NUMBER=`echo $LASTFIELD | sed 's/^[a-zA-Z]*//g'`
TOTALNODE=`echo ${1%.*} | sed 's/\(.*\)/\1.total/'`
TOTAL=`config -g $TOTALNODE | sed 's/.* //'`
NEWTOTAL=$[ $TOTAL -1 ]

# Make backup copy of config file
cp /etc/config/config.xml /etc/config/config.bak
echo "backup of /etc/config/config.xml saved in /etc/config/
config.bak"

if [ -z $NUMBER ] # test whether a singular node is being \
                  # deleted e.g. config.sdt.hosts
then

    echo "Deleting $1"
    config -d "$1"

    echo Done
    exit 0

elif [ $NUMBER = $TOTAL ] # Test if only one item exists
then
    echo "only one item exists"
    # Deleting node
    echo "Deleting $1"
    config -d "$1"

    # Modifying item total.
    config -s "$TOTALNODE=0"

    echo Done
    exit 0

elif [ $NUMBER -lt $TOTAL ] # more than one item exists
then

    # Modify the users list so user numbers are sequential
    # by shifting the users into the gap one at a time...

   echo "Deleting $1"

    LASTFIELDTEXT=`echo $LASTFIELD | sed 's/[0-9]//g'`
    CHECKTOTAL=`config -g $ROOTNODE.$LASTFIELDTEXT$TOTAL`

    if [ -z "$CHECKTOTAL" ]
    then
        echo "WARNING: "$TOTALNODE" greater than number of items"
    fi

    COUNTER=1
    while [ $COUNTER != $((TOTAL-NUMBER+1)) ]
    do
       config -g $ROOTNODE.$LASTFIELDTEXT$((NUMBER+COUNTER)) \
        | while read LINE
        do
            config -s \
            "`echo "$LINE" | sed -e "s/$LASTFIELDTEXT$((NUMBER+ \
            COUNTER))/$LASTFIELDTEXT$((NUMBER+COUNTER-1))/" \
            -e 's / /=/'`"
        done
        let COUNTER++
    done

    # deleting last user
    config -d $ROOTNODE.$LASTFIELDTEXT$TOTAL

    # Modifying item total.
    config -s "$TOTALNODE=$NEWTOTAL"

    echo Done
    exit 0

else
    echo "error: item being deleted has an index greater than total
items. Increase the total count variable."
    exit 0
fi
```

14.1.6. Power cycle any device upon a ping request failure

The `ping-detect` script is designed to run specified commands when a monitored host stops responding to ping requests.

The first parameter taken by the `ping-detect` script is the hostname or IP address of the device to ping. Any other parameters are then regarded as a command to run whenever the ping to the host fails. `ping-detect` can run any number of commands.

Below is an example using `ping-detect` to power cycle an RPC (PDU) outlet whenever a specific host fails to respond to a ping request. `ping-detect` is run from `/etc/config/rc.local` to make sure that the monitoring starts whenever the system boots.

We assume we have a serially controlled RPC connected to port01 on a *console server* and have a router powered by outlet 3 on the RPC and the router has an internal IP address of 192.168.22.2. The following instructions will show you how to continuously ping the router and, when the router fails, to respond to a series of pings, the *console server* will send a command to RPC outlet 3 to power cycle the router, and write the current date/time to a file.

- Copy the `ping-detect` script to `/etc/config/scripts/` on the *console server*.

- Open `/etc/config/rc.local` using `vi` (or another text editor).
- Add the following line to `rc.local`:

  ```
  /etc/config/scripts/ping-detect 192.168.22.2 /bin/bash -c \
  "pmpower -l port01 -o 3 cycle && date" > /tmp/output.log &
  ```

The above command will cause the `ping-detect` script to continuously ping the host at 192.168.22.2, which is the router. If the router crashes it will no longer respond to ping requests. If this happens, the two commands `pmpower` and `date` will run. The output from these commands is sent to the file `/tmp/output.log` so that we have some kind of record. The `ping-detect` is also run in the background using the `&`.

The `rc.local` script is only run by default when the system boots. You can manually run the `rc.local` script or the `ping-detect` script if desired.

The above is just one example of using the `ping-detect` script. The idea of the script is to run any number of commands when a specific host stops responding to ping requests. Here are details of the `ping-detect` script itself.

The ping-detect script

```
# !/bin/sh
# Usage: ping-detect HOST [COMMANDS...]
# This script takes 2 types of arguments: hostname/IPaddress
# to ping, and the commands to run if the ping fails 5 times
# in a row. This script can only take one host/IPaddress per
# instance. Multiple independent commands can be sent to the
# script. The commands will be run one after the other.
#
# PINGREP is the entire reply from the ping command
# LOSS is the percentage loss from the ping command
# $1 must be the hostname/IPaddress of device to ping
# $2... must be the commands to run when the pings fail.

COUNTER=0
TARGET="$1"
shift
# loop indefinitely:
while true
do
    # ping the device 10 times
    PINGREP=`ping -c 10 -i 1 "$TARGET" `
    # get the packet loss percentage
    LOSS=`echo "$PINGREP" | grep "%" | \
    sed -e 's/.* \([0-9]*\)% .*/\1/'`
    if [ "$LOSS" -eq "100" ]
    then
        COUNTER=`expr $COUNTER + 1`
    else
        COUNTER=0
        sleep 30s
    fi
    if [ "$COUNTER" -eq 5 ]
```

```
        then
            COUNTER=0
            "$@"
            sleep 2s
        fi
done
```

14.1.7. Running custom scripts when a configurator is invoked

A configurator is responsible for reading the values in `/etc/config/config.xml` and making the appropriate changes live. Some changes made by the configurators are part of the Linux configuration itself such as user passwords or `ipconfig`.

Currently there are nineteen configurators, each one responsible for a specific group of config. For example, the *users* configurator makes the user configurations in the `config.xml` file live. To see all the available configurators type the following from a command line prompt:

```
# config
```

When a change is made using the Management Console web GUI the appropriate configurator is automatically run. This can be problematic. If another *user* or *administrator* makes a change using the Management Console the configurator could possibly overwrite any custom CLI/linux configurations you may have set.

The solution is to create a custom script that runs after each configurator has run. So after each configurator runs it will check whether that appropriate custom script exists. You can then add any commands to the custom script and they will be invoked after the configurator runs.

The custom scripts must be in the correct location:

```
/etc/config/scripts/config-post-
```

To create an alerts custom script:

```
# cd /etc/config/scripts
# touch config-post-alerts
# vi config-post-alerts
```

This script could be used to recover a specific backup config or overwrite a config or make copies of config files etc.

14.1.8. Backing-up the configuration and restoring using a local USB stick

The `/etc/scripts/backup-usb` script has been written to save and load custom configuration using a USB flash disk. Before saving a configuration locally, you must prepare the USB storage device for use. To do this, disconnect all USB storage devices except for the storage device you wish to use.

Usage:

```
/etc/scripts/backup-usb COMMAND [FILE]
```

command	notes
check-magic	Check volume label.
set-magic	Set volume label.
save *file*	Save configuration to USB.
delete *file*	Delete a configuration tarball from USB.
list	List available config backups on USB
load *file*	Load a specific config from USB.
load-default	Load the default configuration.
set-default *file*	Set which file becomes the default.

The first thing to do is to check if the USB disk has a label:

```
 # /etc/scripts/backup-usb check-magic
```

If this command returns *Magic volume not found*, then run the following command:

```
# /etc/scripts/backup-usb set-magic
```

To save the configuration:

```
# /etc/scripts/backup-usb save config-20May
```

To check if the backup was saved correctly:

```
# /etc/scripts/backup-usb list
```

If this command does not display ** config-20May* then there was an error saving the configuration.

The `set-default` command takes an input file as an argument and renames it to `default.opg`. This default configuration remains stored on the USB disk. The next time you want to load the default config, it will be sourced from the new `default.opg` file. To set a config file as the default:

```
# /etc/scripts/backup-usb set-default config-20May
```

To load this default:

```
# /etc/scripts/backup-usb load-default
```

To load any other config file:

```
# /etc/scripts/backup-usb load {filename}
```

The `/etc/scripts/backup-usb` script can be executed directly with various *commands* or called from other custom scripts you may create. However it is recommended that you do not customize the `/etc/scripts/backup-usb` script itself.

14.1.9. Backing-up the configuration off-box

If you do not have a USB port on your *console server* you can back up the configuration to an off-box file. Before backing up you need to arrange a way to transfer the backup off-box. This could be via an NFS share, a Samba (Windows) share to USB storage or copied off-box via the network. If backing up directly to off-box storage, make sure it is mounted.

`/tmp` is not a good location for the backup except as a temporary location before transferring it off-box. The `/tmp` directory will not survive a reboot. The `/etc/config` directory is not a good place either: it will not survive a restore.

Backup and restore should be done by the *root* user to ensure correct file permissions are set. The `config` command is used to create a backup tarball:

```
# config -e <Output File>
```

The tarball will be saved to the indicated location. It will contain the contents of the `/etc/config/` directory in an uncompressed and unencrypted form.

Example nfs storage:

```
# mount -t nfs 192.168.0.2:/backups /mnt # config -e /mnt/ \
cm7116.config
```

```
# umount/mnt/
```

Example transfer off-box via `scp`:

```
# config -e /tmp/cm7116.config
# scp /tmp/cm7116.config username@192.168.0.2:/backups
```

The config command is also used to restore a backup:

```
# config -i <Input File>
```

This will extract the contents of the previously created backup to `/tmp`, and then synchronize the `/etc/config` directory with the copy in `/tmp`.

One problem that can crop up here is that there is not enough room in `/tmp` to extract files to. The following command will temporarily increase the size of `/tmp`:

```
# mount -t tmpfs -o remount,size=2048k tmpfs /var
```

If restoring to either a new unit or one that has been factory defaulted, it is important to make sure that the process generating SSH keys is either stopped or completed before restoring configuration. If this is not done, then a mix of old and new keys may be put in place.

SSH uses these keys to avoid man-in-the-middle attacks, logging in may be disrupted.

14.2. Advanced PortManager

Opengear's `portmanager` manages *console server* serial ports. It routes network connections to serial ports, checks permissions, and monitors and logs all data flowing to and from ports.

14.2.1. PortManager commands

pmshell

The `pmshell` command behaves similarly to standard `tip` or `cu` commands, but all serial port access is directed via the `portmanager`.

For example, to connect to port 8 via the portmanager:

```
# pmshell -l port08
```

pmshell commands

Once connected, the `pmshell` command supports a subset of the ~ escape commands that `tip` and `cu` support. For SSH you must prefix the escape with an additional ~ character. That is, over SSH use the ~~ escape sequence.

Firmware v3.5.2 and later includes the `pmshell` chooser escape command. You can now use `~m` (or `~~m` over SSH) from connected serial port to drop back to `pmshell`.

For *console servers* running firmware v3.11.0 and later, `pmshell` has a set of key sequences built in to access things like the power menu, return to the serial port selection menu and so on.

command	over ssh	notes
~b	~~b	Generates a BREAK on the connected-to serial port.
~h	~~h	Generates a history on the connected-to serial port. Depends on port logging being enabled.
~p	~~p	Opens the power menu for the connected-to serial port. Said port must be configured for an RPC.
~m	~~m	Connect to the port menu. Goes back to the serial port selection menu.
~?	~~?	Shows the pmshell help message.
~	~~	Quits pmshell.
~rts=[x]	~~rts=[x]	Sets RTS to [x].
-signals	-signals	Shows all signals: 3DSR=1, DTR=1, CTS=1, RTS=1, DCD=0.
-getline	-getline	Reads a line of text from the serial port.

Extra controls (key sequences) can be added to the built in set of key sequences and can be configured per serial port. You can have all ports behave the same or selectively add control sequences to ports. The controls can be different from port to port for the same function.

For example, you could configure `pmshell` such that when you are using serial port 2, pressing Ctrl+p would take you straight to the power menu for that port.

The `pmshell` control commands are configurable only via the command line.

Note: The pmshell help message is **not** *updated with information about any custom control command keys that are configured.*

There is a helper script which will configure a control command on a range of serial ports to eliminate the cumbersome task of entering the configuration command for every port. You will still need to use this script once per control function (see below) but there are only six of these.

per port control command config parameters	notes
config.ports.portX.ctrlcode.break	Generates a BREAK.
config.ports.portX.ctrlcode.portlog	View history
config.ports.portX.ctrlcode.power	open power menu
config.ports.portX.ctrlcode.chooser	connect to port menu
config.ports.portX.ctrlcode.quit	exit pmshell
config.ports.portX.ctrlcode.help	show help message

As an example, to configure Ctrl+p to open the power menu when using serial port 3, enter the following in the console server's command shell:

```
config -s config.ports.port3.ctrlcode.power=16
killall -HUP portmanager
```

The first command sets the power menu command to listen for Ctrl+p. *Decimal 16* is the character code sent when you press Ctrl+p in the serial port session (see the control codes table immediately below).

The second command — `killall -HUP portmanager` — tells portmanager to reload the configuration so that the new control code will take effect. Rebooting the device would also work.

There is a script to set serial control codes on a range of ports so that bulk port configuration can be performed more easily. For example to set the power menu control code to CTRL-P (keycode 16) on ports 4 to 10 inclusive, enter the following at the command line:

```
/etc/scripts/set-serial-control-codes 4 10 power 16
```

This sets the power menu control key to Ctrl+p.

Note: If you've not configured anything on a particular serial port in the included range, configuration for that port will be skipped.

control code	decimal	control code	decimal	control code	decimal
ctrl+a	1	ctrl+j	10	ctrl+s	19
ctrl+b	2	ctrl+k	11	ctrl+t	20
ctrl+c	3	ctrl+l	12	ctrl+u	21
ctrl+d	4	ctrl+m	13	ctrl+v	22
ctrl+e	5	ctrl+n	14	ctrl+w	23
ctrl+f	6	ctrl+o	15	ctrl+x	24
ctrl+g	7	ctrl+p	16	ctrl+y	25
ctrl+h	8	ctrl+q	17	ctrl+z	26
ctrl+i	9	ctrl+r	18		

pmchat

The `pmchat` command is similar to the standard `chat` command, but all serial port access is directed via the `portmanager`.

For example, to run a chat script via the portmanager:

```
# pmchat -v -f /etc/config/scripts/port08.chat < /dev/port08
```

For more information on using `chat` and `pmchat` you should consult the utility's manual page, via the `man chat` command on any Linux or UNIX (including macOS) system, or via the web, including at https://linux.die.net/man/8/chat.

pmusers

The `pmusers` command is used to query the portmanager for active user sessions.

For example, to detect which users are currently active on which serial ports:

```
# pmusers
```

This will output nothing if there are no active users currently connected to any ports. If users are connected it will respond with a sorted list of usernames per active port. For example:

```
Port 1:
    user1
    user2
Port 2:
    user1
Port 8:
    user2
```

The above output indicates that a user named `user1` is actively connected to ports 1 and 2, while `user2` is connected to both ports 1 and 8.

With firmware v3.11 and later the `pmusers` command is extended with the `--disconnect` option. This allows an *administrator* or *root* to disconnect console server sessions from the command line. The following connection types can be disconnected:

telnet
SSH
Raw TCP
Unauthorized Telnet

The `--disconnect` option cannot disconnect an RFC2217 session.

If the `--disconnect` option is specified, the `pmusers` command goes into disconnect mode where you can specify users with `-u` and ports with `-l` (by label) or `-n` (by name).

By default the command will prompt the user before actually disconnecting the matching sessions. This can be overriden with the `--no-prompt` argument.

Some example `pmuser` sessions:

```
# pmusers --disconnect
  Disconnect all users from all ports? (y/n)
  y
  5 sessions were disconnected

# pmusers --disconnect -u robertw
  Disconnect user robertw from all ports? (y/n)
  y
  1 session was disconnected

  # pmusers --disconnect -u robertw -n 5
  Disconnect user robertw from port 5 (BranchRouter01)? (y/n)
  y
  No sessions were disconnected

# pmusers --disconnect -n 5
  Disconnect all users from port 5 (BranchRouter01)? (y/n)
  y
  2 sessions were disconnected

# pmusers --disconnect -u robertw -u pchunt -n 4 -n 6
  Disconnect users robertw, pchunt from ports 4, 6? (y/n)
```

```
   y
   10 sessions were disconnected
```

```
# pmusers --disconnect -u tester --no-prompt
  No sessions were disconnected
```

portmanager dæmon

There is normally no need to stop and restart the dæmon. To restart the dæmon normally, just run the command:

```
# portmanager
```

Supported command line options are:

option	purpose
-nodaemon	Force portmanager to run in the foreground
--loglevel={debug | info |warn | error | alert}	Set the level of debug logging
-c /etc/config/portmanager.conf	Change which configuration file it uses

signals

Sending a SIGHUP signal to the portmanager will cause it to re-read its configuration file.

14.2.2. External scripts & alerts

The portmanager has the ability to execute external scripts on certain events.

When a port is opened by the portmanager

When `portmanager` opens a port, it attempts to execute `/etc/config/scripts/portXX.init` (where `XX` is the number of the port, for example `08`). The script is run with `STDIN` and `STDOUT` both connected to the serial port.

If the script cannot be executed, portmanager executes `/etc/config/scripts/portXX.chat` via the chat command on the serial port.

When an alert occurs on a port

When an alert occurs on a port, `portmanager` attempts to execute `/etc/config/scripts/portXX.alert` (where `XX` is the port number, for example `08`).

The script is run with `STDIN` containing the data which triggered the alert, and `STDOUT` redirected to `/dev/null`, *not* to the serial port.

If you wish to communicate with the port, use `pmshell` or `pmchat` from within the script.

If the script cannot be executed, the alert will be mailed to the address configured in the system administration section.

When a user connects to any port

If a file called `/etc/config/pmshell-start.sh` exists it is run when a *user* connects to a port. It is provided 2 arguments, the *Port number* and the *Username*. Here is a simple example:

```
</etc/config/pmshell-start.sh>
#!/bin/sh
```

```
PORT="$1"
USER="$2"
echo "Welcome to port $PORT $USER"
</etc/config/pmshell-start.sh>
```

The return value from the script controls whether the user is accepted or not, if 0 is returned (or nothing is done on exit as in the above script) the user is permitted, otherwise the user is denied access.

Here is a more complex script which reads from configuration to display the port label if available and denies access to the root user:

```
</etc/config/pmshell-start.sh>
#!/bin/sh
PORT="$1"
USER="$2"
LABEL=$(config -g config.ports.port$PORT.label | cut -f2- -d' ')
if [ "$USER" == "root" ]; then
    echo "Permission denied for Super User"
    exit 1
fi
if [ -z "$LABEL" ]; then
    echo "Welcome $USER, you are connected to Port $PORT"
else
    echo "Welcome $USER, you are connected to Port $PORT ($LABEL)"
fi
</etc/config/pmshell-start.sh>
```

14.3. Raw access to serial ports

14.3.1. Access to serial ports

You can use `tip` and `stty` to completely bypass the `portmanager` and have raw access to the serial ports.

When you run `tip` on a portmanager-controlled port, `portmanager` closes that port, and stops monitoring it until `tip` releases control of it.

With `stty`, the changes made to the port only persist until that port is closed and opened again. Using `stty` for more than initial debugging of a serial connection is not recommended.

If you want to use `stty` to configure a port, you can put `stty` commands in `/etc/config/scripts/portXX.init` which gets run whenever `portmanager` opens the port Otherwise, any setup you do with `stty` will be lost when `portmanager` opens the port.

Note: portmanager sets things back to its config rather than using whatever is on the port, so the port is in a known good state, and will work, no matter what things are done to the serial port outside of portmanager.

14.3.2. Accessing the console modem port

Console dial-in is handled by `mgetty`, with automatic PPP login extensions. `mgetty` is a smart `getty` replacement, designed for Hayes-compatible data and data/fax modems.

`mgetty` knows about modem initialization, manual modem answering (so your modem doesn't answer if the machine isn't ready), and UUCP locking (so you can use the same device for dial-in and dial-out). `mgetty` provides extensive logging facilities. All standard `mgetty` options are supported.

Modem initialization strings

To override the standard modem initialization string either use the Management Console (see chapter 4) or the command line `config` tool (see chapter 14).

Enabling boot messages on the console

If you are not using a modem on the DB9 console port and instead wish to connect to it directly via a Null Modem cable you may want to enable verbose mode allowing you to see the standard linux start-up messages. This can be achieved with the following commands:

```
# /bin/config --set=config.console.debug=on # /bin/config \
--run=console # reboot
```

If at some point in the future you chose to connect a modem for dial-in out-of-band access the procedure can be reversed with the following commands:

```
# /bin/config --del=config.console.debug
# /bin/config --run=console # reboot
```

14.4. IP filtering

The *console server* uses the `iptables` utility to provide a stateful firewall of LAN traffic.

By default, rules are automatically inserted to allow access to enabled services, and serial port access via enabled protocols. The commands which add these rules are in configuration files:

```
/etc/config/fw.rules
```

This is an executable shell script which is run whenever the LAN interface is brought up and whenever modifications are made to the iptables configuration as a result of CGI actions or the config command line tool.

The basic steps performed are as follows:

- the running `iptables` configuration is erased, per-interface.
- other standard system chains are installed.
- fall-through Block rules (default deny) are installed.
- **Serial & Network** > **Services** policies are installed in per-interface chains.
- **Custom Serial & Network** > **Firewall** rules are inserted at the top of the rule sets, taking priority over any other configuration

For further firewall customization, extra rules can be persisted by creating a file at `/etc/config/scripts/firewall-post` containing `iptables` commands to amend the firewall policy.

Thorough documentation regarding iptables is available at the Linux netfilter website, at https://netfilter.org/documentation/.

14.5. SNMP status reporting

Console servers contain an SNMP Service — `snmpd` — which can provide status information on demand. `snmpd` is an SNMP agent which binds to a port and awaits requests from SNMP management software. Upon receiving a request, it processes the request(s), collects the requested information and/or performs the requested operation(s) and returns the information to the sender.

Note: initially only advanced console server models were equipped with an SNMP Service. With firmware v3.0 and later this support was extended to all console servers. Also the MIBS were extended (and renamed for compliance) with this firmware release.

Console servers can also be configured to send SNMP traps or messages to multiple remote SNMP Network Managers on defined trigger events. See chapter 6 for configuration details.

14.5.1. Retrieving status information using SNMP

Console servers can provide serial and device status information through SNMP. This includes

- Serial port status
- Active users
- Remote Power Control (RPC) and Power Distribution Unit (PDU) status
- Environmental Monitoring Device (EMD) status
- Signal alert status
- Environmental alert status and
- UPS alert status

The MIBs in your *console server* are located in `/etc/snmp/mibs`. They include:

MIB	notes
OG-STATUS-MIB	Contains serial and connected device status information for `snmpstatusd` and `snmpalertd`.
OG-STATUSv2-MIB	This MIB contains extended status and alerts.
OG-SMI-MIB	Enterprise structure of management information.
OGTRAP-MIB	SMIv1 traps from old MIBS as `smilint` will not let SMIv1 structures coexist with SMIv2.
OGTRAPv2-MIB	Updated traps.

14.5.2. Check firewall rules

- Navigate to **System > Services**.
- Check the *SNMP dæmon* checkbox for the required interface.

  This allows SNMP requests through the specified interface’s firewall.

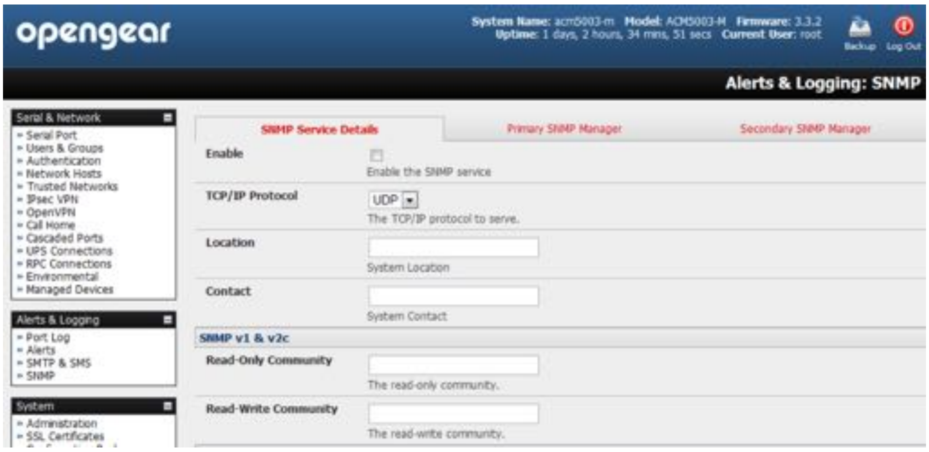
14.5.3. Enable SNMP service

Console servers support different SNMP versions including SNMPv1, SNMPv2c and SNMPv3.

Although an industry standard, SNMP brings with it a variety of security concerns. For example, SNMPv1 and SNMPv2c offer no inherent privacy, while SNMPv3 is susceptible to man-in-the-middle attacks. Recent IETF developments suggest tunnelling SNMP over widely accepted technologies such as SSH (Secure Shell) or TLS (Transport Layer Security) rather than relying on a less mature security systems such as SNMPv3's USM (User-based Security Model).

Additional information regarding SNMP security issues and SNMPv3 can be found at http://net-snmp.sourceforge.net/wiki/index.php/TUT:Security.

- Navigate to **Alerts & Logging > SNMP**.



System Name: acm5003-m **Model:** ACM5003-M **Firmware:** 3.3.2
Uptime: 1 days, 2 hours, 34 mins, 51 secs **Current User:** root

Alerts & Logging: SNMP

Enable ☐ Enable the SNMP service

TCP/IP Protocol: UDP — The TCP/IP protocol to serve.

Location: — System Location

Contact: — System Contact

SNMP v1 & v2c

Read-Only Community: — The read-only community.

Read-Write Community: — The read-write community.

The **SNMP Service Details** tab shows by default. This tab controls aspects of the SNMP service including security level. It also manages requests from external agents for Opengear status information.

- Check the *Enable the SNMP Service* to start the SNMP service.

  SNMP is disabled by default.

- Select either *UDP* or *TCP* for the *TCP/IP Protocol*.

  UDP is the recommended protocol and is selected by default. TCP should only be used in special cases, such as when Port Forwarding SNMP requests/responses to or from the Opengear device is required.

- Complete the *Location* and *Contact* fields.

  The Location field should describe the physical location of the Opengear and will be used in response to requests for the SNMPv2-MIB::sysLocation.0 of the device.

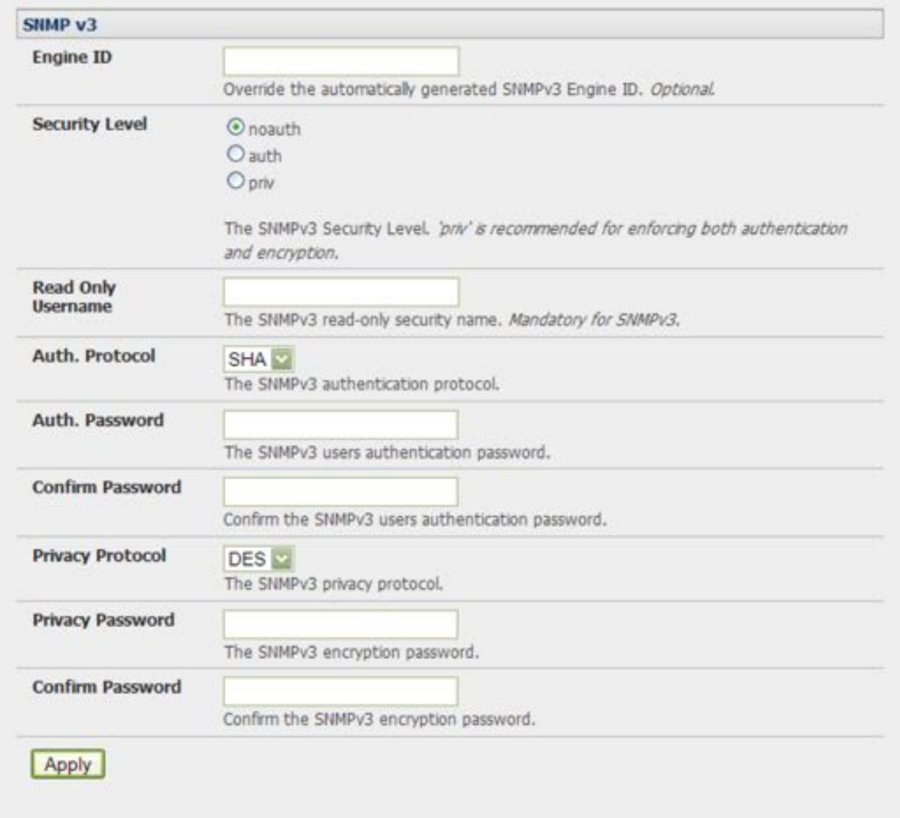
  The Contact field refers to the person responsible for the Opengear such as the System Administrator and will be used in response to requests as follows: SNMPv2-MIB::sysContact.0.

- Enter the *Read-Only Community* and *Read-Write Community*.

  This is required for SNMP v1 & v2c only. The *Read-Only Community* field is used to specify the SNMPv1 or SNMPv2c community that will be allowed read-only (GET and GETNEXT) access. This must be specified in order for both versions to become enabled. The *Read-Write Community* field is used to specify the SNMPv1 or SNMPv2c community that will be allowed read-write (GET, GETNEXT and SET) access.

- Configure **SNMPv3**, if required.

  SNMPv3 provides secure SNMP operations through the use of USM (User-based Security Model). It offers various levels of security including user-based authentication and basic encryption.



SNMP v3

Engine ID	Override the automatically generated SNMPv3 Engine ID. *Optional.*
Security Level	● noauth ○ auth ○ priv The SNMPv3 Security Level. *'priv' is recommended for enforcing both authentication and encryption.*
Read Only Username	The SNMPv3 read-only security name. *Mandatory for SNMPv3.*
Auth. Protocol	SHA The SNMPv3 authentication protocol.
Auth. Password	The SNMPv3 users authentication password.
Confirm Password	Confirm the SNMPv3 users authentication password.
Privacy Protocol	DES The SNMPv3 privacy protocol.
Privacy Password	The SNMPv3 encryption password.
Confirm Password	Confirm the SNMPv3 encryption password.

- Enter an *Engine ID* if required.

  Engine ID is used to localize the SNMPv3 user. It will be automatically generated from a Network Interface (eth0) hardware address, if left blank, or must be entered as a hex value (for example, 0x01020304).

- Specify the *Security Level*.

security level	notes
noauth	No authentication or encryption required. This is the minimum security level.
auth	Authentication will be required but encryption is not enforced. An authentication protocol (SHA or MD5) and password will be required.
priv	Enforces encryption use. This is the highest level of security and requires an encryption protocol (DES or AES) and password in addition to the authentication protocol and password.

- Enter the *Read Only Username*.

  This field is mandatory when configuring the *console server* for SNMPv3.

- For a *Security Level* of *auth*, set the *Auth Protocol* (SHA or MD5) and the *Auth Password*.

  A password of at least 8 characters is required.

- For a *Security Level* of *priv*, set the *Privacy Protocol* (DES or AES) and the *Privacy Password*.

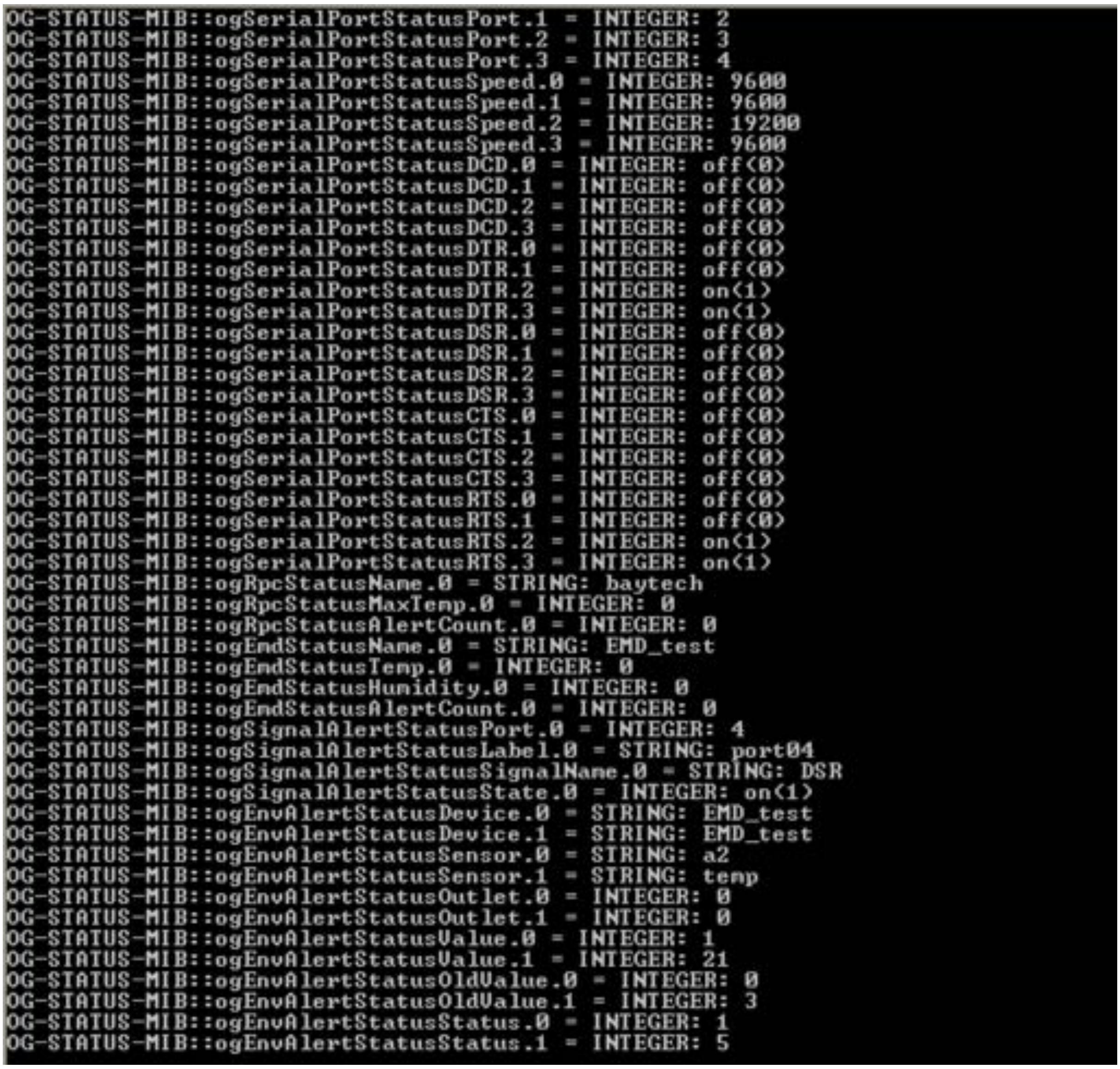
  AES is recommended. A password of at least 8 characters is required.

- Click **Apply**.
- Setup serial ports and devices as per requirements such as UPS, RPC/PDU and EMD.
- Copy the mibs from `/etc/snmp/mibs` on the *console server* to a local directory using scp or Winscp. For example:

  ```
  scp root@im4004:/etc/snmp/mibs/*
  ```

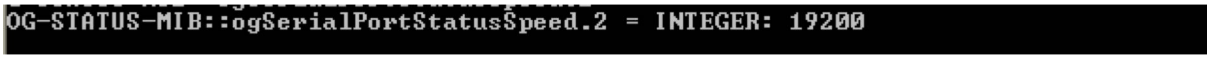
- Using the `snmpwalk` and `snmpget` commands, status information can be retrieved from any *console server*. For example:

  ```
  snmpwalk -Oa -v1 -M .:/usr/share/snmp/mibs -c public im4004 OG-
  STATUS-MIB::ogStatus
  ```



```
OG-STATUS-MIB::ogSerialPortStatusPort.1 = INTEGER: 2
OG-STATUS-MIB::ogSerialPortStatusPort.2 = INTEGER: 3
OG-STATUS-MIB::ogSerialPortStatusPort.3 = INTEGER: 4
OG-STATUS-MIB::ogSerialPortStatusSpeed.0 = INTEGER: 9600
OG-STATUS-MIB::ogSerialPortStatusSpeed.1 = INTEGER: 9600
OG-STATUS-MIB::ogSerialPortStatusSpeed.2 = INTEGER: 19200
OG-STATUS-MIB::ogSerialPortStatusSpeed.3 = INTEGER: 9600
OG-STATUS-MIB::ogSerialPortStatusDCD.0 = INTEGER: off(0)
OG-STATUS-MIB::ogSerialPortStatusDCD.1 = INTEGER: off(0)
OG-STATUS-MIB::ogSerialPortStatusDCD.2 = INTEGER: off(0)
OG-STATUS-MIB::ogSerialPortStatusDCD.3 = INTEGER: off(0)
OG-STATUS-MIB::ogSerialPortStatusDTR.0 = INTEGER: off(0)
OG-STATUS-MIB::ogSerialPortStatusDTR.1 = INTEGER: off(0)
OG-STATUS-MIB::ogSerialPortStatusDTR.2 = INTEGER: on(1)
OG-STATUS-MIB::ogSerialPortStatusDTR.3 = INTEGER: on(1)
OG-STATUS-MIB::ogSerialPortStatusDSR.0 = INTEGER: off(0)
OG-STATUS-MIB::ogSerialPortStatusDSR.1 = INTEGER: off(0)
OG-STATUS-MIB::ogSerialPortStatusDSR.2 = INTEGER: off(0)
OG-STATUS-MIB::ogSerialPortStatusDSR.3 = INTEGER: off(0)
OG-STATUS-MIB::ogSerialPortStatusCTS.0 = INTEGER: off(0)
OG-STATUS-MIB::ogSerialPortStatusCTS.1 = INTEGER: off(0)
OG-STATUS-MIB::ogSerialPortStatusCTS.2 = INTEGER: off(0)
OG-STATUS-MIB::ogSerialPortStatusCTS.3 = INTEGER: off(0)
OG-STATUS-MIB::ogSerialPortStatusRTS.0 = INTEGER: off(0)
OG-STATUS-MIB::ogSerialPortStatusRTS.1 = INTEGER: off(0)
OG-STATUS-MIB::ogSerialPortStatusRTS.2 = INTEGER: on(1)
OG-STATUS-MIB::ogSerialPortStatusRTS.3 = INTEGER: on(1)
OG-STATUS-MIB::ogRpcStatusName.0 = STRING: baytech
OG-STATUS-MIB::ogRpcStatusMaxTemp.0 = INTEGER: 0
OG-STATUS-MIB::ogRpcStatusAlertCount.0 = INTEGER: 0
OG-STATUS-MIB::ogEmdStatusName.0 = STRING: EMD_test
OG-STATUS-MIB::ogEmdStatusTemp.0 = INTEGER: 0
OG-STATUS-MIB::ogEmdStatusHumidity.0 = INTEGER: 0
OG-STATUS-MIB::ogEmdStatusAlertCount.0 = INTEGER: 0
OG-STATUS-MIB::ogSignalAlertStatusPort.0 = INTEGER: 4
OG-STATUS-MIB::ogSignalAlertStatusLabel.0 = STRING: port04
OG-STATUS-MIB::ogSignalAlertStatusSignalName.0 = STRING: DSR
OG-STATUS-MIB::ogSignalAlertStatusState.0 = INTEGER: on(1)
OG-STATUS-MIB::ogEnvAlertStatusDevice.0 = STRING: EMD_test
OG-STATUS-MIB::ogEnvAlertStatusDevice.1 = STRING: EMD_test
OG-STATUS-MIB::ogEnvAlertStatusSensor.0 = STRING: a2
OG-STATUS-MIB::ogEnvAlertStatusSensor.1 = STRING: temp
OG-STATUS-MIB::ogEnvAlertStatusOutlet.0 = INTEGER: 0
OG-STATUS-MIB::ogEnvAlertStatusOutlet.1 = INTEGER: 0
OG-STATUS-MIB::ogEnvAlertStatusValue.0 = INTEGER: 1
OG-STATUS-MIB::ogEnvAlertStatusValue.1 = INTEGER: 21
OG-STATUS-MIB::ogEnvAlertStatusOldValue.0 = INTEGER: 0
OG-STATUS-MIB::ogEnvAlertStatusOldValue.1 = INTEGER: 3
OG-STATUS-MIB::ogEnvAlertStatusStatus.0 = INTEGER: 1
OG-STATUS-MIB::ogEnvAlertStatusStatus.1 = INTEGER: 5
```

```
snmpget -Oa -v1 -M .:/usr/share/snmp/mibs -c public im4004 OG-
STATUSMIB::ogSerialPortStatusSpeed.2
```



```
OG-STATUS-MIB::ogSerialPortStatusSpeed.2 = INTEGER: 19200
```

noauth

```
snmpwalk -Oa –v3 –l noAuthNoPriv –u readonlyusername -M .:/usr/
share/snmp/mibs im4004 OG-STATUS-MIB::ogStatus
```

auth

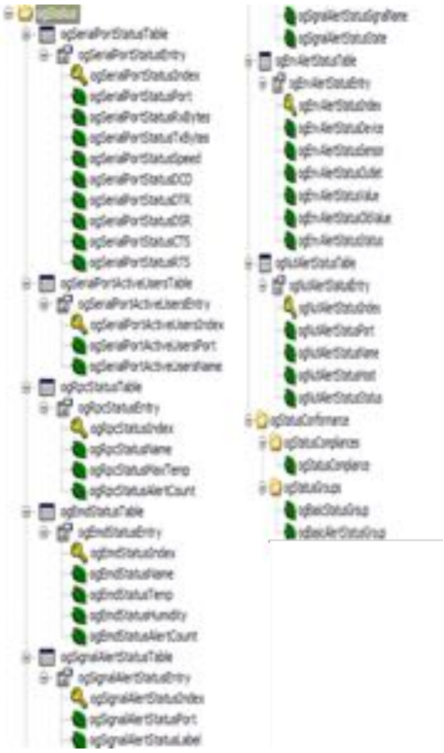
```
snmpwalk -Oa –v3 –l authNoPriv –u readonlyusername –a SHA –A
“authpassword” -M .:/usr/share/snmp/mibs im4004 OG-STATUS-
MIB::ogStatus
```

priv

```
snmpwalk -Oa –v3 –l authNoPriv –u readonlyusername –a SHA –A
“authpassword” –x DES –X “privpassword” -M .:/usr/share/snmp/mibs
im4004 OG-STATUS-MIB::ogStatus
```

snmp argument	purpose
-l	security level.
-u	security name or read-only username.
-a	authentication protocol: SHA or MD5.
-A	authentication password.
-x	privacy protocol: DES or AES.
-X	privacy password.

A mib browser can explore the Opengear enterprise MIB structure. For example, the ogStatus tree is shown below:



14.5.4. Adding multiple remote SNMP managers

You can add multiple SNMP servers for alert traps. Add the first and second SNMP servers using the Management Console (see chapter 6) or the command line `config` tool. Further SNMP servers must be added manually using `config`.

Log in to the *console server's* command line shell as `root` or an `admin` user.

- Set the SNMP Manager Address field:

  ```
  config —set="config.system.snmp.address3=w.x.y.z"
  ```

  replacing `w.x.y.z` with the IP address or hostname.

- Set the Manager Trap Port field:

  ```
  config --set=”config.system.snmp.trapport3=162”
  ```

  replacing `162` with the TCP/UDP port number

- Set the SNMP Manager Protocol field:

  ```
  config --set="config.system.snmp.protocol3=UDP"
  ```

  or

  ```
  config --set="config.system.snmp.protocol3=TCP"
  ```

- Set the SNMP Manager Version field:

  ```
  config --set="config.system.snmp.version3=3"
  ```

- Set the SNMP Manager v1 & v2c community field:

  ```
  config --set="config.system.snmp.community3=public"
  ```

- Set the SNMP Manager v3 Engine ID field:

  ```
  config —set="config.system.snmp.engineid3=0x8000000001020304"
  ```

  replacing `0x8000000001020304` with the hex Engine-ID.

- Set the SNMP Manager v3 Security Level field:

  ```
  config --set="config.system.snmp.seclevel3=noAuthNoPriv"
  ```

  or

  ```
  config --set="config.system.snmp.seclevel3=authNoPriv"
  ```

  or

  ```
  config --set="config.system.snmp.seclevel3=authPriv"
  ```

- Set the SNMP Manager v3 Username field:

  ```
  config --set="config.system.snmp.username3=username"
  ```

- Set the SNMP Manager v3 Auth. Protocol and password fields:

  ```
  config –set="config.system.snmp.authprotocol3=SHA"
  ```

or

```
config --set="config.system.snmp.authprotocol3=MD5"
config --set="config.system.snmp.authpassword3=password 1"
```

- To set the SNMP Manager v3 Privacy Protocol and password fields:

```
config —set="config.system.snmp.privprotocol3=AES"
```

or

```
config —set="config.system.snmp.privprotocol3=DES"
config --set="config.system.snmp.privpassword3=password 2"
```

- Once the fields are set, apply the configuration with the following command:

```
config --run snmp
```

You can add a third or more SNMP servers by incrementing the `2` in the above commands. For example, `config.system.snmp.protocol3`, `config.system.snmp.address3`, etc.

14.6. Secure shell (SSH) public key authentication

This section covers the generation of public and private keys in a Linux and Windows environment and configuring SSH for public key authentication. The steps to use in a Clustering environment are:

- generate a new public and private key pair.
- upload the keys to the master and to each slave console server.
- fingerprint each connection to validate.

14.6.1. SSH overview

Popular TCP/IP applications such as `telnet`, `rlogin`, `ftp`, and others transmit their passwords unencrypted. Doing this across pubic networks like the Internet can have catastrophic consequences. It leaves the door open for eavesdropping, connection hijacking, and other network-level attacks.

Secure Shell (SSH) is a program to log into another computer over a network, to execute commands in a remote machine, and to move files from one machine to another. It provides strong authentication and secure communications over insecure channels.

OpenSSH, the de facto open source SSH application, encrypts all traffic (including passwords) to effectively eliminate these risks. Additionally, OpenSSH provides a myriad of secure tunneling capabilities, as well as a variety of authentication methods.

OpenSSH is the port of OpenBSD's excellent OpenSSH[0] to Linux and other versions of Unix. OpenSSH is based on the last free version of Tatu Ylonen’s sample implementation with all patent-encumbered algorithms removed (to external libraries), all known security bugs fixed, new features reintroduced and many other clean-ups.

The only changes in the Opengear SSH implementation are:

- PAM support.

- EGD[1]/PRNGD[2] support and replacements for OpenBSD library functions that are absent from other versions of UNIX.
- The config files are now in `/etc/config/`. For example:

  `/etc/config/sshd_config` not `/etc/sshd_config`
  `/etc/config/ssh_config` not `/etc/ssh_config`
  `/etc/config/users/<username>/.ssh` / not `/home/<username>/.ssh/`

14.6.2. Generating public keys (Linux)

To generate new SSH key pairs use the Linux `ssh-keygen` command.

This produces an RSA or DSA public/private key pair. You will be prompted for a path to store the two key files: `id_dsa.pub` (the public key) and `id_dsa` (the private key). For example:

```
$ ssh-keygen -t [rsa|dsa]
Generating public/private [rsa|dsa] key pair.
Enter file in which to save the key (/home/user/.ssh/id_[r|dsa]):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/user/.ssh/id_[r|dsa].
Your public key has been saved in /home/user/.ssh/id_[r|dsa].pub.
The key fingerprint is:
28:aa:29:38:ba:40:f4:11:5e:3f:d4:fa:e5:36:14:d6 user@server
$
```

It is advisable to create a new directory to store your generated keys. It is also possible to name the files after the device they will be used for. For example:

```
$ mkdir keys
$ ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key: ~/keys/control_room
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in ~/keys/control_room
Your public key has been saved in ~/keys/control_room.pub.
The key fingerprint is:
28:aa:29:38:ba:40:f4:11:5e:3f:d4:fa:e5:36:14:d6 user@server
$
```

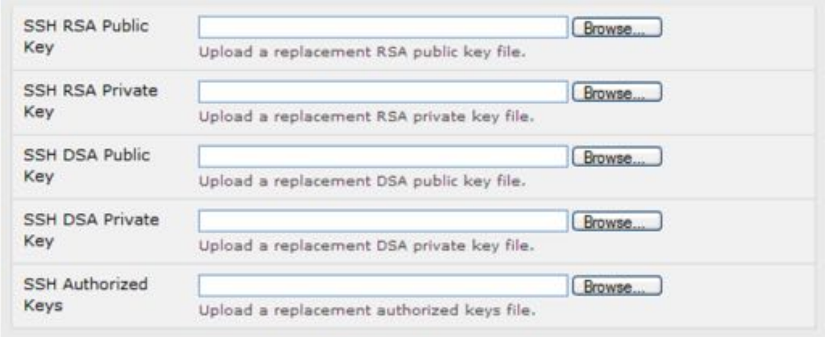
There must be no password associated with the keys. If there is a password, Opengear devices will have no way to supply it at runtime.

Full documentation for the ssh-keygen command can be found at http://man.openbsd.org/OpenBSD-current/man1/ssh-keygen.1.

14.6.3. Installing the SSH public & private keys (clustering)

For *console servers* the keys can be uploaded through the web interface, on the **System > Administration** page.

This enables you to upload stored RSA or DSA Public Key pairs to the master and apply the

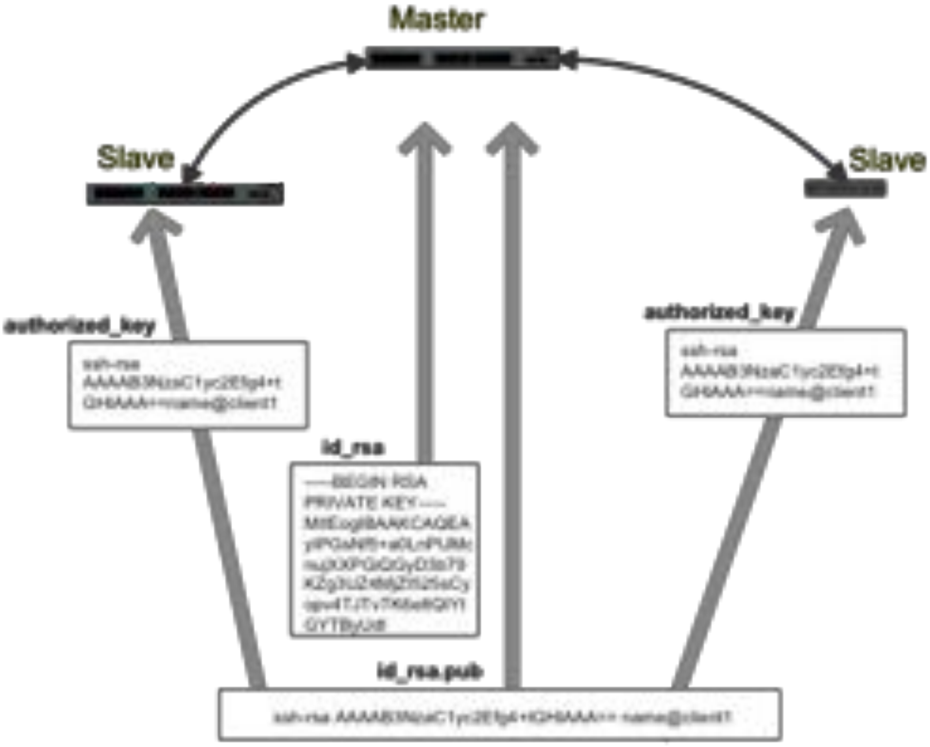


SSH RSA Public Key	Browse... Upload a replacement RSA public key file.
SSH RSA Private Key	Browse... Upload a replacement RSA private key file.
SSH DSA Public Key	Browse... Upload a replacement DSA public key file.
SSH DSA Private Key	Browse... Upload a replacement DSA private key file.
SSH Authorized Keys	Browse... Upload a replacement authorized keys file.

authorized key to the slave as documented in chapter 3. Once complete you then proceed to Fingerprinting as documented below.

14.6.4. Installing SSH public key authentication (Linux)

Alternately the public key can be installed on the unit remotely from the linux host with the `scp` utility as follows.


Master
Slave
Slave
authorized_key
ssh-rsa AAAAB3NzaC1yc2Efg4+t GHiAAA++name@client1
authorized_key
ssh-rsa AAAAB3NzaC1yc2Efg4+t GHiAAA++name@client1
id_rsa
-----BEGIN RSA PRIVATE KEY----- MIIEogIBAAKCAQEA yIPGaNf5+a0LnPUMc nuJXXPGrQrGyD3a79 KZg3U2+MjZH2fsCy qw4TJTvTK6eRQIYI GYTByUt8
id_rsa.pub
ssh-rsa AAAAB3NzaC1yc2Efg4+tGHiAAA++ name@client1

Assumptions:

- the Management Console username is `fred`.
- the *console server* IP address is 192.168.0.1 (a *console server's* default private IP address).
- the public key is stored on the Linux- or UNIX-based system in `~/.ssh/id_dsa.pub`.

Given this, run the following command from the Linux- or UNIX-based system:

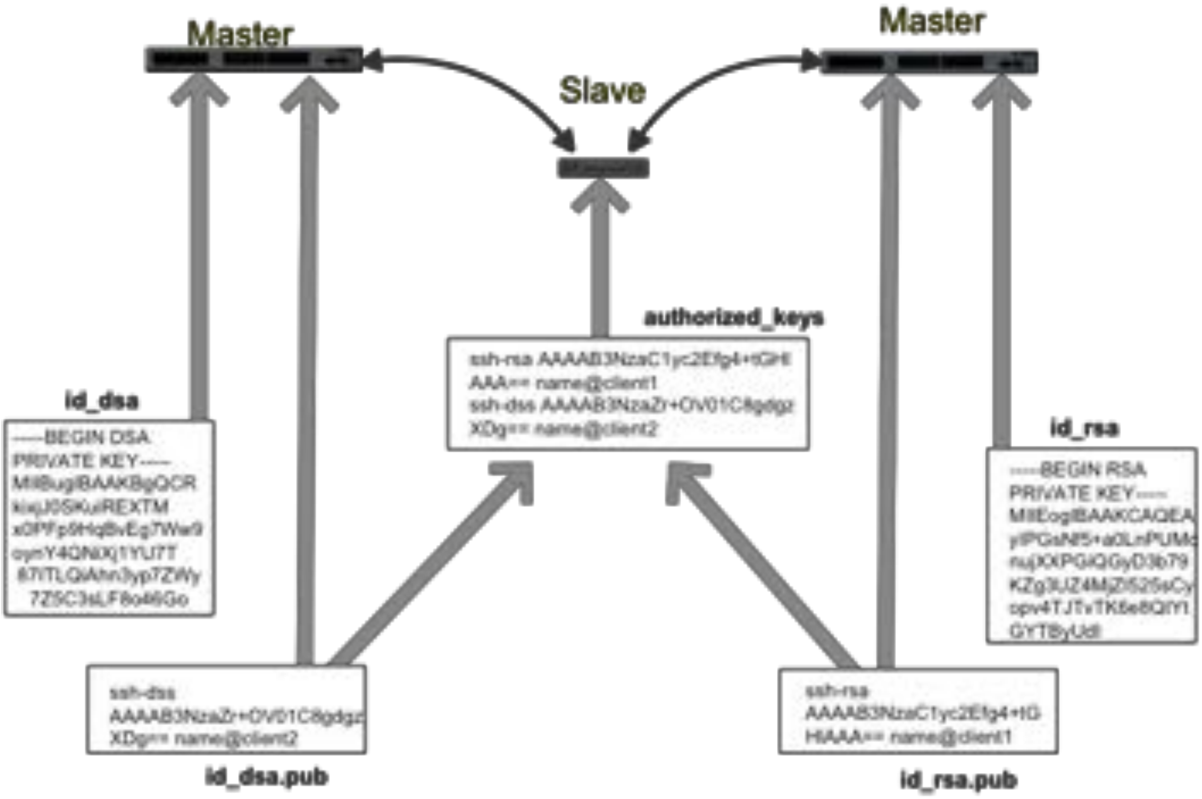
```
scp ~/.ssh/id_dsa.pub \
root@192.168.0.1:/etc/config/users/fred/.ssh/authorized_keys
```

This copies the file to the *console server* but doesn't set ownership as required. The authorized_keys file on the *console server* needs to be owned by `fred`. To affect this, login to the Management Console as *root* and run the following command:

```
chown fred /etc/config/users/fred/.ssh/authorized_keys
```

If the *console server* selected to be the server has only one client device, the `authorized_keys` file is simply a copy of the public key for that device.

If one or more devices will be clients of the *console server*, the authorized_keys file will contain copies of all of the public keys.



RSA and DSA keys may be freely mixed in the authorized_keys file. For example, assume we already have one server, called `bridge_server`, and two sets of keys, for the `control_room` and the `plant_entrance`. The following commands 1) show the stored keys and 2) combine two of them into a single file, `authorized_keys_bridge_server`.

```
$ ls /home/user/keys
control_room
control_room.pub
plant_entrance
plant_entrance.pub
```

```
$ cat ~/keys/control_room.pub ~/keys/plant_entrance.pub > ~/keys/
authorized_keys_bridge_server
```

More OpenSSH documentation can be found at https://openssh.com/manual.html and http://man.openbsd.org/OpenBSD-current/man1/ssh.1.

14.6.5. Generating public & private keys for SSH (Windows)

This section describes how to generate and configure SSH keys using Windows.

The OpenSSH project does not produce a Windows binary. The OpenSSH project's development is entirely focussed on producing 'a very small, secure, and easy to maintain version for the OpenBSD project'.

The versions of OpenSSH that ship on other Unix- and Unix-like operating systems are managed and produced by the OpenSSH Portability Team.

As of 2016-10, and despite Microsoft announcing 'the PowerShell team will support and contribute to the OpenSSH community... to deliver the PowerShell and Windows SSH solution', there is no Windows version of the current OpenSSH release.

Consequently, Simon Tatham's long-standing SSH client for Windows, *PuTTY*, which includes the key generator, `PuTTYgen.exe`, is used in the following procedure.

Before beginning, make sure you have the most recent `PuTTYgen` release installed. `PuTTYgen` is available for download from http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html.

This procedure also requires the current version of WinSCP — a Windows-equivalent to the `scp` utliltiy — be installed. WinSCP is available for download from https://winscp.net/.

- Create a new user from the Opengear Management Console.

  The following example uses a user called `testuser`. This user must be a member of the `users` group.

- If you do not already have a public/private key pair generate them now using `PuTTYgen`.
- Launch `PuTTYgen.exe`.
- Select the desired key type — SSH2 DSA — in the Parameters section.

  You may use RSA or DSA.

- Leave the passphrase field blank.
- Click **Generate**.
- As instructed, move the mouse pointer over the blank area of the program in order to create random data used by PUTTYGEN to generate secure keys.

  Key generation occurs once PUTTYGEN has collected sufficient random data.

- Copy the public key data from the *Public key for pasting into OpenSSH authorized_keys file* section of the **PuTTY Key Generator** window.
- Launch Notepad (*not* Microsoft Word or any other word processor).
- paste the key data into the Notepad window.

  Make sure there is only one line of text in this file.

- Save the Notepad file as `authorized_keys`.
- Launch WinSCP.

- Copy `authorized_keys` to the user's home directory on the *console server* which will be the SSH server.

  For example, if the user's username is `testuser`, copy the file to

  `/etc/config/users/testuser/.ssh/authorized_keys`

- From the *console server's* command line run the following commands to give the file the correct text-format and the correct permissions:

  ```
  # dos2unix /etc/config/users/testuser/.ssh/authorized_keys
  # chown testuser /etc/config/users/testuser/.ssh/authorized_keys
  ```

- Using WinSCP, copy the local `sshd_config` file over `/etc/config/sshd_config` on the *console server.*

  This ensures public key authentication is enabled.

- Test the public key by logging in to the *console server* as `testuser`.

- At the *console server's* command line type the following:

  ```
  # ssh -o StrictHostKeyChecking=no <server-ip>
  ```

To automate connection of the SSH tunnel from the client on every power-up you need to make the client's `/etc/config/rc.local` look like the following:

```
#!/bin/sh
ssh -L9001:127.0.0.1:4001 -N -o \
StrictHostKeyChecking=no testuser@<server-ip> &
```

This will run the tunnel redirecting local port 9001 to the server port 4001.

14.6.6. Fingerprinting

Fingerprints are used to ensure you are establishing an SSH session to who you think you are. On the first connection to a remote server you will receive a fingerprint which you can use on future connections.

This fingerprint is related to the host key of the remote server. Fingerprints are stored in `~/.ssh/known_hosts`.

- To receive the fingerprint from the remote server, log in to the client as the required user (usually *root*) and establish a connection to the remote host:

  ```
  # ssh rh
  The authenticity of host 'rh (192.168.0.1)' can't be established.
  RSA key fingerprint is 8d:11:e0:7e:8a:6f:ad:f1:94:0f:93:fc:
  7c:e6:ef:56.
  Are you sure you want to continue connecting (yes/no)?
  ```

- Answer yes to accept the key.

- The following message will be returned:

  ```
  Warning: Permanently added 'rh,192.168.0.1' (RSA) to the list of
  known hosts.
  ```

- You may be prompted for a password.

  There is no need to log in, however: you have received the fingerprint.

- Press Ctrl-C to cancel the connection.

If the host key changes you will receive the following warning, and not be allowed to connect to the remote host:

```
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
@   WARNING: REMOTE HOST IDENTIFICATION HAS CHANGED!    @
@ IT IS POSSIBLE THAT SOMEONE IS DOING SOMETHING NASTY! @
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
```

Someone could be eavesdropping on you right now using a *man-in-the-middle* attack.

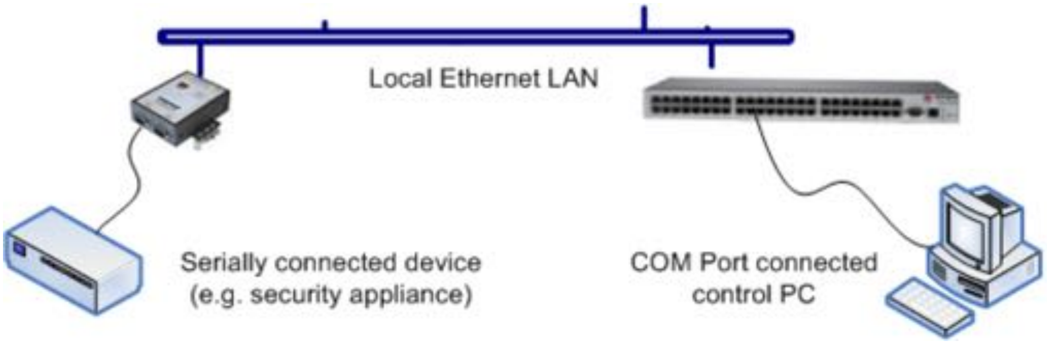
It is also possible that the RSA host key has just been changed:

```
The fingerprint for the RSA key sent by the remote host is
ab:7e:33:bd:85:50:5a:43:0b:e0:bd:43:3f:1c:a5:f8.
Please contact your system administrator.
Add correct host key in /.ssh/known_hosts to get rid of this
message.
Offending key in /.ssh/known_hosts:1
RSA host key for remhost has changed and you have requested strict
checking.
Host key verification failed.
```

If the host key has legitimately changed, it can be removed from the `~/.ssh/known_hosts` file and the new fingerprint added. If it has not changed legitimately, this indicates a serious problem that should be investigated immediately.

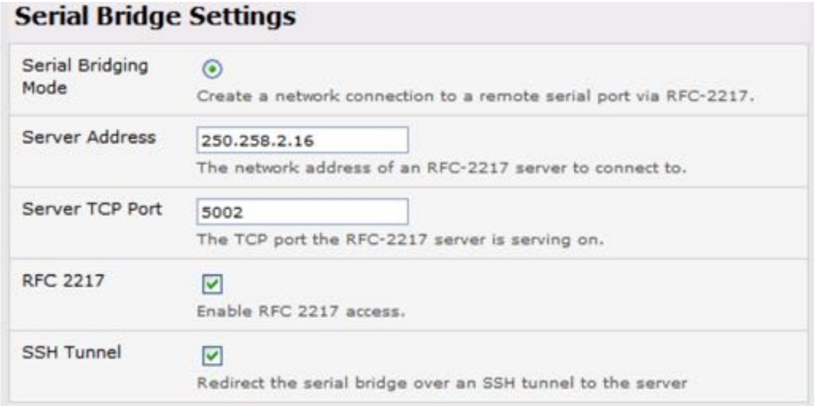
14.6.7. SSH tunnelled serial bridging

You can apply SSH tunneling when two Black Box *console servers* are configured for serial bridging.



As detailed in chapter 3, the Server *console server* is setup in Console Server mode with either RAW or RFC2217 enabled and the Client console server is set up in Serial Bridging Mode with the Server Address, and Server TCP Port (4000 + port for RAW or 5000 + port # for RFC2217) specified:

- Select SSH Tunnel when configuring the **Serial Bridging Setting**.



Serial Bridge Settings

Serial Bridging Mode	● Create a network connection to a remote serial port via RFC-2217.
Server Address	250.258.2.16 The network address of an RFC-2217 server to connect to.
Server TCP Port	5002 The TCP port the RFC-2217 server is serving on.
RFC 2217	☑ Enable RFC 2217 access.
SSH Tunnel	☑ Redirect the serial bridge over an SSH tunnel to the server

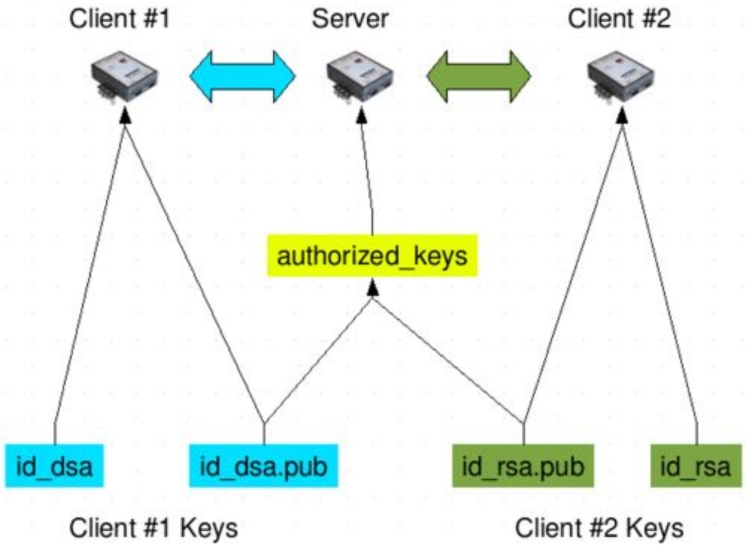
- set up SSH keys for each end of the tunnel and upload these keys to the Server and Client console servers.

Client keys

The first step in setting up ssh tunnels is to generate keys. Ideally, you will use a separate, secure, machine to generate and store all keys to be used on the console servers. However, if this is not ideal to your situation, keys may be generated on the console servers themselves.

It is possible to generate only one set of keys, and reuse them for every SSH session. While this is not recommended, each organization will need to balance the security of separate keys against the additional administration they bring.

Generated keys may be one of two types — RSA or DSA — and it is beyond the scope of this document to recommend one over the other. RSA keys will go into the files `id_rsa` and `id_rsa.pub`. DSA keys will be stored in the files `id_dsa` and `id_dsa.pub`.



For simplicity going forward the term private key will be used to refer to either `id_rsa` or `id_dsa` and public key to refer to either `id_rsa.pub` or `id_dsa.pub`.

To generate the keys use the `ssh-keygen` program (part of the OpenSSH suite):

```
$ ssh-keygen -t [rsa|dsa]
```

```
Generating public/private [rsa|dsa] key pair.
Enter file in which to save the key (/home/user/.ssh/id_[r|
dsa]):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/user/.ssh/id_[r|
dsa].
Your public key has been saved in /home/user/.ssh/id_[r|
dsa].pub.
The key fingerprint is:
28:aa:29:38:ba:40:f4:11:5e:3f:d4:fa:e5:36:14:d6 user@server
$
```

It is advisable to create a new directory to store your generated keys. It is also possible to name the files after the device they will be used for. For example:

```
$ mkdir keys
$ ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key: ~/keys/control_room
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in ~/keys/control_room
Your public key has been saved in ~/keys/control_room.pub.
The key fingerprint is:
28:aa:29:38:ba:40:f4:11:5e:3f:d4:fa:e5:36:14:d6 user@server
$
```

There must be no password associated with the keys. If there is a password, Opengear devices will have no way to supply it at runtime.

Authorized keys

If the *console server* selected to be the server has only one client device, the `authorized_keys` file is simply a copy of the public key for that device.

If one or more devices will be clients of the *console server*, the authorized_keys file will contain copies of all of the public keys.

RSA and DSA keys may be freely mixed in the authorized_keys file. For example, assume we already have one server, called `bridge_server`, and two sets of keys, for the `control_room` and the `plant_entrance`. The following commands 1) show the stored keys and 2) combine two of them into a single file, `authorized_keys_bridge_server`.

```
$ ls /home/user/keys
control_room
control_room.pub
plant_entrance
plant_entrance.pub
$ cat ~/keys/control_room.pub ~/keys/plant_entrance.pub > ~/
keys/authorized_keys_bridge_server
```

Uploading keys

The keys for the server can be uploaded through the web interface, on the **System > Administration** page as detailed earlier. If only one client will be connecting, then simply upload the appropriate public key as the authorized keys file. Otherwise, upload the authorized keys file constructed in the previous step.

Each client will then need its own set of keys uploaded through the same page. Take care to ensure that the correct type of keys (DSA or RSA) goes in the correct spots, and that the public and private keys are in the correct spot.

14.6.8. SDT connector public key authentication

SDT Connector can authenticate against a *console server* using your SSH key pair rather than requiring your to enter your password (that is public key authentication).

To use public key authentication with SDT Connector, first create an RSA or DSA key pair (using `ssh-keygen`, `PuTTYgen` or a similar tool) and add the public part of your SSH key pair to the console server.

Next, add the private part of your SSH key pair (this file is typically named `id_rsa` or `id_dsa`) to the *SDT Connector* client:

- Navigate to **Edit > Preferences > Private Keys > Add**.
- Locate the private key file.
- Click **OK**.

You do not have to add the public part of your SSH key pair, it is calculated using the private key.

SDT Connector will now use public key authentication when SSH-connecting through the *console server*. You may have to restart *SDT Connector* to shut down any existing tunnels that were established using password authentication.

If you have a host behind the *console server* that you connect to by clicking the **SSH** button in *SDT Connector*, you can also configure it for public key authentication.

Essentially what you are using is SSH over SSH. The two SSH connections are entirely separate, and the host configuration is entirely independent of *SDT Connector* and the *console server*. You must configure the SSH client that SDT Connector launches (for example Putty or OpenSSH) and the host's SSH server for public key authentication.

14.7. Secure sockets layer (SSL) support

Secure Sockets Layer (SSL) is a protocol developed by Netscape for transmitting private documents via the Internet. SSL works by using a private key to encrypt data that's transferred over the SSL connection.

The *console server* includes OpenSSL. The OpenSSL Project is a collaborative effort to develop a robust, commercial-grade, full-featured, and Open Source toolkit implementing the Secure Sockets Layer (SSL v2/v3) and Transport Layer Security (TLS v1) protocols as well as a full-strength general purpose cryptography library. The project is managed by a worldwide community of volunteers that use the Internet to communicate, plan, and develop the OpenSSL toolkit and its related documentation.

OpenSSL is based on the Slay library developed by Eric A Young and Tim J Hudson. The OpenSSL toolkit is licensed under an Apache-style license, which basically means that you are free to get and use it for commercial and non-commercial purposes subject to some simple license conditions. In the *console server* OpenSSL is used primarily in conjunction with `https` in order to have secure browser access to the GUI management console across insecure networks.

OpenSSL documentation is available at https://openssl.org/docs/manmaster/apps/openssl.html.

The OpenSSL project itself ‘highly recommends’ Ivan Ristić’s *OpenSSL Cookbook*, available as a free download from https://feistyduck.com/books/openssl-cookbook/.

14.8. HTTPS

The Management Console UI is served using HTTPS by the built in `cherokee` webserver.

If your default network address is changed or the unit is to be accessed via a known Domain Name you can use the following steps to replace the default SSL Certificate and Private Key with ones tailored for your new address.

14.8.1. Generating an encryption key

To create a 1024 bit RSA key with a password issue the following command on the command line of a linux host with the `openssl` utility installed:

```
# openssl genrsa -des3 -out ssl_key.pem 1024
```

14.8.2. Generating a self-signed certificate with OpenSSL

This example shows how to use OpenSSL to create a self-signed certificate on a Linux- or Unix-based system. OpenSSL ships as part of macOS and is available for most Linux distributions via the default package management mechanism.

The OpenSSL project ‘does not distribute any code in binary form, and does not officially recommend any specific binary distributions.’ The project does, however, maintain a page on its community wiki: https://wiki.openssl.org/index.php/Binaries.

This page lists 3rd-party binaries that are ‘stable and can provide continued support for OpenSSL’. Windows users should check here for a suitable binary.

To create a 1024-bit RSA key and a self-signed certificate, issue the following command from the host you have `openssl` installed on:

```
# openssl req -x509 -nodes -days 1000 -newkey rsa:1024 -keyout \
ssl_key.pem -out ssl_cert.pem
```

You will be prompted to enter a lot of information. Most of it doesn't matter, but the `Common Name` should be the domain name of your computer (for example, `test.opengear.com`).

When you have entered everything, the certificate will be created in a file called `ssl_cert.pem`.

14.8.3. Installing the key & certificate

The recommended method for copying files securely to the console server unit is with a Secure Copying Protocol client (for example, the shell-based tool: scp).

The scp utility ships with macOS and ships with OpenSSH for most Linux distributions. Windows users can use something like the PSCP command line utility available with *PuTTY*.

The files created in the steps above can be installed remotely with the scp utility as follows:

```
# scp ssl_key.pem root@<address of unit>:/etc/config/
# scp ssl_cert.pem root@<address of unit>:/etc/config/
```

or, using PSCP:

```
pscp -scp ssl_key.pem root@<address of unit>:/etc/config/
pscp -scp ssl_cert.pem root@<address of unit>:/etc/config/
```

PuTTY and the PSCP utility can be downloaded from http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html.

Detailed documentation on PSCP can be found at https://the.earth.li/~sgtatham/putty/0.67/htmldoc/Chapter5.html.

14.8.4. Launching the HTTPS server

The easiest way to enable the HTTPS server is from the web Management Console.

- click the appropriate checkbox in **Network > Services > HTTPS Server**.

  The HTTPS server will now be activated (assuming ssl_key.pem and ssl_cert.pem exist in the /etc/config/).

Alternatively, inetd can be configured to launch the secure fnord server from the command line of the unit as follows.

- Edit the inetd configuration file. From the unit command line:

  ```
  # vi /etc/config/inetd.conf
  ```

- Append a line:

  ```
  443 stream tcp nowait root sslwrap -cert /etc/config/ssl_cert.pem
  -key /etc/config/ssl_key.pem -exec /bin/httpd /home/httpd"
  ```

- Save the file.
- Signal inetd of the configuration change:

  ```
  # kill -HUP `cat /var/run/inetd.pid`
  ```

The HTTPS server should now be accessible from a web client at a URL similar to this: https://common-name-of-unit/.

14.9. Power strip control

The console server supports a growing list of remote power-control devices (RPCs) which can be configured using the Management Console as described in chapter 7. These RPCs are controlled using the open source *PowerMan* and *Network UPS Tools* and with Opengear's `pmpower` utility.

14.9.1. the PowerMan tool

PowerMan provides power management in a data center or compute cluster environment. It performs operations such as power on, power off, and power cycle via remote power controller (RPC) devices.

The `powerman` man page is not shipped with Opengear hardware. It is reproduced below.

Synopsis

```
powerman | pm [-options][targets]
```

options	notes regarding targets
-1 --on	power *on* targets.
-0 --off	power *off* targets.
-c --cycle	Power cycle targets.
-r --reset	Assert hardware reset for targets (if implemented by RPC).
-f --flash	Turn beacon *on* for targets (if implemented by RPC).
-u --unflash	Turn beacon *off* for targets (if implemented by RPC).
-l --list	List available targets. If possible, output will be compressed into a host range (see *target specification* below).
-q --query	Query plug status of targets. If none specified, query all targets. Status is not cached; each time this option is used, powerman queries the appropriate RPC's. Targets connected to RPC's that could not be contacted (e.g. due to network failure) are reported as status "unknown". If possible, output will be compressed into host ranges.
-n --node	Query node power status of targets (if implemented by RPC). If no targets specified, query all targets. In this context, a node in the *off* state could be *on* at the plug but operating in standby power mode.
-b --beacon	Query beacon status (if implemented by RPC). If no targets are specified, query all targets.
-t --temp	Query node temperature (if implemented by RPC). If no targets are specified, query all targets. Temperature information is not interpreted by powerman and is reported as received from the RPC on one line per target, prefixed by target name.
-h --help	Display option summary.
-L --license	Show powerman license information.
-d --destination	*host[:port]*. Connect to a powerman daemon on non-default host and optionally port.
-V --version	Display the powerman version number and exit.
-D --device	Displays RPC status information. If targets are specified, only RPC's matching the target list is displayed.
-T --telemetry	Causes RPC telemetry information to be displayed as commands are processed. Useful for debugging device scripts.
-x --exprange	Expand host ranges in query responses.

For more details see http://linux.die.net/man/1/powerman.

Target specification

powerman target hostnames may be specified as comma separated or space separated hostnames or host ranges.

Host ranges are of the general form:

```
  prefix[n-m,l-k,...]
```

where n < m and l < k, etc.

This form should not be confused with regular expression character classes, which are also denoted by `[]`. For example, `foo[19]` does not represent `foo1` or `foo9`, but rather represents a degenerate range: `foo19`.

This range syntax is meant only as a convenience on clusters with a prefix NN naming convention and specification of ranges should not be considered necessary -- the list `foo1,foo9` could be specified as such, or by the range `foo[1,9]`.

Some examples of powerman targets follow.

Power on hosts bar,baz,foo01,foo02,...,foo05: `powerman --on bar baz foo[01-05]`
Power on hosts bar,foo7,foo9,foo10: `powerman --on bar,foo[7,9-10]`
Power on foo0,foo4,foo5: `powerman --on foo[0,4-5]`

As a reminder to the reader, some shells will interpret brackets — [and] — for pattern matching. Depending on your shell, it may be necessary to enclose ranged lists within quotes. For example, in tcsh, the last example above should be executed as:

```
powerman --on "foo[0,4-5]"
```

14.9.2. The pmpower tool

The `pmpower` utility is a high level tool for manipulating remote preconfigured power devices connected to the console server either via a serial or network connection. The PDU UPS and IPMI power devices are variously controlled using the open source `PowerMan`, `IPMItool` or Network UPS Tools and Opengear's `pmpower` utility arches over these tools so the devices can be controlled through the one command line:

Synopsis

```
pmpower [-?h] [-l device | -r host] [-o outlet] [-u username]\
        [-p password] action
```

options	notes
-? -h	This help message.
-/	The serial port to use.
-o	The outlet on the power target to apply to.
-r	The remote host address for the power target
-u	Override the configured username.
-p	Override the configured password.
on	This *action* switches the specified device or outlet(s) on.
off	This *action* switches the specified device or outlet(s) off.
cycle	This *action* switches the specified device or outlet(s) off and on again.

status	This *action* retrieves the current status of the device or outlet.

Examples:

To turn outlet 4 of the power device connected to serial port 2 on:

```
# pmpower -l port02 -o 4 on
```

To turn an IPMI device off located at IP address 192.168.1.100 where the username is *root* and the password is *calvin*:

```
# pmpower -r 192.168.1.100 -u root -p calvin off
```

Default system Power Device actions are specified in `/etc/powerstrips.xml`.

Custom Power Devices can be added in `/etc/config/powerstrips.xml`. If an action is attempted which has not been configured for a specific Power Device `pmpower` will exit with an error.

14.9.3. Adding new RPC devices

There are a number of simple paths to adding support for new RPC devices.

The first is to have scripts to support the particular RPC included in either the open source `PowerMan` project — https://code.google.com/archive/p/powerman/ — or the open source `NUT UPS` Tools project — http://networkupstools.org/.

The `PowerMan` device specifications are rather weird and it is suggested that you leave the actual writing of these scripts to the `PowerMan` authors. However documentation on how they work can be found at http://linux.die.net/man/5/powerman.dev. The Network UPS Tools (`NUT`) project has moved on from its UPS management origins to also cover SNMP PDUs (and embrace `PowerMan`). Opengear progressively includes the updated `PowerMan` and `NUT` build into the console server firmware releases.

The second path is to directly add support for the new RPC devices (or to customize the existing RPC device support) on your particular *console server*. The **Manage > Power** page uses information contained in `/etc/powerstrips.xml` to configure and control devices attached to a serial port. The configuration also looks for (and loads) `/etc/config/powerstrips.xml` if it exists.

You can add support for more devices by putting definitions for them into `/etc/config/powerstrips.xml`. This file can be created on a host system and copied to the Management Console device using `scp`. Alternatively, login to the Management Console and use `ftp` or `wget` to transfer files.

Here is a brief description of the elements of the XML entries in `/etc/config/powerstrips.xml`.

```
<powerstrip>
    <id>Name or ID of the device support</id>
    <outlet port="port-id-1">Display Port 1 in menu</outlet>
    <outlet port="port-id-2">Display Port 2 in menu</outlet>
    ...
    <on>script to turn power on</on>
    <off>script to power off</off>
    <cycle>script to cycle power</cycle>
    <status>script to write power status to
            /var/run/power-status</status>
    <speed>baud rate</speed>
    <charsize>character size</charsize>
    <stop>stop bits</stop>
    <parity>parity setting</parity>
</powerstrip>
```

The `id` appears on the web page in the list of available devices types to configure.

The outlets describe targets that the scripts can control. For example a power control board may control several different outlets. The `port-id` is the native name for identifying the outlet. This value will be passed to the scripts in the environment variable outlet, allowing the script to address the correct outlet.

There are four possible scripts: `on`, `off`, `cycle` and `status`.

When a script is run, it's standard input and output is redirected to the appropriate serial port. The script receives the outlet and port in the outlet and port environment variables respectively.

The script can be anything that can be executed within the shell.

All of the existing scripts in `/etc/powerstrips.xml` use the `pmchat` utility.

`pmchat` works just like the standard unix `chat` program, only it ensures interoperation with the port manager.

The final options, `speed`, `charsize`, `stop` and `parity` define the recommended or default settings for the attached device.

14.10. IPMItool

The *console server* includes the `ipmitool` utility for managing and configuring devices that support the Intelligent Platform Management Interface (IPMI) versions 1.5 and 2.0.

IPMI is an open standard for monitoring, logging, recovery, inventory, and control of hardware that is implemented independent of the main CPU, BIOS, and OS. The service processor (or Baseboard Management Controller, BMC) is the brain behind platform management and its primary purpose is to handle the autonomous sensor monitoring and event logging features.

The `ipmitool` program provides a simple command-line interface to this BMC. It features the ability to read sensor data repository (SDR) and print sensor values, display the contents of the System Event Log (SEL), print Field Replaceable Unit (FRU) inventory information, read and set LAN configuration parameters, and perform remote chassis power control.

The `ipmitools` man page is not shipped with Opengear hardware. It is reproduced below.

Synopsis

```
ipmitool [-c|-h|-v|-V] -I open <command>
ipmitool [-c|-h|-v|-V] -I lan -H <hostname>
    [-p <port>]
    [-U <username>]
    [-A <authtype>]
    [-L <privlvl>]
    [-a|-E|-P|-f <password>]
    [-o <oemtype>]
    <command>

ipmitool [-c|-h|-v|-V] -I lanplus -H <hostname>
    [-p <port>]
    [-U <username>]
    [-L <privlvl>]
    [-a|-E|-P|-f <password>]
    [-o <oemtype>]
    [-C <ciphersuite>]
    <command>
```

Description

This program lets you manage Intelligent Platform Management Interface (IPMI) functions of either the local system, via a kernel device driver, or a remote system, using IPMI V1.5 and IPMI v2.0. These functions include printing FRU information, LAN configuration, sensor readings, and remote chassis power control.

IPMI management of a local system interface requires a compatible IPMI kernel driver to be installed and configured. On Linux this driver is called OpenIPMI and it is included in standard distributions. On Solaris this driver is called BMC and is included in Solaris 10. Management of a remote station requires the IPMI-over-LAN interface to be enabled and configured. Depending on the particular requirements of each system it may be possible to enable the LAN interface using ipmitool over the system interface.

Options

option	variable	notes
-a		Prompt for the remote server password.
-A	<authtype>	Present output in CSV (comma separated variable) format. This is not available with all commands.
-c		
-C	<ciphersuite>	The remote server authentication, integrity, and encryption algorithms to use for IPMIv2 lanplus connections. See table 22-19 in the IPMIv2 specification. The default is 3 which specifies RAKP-HMAC-SHA1 authentication, HMAC-SHA1-96 integrity, and AES-CBC-128 encryption algorithms.
-E		The remote server password is specified by the environment variable IPMI_PASSWORD.
-f	<password_file>	Specifies a file containing the remote server password. If this option is absent, or if password_file is empty, the password will default to NULL.
-h		Get basic usage help from the command line.
-H	<address>	Remote server address, can be IP address or hostname. This option is required for lan and lanplus interfaces.
-I	<interface>	Selects IPMI interface to use. Supported interfaces that are compiled in are visible in the usage help output.

-L	<privlvl>	Force session privilege level. Can be CALLBACK, USER, OPERATOR, and ADMIN. Default is ADMIN.
-m	<local_address>	Set the local IPMB address. The default is 0x20 and there should be no need to change it for normal operation.
-o	<oemtype>	Select OEM type to support. This usually involves minor hacks in place in the code to work around quirks in various BMCs from various manufacturers. Use -o list to see a list of current supported OEM types.
-p	<port>	Remote server UDP port to connect to. Default is 623.
-P	<password>	Remote server password is specified on the command line. If supported it will be obscured in the process list. Note! Specifying the password as a command line option is not recommended.
-t	<target_address>	Bridge IPMI requests to the remote target address.
-U	<username>	Remote server username, default is NULL user.
-v		Increase verbose output level. This option may be specified multiple times to increase the level of debug output. If given three times you will get hexdumps of all incoming and outgoing packets.
-V		Display version information.

If no password method is specified then ipmitool will prompt the user for a password. If no password is entered at the prompt, the remote server password will default to NULL.

Security

The `ipmitool` documentation highlights that there are several security issues to be considered before enabling the IPMI LAN interface. A remote station has the ability to control a system's power state as well as being able to gather certain platform information. To reduce vulnerability it is strongly advised that the IPMI LAN interface only be enabled in 'trusted' environments where system security is not an issue or where there is a dedicated secure 'management network' or access has been provided through an console server.

Further it is strongly advised to not enable IPMI for remote access without setting a password. That that password should not be the same as any other password on that system.

When an IPMI password is changed on a remote machine with the IPMIv1.5 lan interface the new password is sent across the network as clear text. This could be observed and then used to attack the remote system. It is thus recommended that IPMI password management only be done over IPMIv2.0 lanplus interface or the system interface on the local station.

For IPMI v1.5, the maximum password length is 16 characters. Longer passwords are truncated. For IPMI v2.0, the maximum password length is 20 characters. Longer passwords are truncated.

Commands

command	notes
help	This can be used to get command-line help on ipmitool commands. It may also be placed at the end of commands to get option usage help.
raw	Send a RAW IPMI request and print response
lan	Configure LAN Channels
chassis*	Get chassis status and set power state

event	Send pre-defined events to MC
mc	Management Controller status and global enables
sdr	Print Sensor Data Repository entries and readings
sensor	Print detailed sensor information
fru	Print built-in FRU and scan SDR for FRU locators
sel	Print System Event Log (SEL)
pef	Configure Platform Event Filtering (PEF)
sol	Configure IPMIv2.0 Serial-over-LAN
isol	Configure IPMIv1.5 Serial-over-LAN
user	Configure Management Controller users
channel	Configure Management Controller channels
session	Print session information
exec	Run list of commands from file
set	Set runtime variable for shell and exec

*chassis commands: status, power, identify, policy, restart_cause, poh, bootdev.

chassis power commands: status, on, off, cycle, reset, diag, soft.

More details on `ipmitools` are availalbe at the project site, https://sourceforge.net/projects/ipmitool/.

14.11. Custom development kit (CDK)

As detailed in this manual, customers can copy scripts, binaries and configuration files directly to the *console server*.

Opengear also freely provides a development kit which allows changes to be made to the software in console server firmware image. The customer can use the CDK to:

- generate a firmware image without certain programs, such as `telnet`, which may be banned by company policy.
- generate an image with new programs, such as custom Nagios plug-in binaries or company specific binary utilities.
- generate an image with custom defaults e.g. it may be required that the console server be configured to have a specific default serial port profile which is reverted to even in event of a factory reset
- place configuration files into the firmware image, which cannot then be modified.

  For example

  ```
  # /bin/config --set= tools
  ```

  updates the configuration files in `/etc/config` which are read/write, whereas the files in `/etc` are read only and cannot be modified.

The CDK essentially provides a snapshot of the Opengear build process (taken after the programs have been compiled and copied to a temporary directory, `romfs`) just before the compressed file systems are generated.

You can obtain a copy of the Opengear CDK for the particular appliance you are working with from ftp://ftp.opengear.com/cdk. Further information is avalable at http://opengear.com/faq284.html.

Note: the CDK is free, however Opengear does not provide free technical support for systems modified using the CDK and any changes are the responsibility of the user.

14.12. Scripts for managing slaves

When the console servers are cascaded the Master is in control of the serial ports on the Slaves, and the Master's Management Console provides a consolidated view of the settings for its own and all the Slave's serial ports.

However the Master does not provide a fully consolidated view. **Status > Active Users** only displays those users active on the Master's ports. You will need to write a custom bash script that parses the port logs if you want to find out who's logged in to cascaded serial ports from the master.

You will probably also want to enable remote or USB logging, as local logs only buffer 8K of data and don't persist between reboots.

This script would, for example, parse each port log file line by line

Each time it sees `LOGIN: username`, it adds `username` to the list of connected users for that port. Each time it sees `LOGOUT: username`, it removes it from the list.

The list can then be nicely formatted and displayed. It's also possible to run this as a CGI script on the remote log server.

To enable log storage and connection logging:

- select **Alerts & Logging > Port Log**.
- configure log storage.
- select **Serial & Network > Serial Port**.
- Edit the serial port(s).
- Under *Console Server*, select Logging Level 1.
- click **Apply**.

Note: a useful tutorial on creating a bash script CGI is at http://yolinux.com/TUTORIALS/LinuxTutorialCgiShellScript.html.

Similarly the Master maintains a view of the status of the slaves:

- select **Status > Support Report**.
- scroll down to **Processes**.
- look for `/bin/ssh -MN -o ControlPath=/var/run/cascade/%h slavename`.

These are the slaves that are connected

Note: the end of the Slaves' names will be truncated, so the first 5 characters must be unique

Alternatively, you can write a custom CGI script as described above. The currently connected Slaves can be determined by running `ls /var/run/cascade` and the configured slaves can be displayed by running `config -g config.cascade.slaves`.

14.13. SMS server tools

Firmware releases v3.1 and later include the *SMS Server Tools* software which provides an SMS Gateway which can send and receive short messages through GSM modems and mobile phones.

You can send short messages by simply storing text files into a special spool directory. The program monitors this directory and sends new files automatically. It also stores received short messages into another directory as text files. Binary messages (including Unicode text) are also supported, for example ring tone messages. It's also possible to send a WAP Push message to a WAP- or MMS-capable mobile phone.

The program can be run as an SMS daemon which can be started automatically when the operating system starts. High availability can be ensured by using multiple GSM devices (currently up to 64).

The program can run other external programs or scripts after events like reception of a new message, successful sending and also when the program detects a problem. These programs can inspect the related text files and perform automatic actions

The SMS Server Tools software needs a GSM modem (or mobile phone) with SMS command set according to the European specifications

GSM 07.05 (=ETSI TS 300 585) and GSM 03.38 (=ETSI TS 100 900).

The AT command set is supported. Devices can be connected with serial port, infrared or USB.

For more information see http://smstools3.kekekasvi.com/ or the online Opengear FAQ.

14.14. Multicast

By default, all Opengear console servers come with Multicasting enabled. Multicasting provides Opengear products with the ability to simultaneously transmit information from a single device to a select group of hosts.

With firmware releases v3.1 and later, multicasting can be disabled and re-enabled from the command line. To disable multicasting type:

```
ifconfig eth0 -multicast
```

To re-enable multicasting from the command line type:

```
ifconfig eth0 multicast
```

IPv6 may need to be restarted when toggling between multicast states.

14.15. Bulk provisioning

Opengear appliances include wizard scripts to facilitate configuration and deployment en masse. These wizards operate at the command line level, so knowledge of the Linux command line and shell scripting is useful, but not necessary – they aim to be user-friendly enough for remote hands to manage. This bulk provisioning feature is supported by firmware version 3.9.1 or later, and Lighthouse version 4.4.0 and later (optional).

Both the bulk provisioning of Opengear appliances and bulk enrollment of these appliances into Lighthouse central management system(s) is supported. These features may be used separately or in conjunction.

Using this method, an Opengear appliance can be fully configured and enrolled into Lighthouse with minimal interaction, in under 5 minutes. The basic steps are:

- Configure an individual *golden master* appliance with the baseline configuration shared by all Opengear appliances. This may be a minimal configuration if the installs are quite diverse, or a complete configuration when dealing with replicated installs.
- Use `make-template` to turn the golden master's active configuration into a template configuration that may be applied to other appliances.
- Create an OPG backup of the templated golden master appliance.
- Restore this configuration to each target devices via the CLI, web UI or using a USB thumb drive.
- Login via the CLI to complete configuration using `setup-wizard`.
- (Optional) On Lighthouse, use *enrollment-wizard* to automatically place appliances under management. This may be local/routable appliances, or remote appliances that have automatically Call Home using *callhome-wizard*.

Steps 5 and 6 may be reversed for remote setup via Lighthouse.

Full details for the above steps can be found in the Knowledge Base

14.16. Zero touch provisioning

Zero Touch Provisioning (ZTP) was introduced with firmware release 3.15.1 to allow Opengear appliances to be provisioned during their initial boot from a DHCP server.

14.16.1.Preparation

These are typical steps for configuration over a trusted network:

- Configure a same-model Opengear device.
- Optionally use the *Bulk Provisioning* wizard scripts to remove any appliance-specific settings (that is, create a template configuration) and/or prepare the configuration for automated Lighthouse enrollment. See chapter 14.15.
- Save the configuration as an Opengear backup (`.opg`) file under **System > Configuration Backup** in the web UI, or via `config -e` in the CLI.

  Alternatively, you can save the XML configuration as a file ending in `.xml`.
- Publish the `.opg` or `.xml` file on a fileserver that understands one of the HTTPS, HTTP, FTP or TFTP protocols.
- Configure your DHCP server to include a vendor specific option for Opengear devices. The

option text should be a URL to the location of the `.opg` or `.xml` file. The option text should not exceed 250 characters in length. It must end in either `.opg` or `.xml`.

- Connect a new Opengear device (either at defaults from the factory, or config erased) to the network and apply power.

Note: it may take up to 5 minutes for the device to find the .opg or .xml file via DHCP, download, install the file and reboot itself.

14.16.2.Example ISC DHCP server configuration

The following is an example ISC DHCP server configuration fragment for serving an `.opg` configuration image:

```
option space opengear code width 1 length width 1;
option opengear.config-url code 1 = text;

class "opengear-ztp" {
 match if option vendor-class-identifier ~~ "^Opengear/";
 vendor-option-space opengear;
 option opengear.config-url "https://example.com/opg/$
{class}.opg";
}
```

For other DHCP servers, please consult their documentation on specifying vendor specific option fields.

We use sub-option 1 to hold the URL text.

14.16.3.Setup for an untrusted LAN

If network security is a concern, and you can have remote hands insert a trusted USB flash drive into the Opengear device during provisioning, then follows are a summary of the steps required for deploying configuration in an untrusted network:

- Generate an X.509 certificate for the client. Place it and its private key file onto a USB flash drive (concatenated as a single file, `client.pem`).
- Set up a HTTPS server that restricts access to the `.opg` or `.xml` file for HTTPS onnections providing the client certificate.
- Put a copy of the CA cert (that signed the HTTP server's certificate) onto the USB flash drive as well (`ca-bundle.crt`).
- Insert the USB flash drive into the Opengear device *before attaching power or network*.
- Continue with the steps above, but using only an https URL.

14.16.4.How it works

This section explains in detail how the Opengear device uses DHCP to obtain its initial configuration.

First, an Opengear console manager is either configured or unconfigured. ZTP needs it to be in an unconfigured state, which is only obtained in the following ways:

- Firmware programming at factory.
- Pressing the Config Erase button twice during operation.
- Selecting **Config Erase** under **System > Administration** in the web UI, and rebooting.
- Creating the file `/etc/config/.init` and then rebooting.

When an unconfigured Opengear device boots, it performs these steps to find a configuration:

- the Opengear device transmits a DHCP DISCOVER request onto its primary Network Interface (WAN).

  This DHCP request carries a Vendor Class Identifier of the form Opengear/model-name (for example, Opengear/ACM5003-M) and its parameter request list will include option 43 (Vendor-Specific Information).
- On receipt of a DHCP OFFER, the device will use the information in the offer to assign an IPv4 address to its primary Network Interface, add a default route, and prepare its DNS resolver.
- If the offer also contained an option 43 with sub-option 1, the device interprets the sub-option as a whitespace-separated list of URLs to configuration files to try to restore.
- If an NTP server option was provided in the DHCP offer, the system clock is synchronized with the NTP server.
- The system now searches all attached USB storage devices for two optional certificate files. The first file is named `ca-bundle.crt` and the second one is whichever one of the following filenames is found first:

file-name	notes
client-*aabbccddeeff*.pem	*aabbccddeeff* is the MAC address of the primary network interface.
client-*model*.pem	*model* is the (vendor class) model name in lowercase.
client.pem	

- If both files — `ca-bundle.crt` and `client*.pem` — are found, then secure mode is enabled for the next section.

Each URL in the list obtained from option 43 sub-option 1 is tried in sequence until one succeeds:

- the URL undergoes substring replacement from the following table:

sub-string	replaced by	example
${mac}	the 12-digit MAC address of the device.	0013b600b669
${model}	the full model name, in lowercase.	acm5504-5-g-w-i
${class}	the firmware hardware class.	ACM550x
${version}	the firmware version number.	3.15.1

- the resulting URL must end in `.opg` or `.xml` (an optional `?query-string` is permitted).

  If is doesn't, it is skipped and the next URL is tried.

- in secure mode, the URL must use the https scheme or it is skipped.
- otherwise the available schemes are: http, https, tftp, ftp, and ftps.
- The `curl` program is used to download the URL.
- In secure mode, the server's certificate must validate against the `ca-bundle.crt`.

  The (required) `client.pem` file is provided to authenticate the client to the server. See the curl documentation for the format of these files.
- The URL is downloaded.

  For `.opg` files, its header is checked to see if it is compatible with the current device.

  For `.xml` files, a parse check is made. If the check fails, the downloaded file is abandoned and the next URL is tried.
- The file is imported into the current configuration.
- The system checks to see if a hostname has been set in the config. If not, it is set to `${model}-${mac}`.
- The system checks to see if it is still in an unconfigured state. If it is, then the network interface mode is set to DHCP. This effectively forces the system into a configured state, preventing a future reboot loop.
- The system reboots.

Note: *If all the URLs were skipped or failed, the system will wait for 30 seconds before retrying again. It will retry all the URLs up to 10 times. After the 10th retry, the system reboots. If the system has been manually configured in the meantime, the retries stop and ZTP is disabled.*

Note: *Note: If no option 43 is received over DHCP, no URLs are downloaded and no reboots occur: the system must be manually configured. Once configured (manually or by ZTP), an Opengear will no longer request option 43 from the DHCP server, and it will ignore any option 43 configuration URLs presented to it.*

14.17. Internal storage

Some models have an internal USB flash drive, a non-volatile NAND flash partition, or both, which can be used by portmanager for log storage and the TFTP/FTP server for file storage.

These storage devices are automatically mounted as subdirectories of /var/mnt/. The default directory served by FTP or TFTP is set to the preferred internal storage (if any), otherwise the first detected attached USB storage. The location of portmanager logs must be manually configured.

14.17.1.Filesystem location of FTP & TFTP directory

product	preferred storage	directory
ACM7000	internal flash	/var/mnt/storage.nvlog/tftpboot/
CM7100	internal USB flash	/var/mnt/storage.usb/tftpboot/
IM7200	internal USB flash	/var/mnt/storage.usb/tftpboot/
ACM5500	internal USB flash	/var/mnt/storage.usb/tftpboot/

ACM5000-F	internal USB flash option	/var/mnt/storage.usb/tftpboot/
Other products with USB	first-attached USB storage	/var/mnt/storage.usb/tftpboot/

14.17.2.Filesystem location of portmanager logs

port log server type	directory
USB flash memory	/var/mnt/storage.usb
non-volatile internal storage	/var/mnt/storage.nvlog
micros-SD card	/var/mnt/storage.sd
other (NFS, CIFS, etc)	as explicitly configured

14.17.3.Configuring FTP & TFTP directory

The FTP or TFTP services can be configured to serve different directories via the command line. For example:

```
config -s config.services.ftp.directory=/var/mnt/storage.usb/\
my-ftp-dir
config -r services
```

The directory will be created if it doesn't already exist.

14.17.4.Mounting a preferred USB disk by label

Currently, the 'first' USB storage device is mounted at `/var/mnt/storage.usb` by detecting the lowest numbered disk partition, for example `/dev/sda1`. This can be constrained to match a particular port or a labelled device.

- Attach the USB disk you plan to use.
- Look in directories `/dev/disk/by-path/` or `/dev/disk/by-label/` to find a suitably stable way of identifying your disk.
- Use the following command to see the current device matching string used:
- `# config -g config.storage.usb.device`
- Change the path match with (for example):
- `# config -s config.storage.usb.device=/dev/disk/by-label/1103`

Appendix 1. Commands & source code

Appendix 1.1.Commands

The *console server* platform is a dedicated Linux computer, optimized to provide monitoring and secure access to serial and network consoles of critical server systems and their supporting power and networking infrastructure.

Opengear console servers are built on the **uCLinux** distribution as developed by the uCLinux project. This is GPL code and the source can be found at http://uclinux.org/pub/uClinux/dist/.

Some **uCLinux** commands have config files that can be altered (for example, *portmanager*, *inetd*, *init*, and *sshd*).

Other commands you can run and do neat stuff with (for example *loopback*, *bash* (shell), *ftp*, *hwclock*, *iproute*, *iptables*, *netcat*, *ifconfig*, *mii-tool*, *netstat*, *route*, *ping*, *portmap*, *pppd*, *routed*, *setserial*, *smtpclient*, *stty*, *stunel*, *tcpdump*, *tftp*, *tip*, and *traceroute*).

Opengear console servers also ship with **Busybox**, the ‘Swiss Army Knife of embedded Linux’ which ‘combines tiny versions of many common UNIX utilities into a single small executable.’ See https://busybox.net/ for more information.

The table below lists most of the standard **uCLinux** commands (ucl), **Busybox** commands (bb), and some custom Opengear commands (og), included in the default build tree. The shorthand immediately right of each listed command shows which source is used to run a given command: *ucl* for **uCLinux**; *bb* for **Busybox**; and *og* for Opengear-specific commands.

The Administrator can use these to configure the console server, and monitor and manage attached serial console and host devices.

command		description
addgroup	*bb*	Add a group or add a user to a group.
adduser	*bb*	Add a user.
agetty	*ucl*	Alternative Linux getty.
arp	*ucl*	Manipulate the system ARP cache.
arping	*ucl*	Send ARP requests/replies.
bash	*ucl*	GNU Bourne-Again Shell.
busybox	*bb*	Swiss army knife of embedded Linux commands.
cat	*bb*	Concatenate file(s) and print them to stdout.
chat	*ucl*	Useful for interacting with a modem connected to stdin/stdout.
chgrp	*bb*	Change file access permissions.
chmod	*bb*	Change file access permissions.
chown	*bb*	Change file access permissions.
config	*og*	Tool to manipulate and query system configuration from the shell.
cp	*bb*	Copy files and directories.
date	*bb*	Print or set the system date and time.
dd	*bb*	Convert and copy a file.
deluser	*bb*	Delete a user from the system.
df	*bb*	Report file system disk space usage.
dhcpd	*ucl*	Dynamic Host Configuration Protocol server.
discard	*ucl*	Network utility that listens on the discard port.
dmesg	*bb*	Print or control the kernel ring buffer.
echo	*bb*	Print the specified ARGs to stdout.
erase	*ucl*	Tool for erasing MTD partitions.
eraseall	*ucl*	Tool for erasing entire MTD partitions.
false	*bb*	True and false return an exit status. Zero for true; non-zero for false.
find	*ucl*	Search for files.
flashw	*ucl*	Write data to individual flash devices.
flatfsd	*ucl*	dæmon to save RAM file systems back to FLASH.
ftp	*ucl*	Internet file transfer program.
gen-keys	*ucl*	SSH key generation program
getopt	*bb*	Parses command options.
gettyd	*ucl*	Getty dæmon
grep	*bb*	Print lines matching a pattern.
gunzip	*bb*	Compress or expand files.
gzip	*bb*	Compress or expand files.
hd	*ucl*	ASCII, decimal, hexadecimal, octal dump.
hostname	*bb*	Get or set hostname or DNS domain name.
httpd	*ucl*	Listen for incoming HTTP requests.
hwclock	*ucl*	Query and set hardware clock (RTC).
inetd	*ucl*	Network super-server dæmon.
inetd-echo	*ucl*	Network echo utility.
init	*ucl*	Process control initialization.

ip	*ucl*	Show or manipulate routing, devices, policy routing, and tunnels.
ipmitool	*ucl*	Linux IPMI manager.
iptables	*ucl*	Administration tool for IPv4 packet filtering and NAT.
ip6tables	*ucl*	Administration tool for IPv6 packet filtering.
iptables-restore	*ucl*	Restore IP tables.
iptables-save	*ucl*	Save IP tables.
kill	*bb*	Send a signal to a process to end gracefully.
ln	*bb*	Make links between files.
login	*ucl*	Begin session on the system.
loopback	*og*	Loopback diagnostic command.
loopback1	*og*	Loopback diagnostic command.
loopback2	*og*	Loopback diagnostic command.
loopback8	*og*	Loopback diagnostic command.
loopback16	*og*	Loopback diagnostic command.
loopback48	*og*	Loopback diagnostic command.
ls	*bb*	List directory contents.
mail	*ucl*	Send and receive mail.
mkdir	*bb*	Make directories.
mkfs.jffs2	*ucl*	Create an MS-DOS file system under Linux.
mknod	*bb*	Make block or character special files.
more	*bb*	File persual filter for crt viewing.
mount	*bb*	Mount a file system.
msmtp	*ucl*	SMTP mail client.
mv	*bb*	Move (rename) files.
nc	*ucl*	TCP/IP Swiss army knife.
netflash	*ucl*	Upgrade firmware on uCLinux platforms using the blkmem interface.
netstat	*ucl*	Print network connections, routing tables, interface statistics, etc.
ntpd	*ucl*	Network Time Protocol (NTP) dæmon.
pgrep	*ucl*	Display process(es) selected by regex pattern.
pidof	*ucl*	Find the process ID of a running program.
ping	*ucl*	Send ICMP ECHO_REQUEST packets to network hosts.
ping6	*ucl*	IPv6 ping.
pkill	*ucl*	Sends a signal to process(es) selected by regex pattern.
pmchat	*og*	Similar command to the standard *chat* command (via *portmanager*).
pmdeny	*og*	
pminetd	*og*	
pmloggerd	*og*	
pmshell	*og*	Similar to *tip* or *cu* but all serial port access is directed via portmanager.
portmanager	*og*	Command to handle all serial port access.
portmap	*ucl*	DARPA port to RPC program number mapper.
pppd	*ucl*	Point-to-point protocol dæmon.
ps	*bb*	Report a snapshot of the current processes.
pwd	*bb*	Print name of current working directory.

reboot	*bb*	Soft reboot the system.
rm	*bb*	Remove files or directories.
rmdir	*bb*	Remove empty directories.
routed	*ucl*	Show or manipulate the IP routing table.
routef	*ucl*	IP route tool to flush IPv4 routes.
routel	*ucl*	IP route tool to list routes.
rtacct	*ucl*	network statistics tool.
rtmon	*ucl*	RTnetlink listener.
scp	*ucl*	Secure copy (remote file copy program).
sed	*bb*	Stream text editor.
setmac	*ucl*	Sets the MAC address.
setserial	*ucl*	Sets and reports serial port configuration.
sh	*ucl*	The Bourne shell.
showmac	*ucl*	Shows the MAC address.
sleep	*bb*	Delay for a specified amount of time.
smbmnt	*ucl*	Helper utility for mounting SMB file systems.
smbmount	*ucl*	Mount an SMBFS file system.
smbumount	*ucl*	SMBFS umount for normal users.
snmpd	*ucl*	SNMP dæmon.
snmptrap	*ucl*	Sends an SNMP notification to a manager.
sredird	*ucl*	RFC2217-compliant serial port redirector.
ssh	*ucl*	OpenSSH SSH client (remote login program).
ssh-keygen	*ucl*	Authentication kkey generation, management, and conversion.
sshd	*ucl*	OpenSSH SSH dæmon.
stty	*ucl*	Change and print terminal line settings.
stunnel	*ucl*	Universal SSL tunnel.
sync	*bb*	Flush file system buffers.
sysctl	*ucl*	Configure kernel parameters at runtime.
syslogd	*ucl*	System logging utility.
tar	*bb*	The tar archiving utility.
tc	*ucl*	Show traffic control settings.
tcpdump	*ucl*	Dump traffic on a network.
telnetd	*ucl*	Telnet protocol server.
tftp	*ucl*	Client to transfer a file to or from a tftp server.
tftpd	*ucl*	Trivial file transfer protocol (tftp) server.
tip	*ucl*	Simple terminal emulator for connecting to modems and serial devices.
top	*ucl*	Provide a view of process activity in real time.
touch	*bb*	Change file timestamps.
traceroute	*ucl*	Print the route packets take to a network host.
traceroute6	*ucl*	Traceroute for IPv6.
true	*bb*	True and false return an exit status. Zero for true; non-zero for false.
umount	*bb*	Unmounts file systems.
uname	*bb*	Print system information.
usleep	*bb*	Delay for a specified time.

vconfig	*bb*	Create and remove virtual ethernet devices.
vi	*bb*	Busybox clone of the VI text editor.
w	*ucl*	Show who is logged on and what they are doing.
zcat	*bb*	Identical to *gunzip -c*.

With most of the above commands, the *-h* or *--help* argument provides a terse runtime description of their behavior.

More details on the Linux commands can found at http://en.tldp.org/HOWTO/HOWTO-INDEX/howtos.html and http://faqs.org/docs/Linux-HOWTO/Remote-Serial-Console-HOWTO.html.

An updated list of the commands in the latest console server build can be found at http://www.opengear.com/faq233.html. Alternatively, run *ls* when */bin/* is the present working directory (pwd) to view all the commands available on your *console server*.

There were a number of Opengear tools listed above, each denoted as *og*, that make it simple to configure the console server and ensure the changes are stored in the *console server's* flash memory. These commands are documented in previous chapters and include:

- *config*, which allows manipulation and querying of the system configuration from the command line. With config a new configuration can be activated by running the relevant configurator, which performs the action necessary to make the configuration changes live.
- *portmanager*, which provides a buffered interface to each serial port. It is supported by the *pmchat* and *pmshell* commands which ensure all serial port access is directed via the *portmanager*.
- *pmpower*, which is a configurable tool for manipulating remote power devices that are serially- or network-connected to the *console server*.
- *SDT Connector*, which is a java client applet that provides point-and-click SSH-tunneled connections to the *console server* and Managed Devices.

There are also a number of other CLI commands related to other open source tools embedded in the console server including:

- *PowerMan*, which provides power management for many preconfigured remote power controller (RPC) devices. For CLI details see http://linux.die.net/man/1/powerman.
- *Network UPS Tools (NUT)*, which provides reliable monitoring of UPS and PDU hardware and ensure safe shutdowns of the systems which are connected, with a goal to monitor every kind of UPS and PDU. For CLI details see http://networkupstools.org/.
- *Nagios*, which is a popular, enterprise-class management tool that provides central monitoring of the hosts and services in distributed networks. For CLI details see http://nagios.org/.

The *console server* also supports GNU bash shell scripts, enabling the Administrator to run custom scripts. GNU bash, version 2.05.0(1)-release (arm-OpenGear-linux-gnu) offers the following shell commands:

command	**arguments**
alias	[-p] [*name*[=*value*] ...]
bg	[*jobspec* ...]

bind	[-lpvsPVS] [-m keymap] [-f fi break [n]
case	*word* in [[(] *pattern* [| *pattern*]…) *command-list* ;;]… esac
cd	[-L|[-P [-e]] [-@] [*directory*]
command	[-pVv] *command* [arguments …]
compgen	[*option*] [*word*]
complete	[-abcdefgjksuv] [-o *comp-option*] [-DE] [-A *action*] [-G *globpat*] [-W *wordlist*] [-F *function*] [-C *command*] [-X *filterpat*] [-P *prefix*] [-S *suffix*] name [*name* …] complete -pr [-DE] [*name* …]
continue	[*n*]
declare	[-aAfFgilnrtux] [-p] [*name*[=*value*] …]
dirs	[-clpv] [+*N* | -*N*]
disown	[-ar] [-h] [*jobspec* … | *pid* …]
echo	[-neE] [*arg* …]
enable	[-a] [-dnps] [-f *filename*] [*name* …]
eval	[*arguments*]
exec	[-cl] [-a *name*] [*command* [*arguments*]]
exit	[*n*]
export	[-fn] [-p] [*name*[=*value*]]
false	
fc	[-e *ename*] [-lnr] [*first*] [*last*] -s [*pat*=*rep*] [*command*]
fg	[*jobspec*]
for	*name* [[in [*words* …]] ;] do *commands*; done
function	*name* { *commands* ; } or NA
getopts	*optstring name* [*args*]
hash	[-r] [-p *filename*] [-dt] [*name*]
help	[-dms] [*pattern*]
history	[*n*] -c -d *offset* [-anrw] [*filename*] -ps *arg*
if	*test-commands*; then *consequent-commands*; [elif *more-test-commands*; then *more-consequents*;] [else *alternate-consequents*;] fi
kill	[-s *sigspec*] [-n *signum*] [-*sigspec*] *jobspec or pid* -l|-L [*exit_status*]
local	[*option*] *name*[=*value*] …
logout	
popd	[-n] [+*N* | -*N*]
printf	[-v *var*] *format* [*arguments*]
pushd	[-n] [+*N* | -*N* | *dir*]
pwd	[-LP]
read	[-ers] [-a *aname*] [-d *delim*] [-i *text*] [-n *nchars*] [-N *nchars*] [-p *prompt*] [-t *timeout*] [-u *fd*] [*name* …]
readonly	[-aAf] [-p] [*name*[=*value*]] …
select	*name* [in words …]; do *commands*; done
set	[--abefhkmnptuvxBCEHPT] [-o *option-name*] [*argument* …] [+abefhkmnptuvxBCEHPT] [+o *option-name*] [*argument* …]

shift	[*n*]
shopt	[-pqsu] [-o] [*optname* ...]
source	*filename*
suspend	[-f]
test	*expr*
time	[-lp]
times	
trap	[-lp] [*arg*] [*sigspec* ...]
true	
type	[-afptP] [*name* ...]
typeset	[-afFgrxilnrtux] [-p] [*name*[=*value*] ...]
umask	[-p] [-S] [*mode*]
unalias	[-a] [*name* ...]
unset	[-fnv] [*name*]
until	*test-commands*; do *consequent-commands*; done
variables	*variable* wait [n] while *commands*; do *commands*; done
while	*test-commands*; do *consequent-commands*; done

Appendix 1.2.Source code

Many *console server* software components are licensed under the GNU General Public License, Version 2, which Opengear supports. A copy of the GNU General Public License is included in Appendix 6: End-user license agreements. A copy is also available at http://gnu.org/licenses/old-licenses/gpl-2.0.html. Opengear will provide source code for any of the components of the software licensed under the GNU General Public License upon request.

The source code package can be had on CD by sending a US$5.00 money order or check to:

Opengear Support
630 West 9560 South, Suite A
Sandy, UT 84070, USA

Alternately the complete source code corresponding to each released version is available from us for a period of three years after its last shipment. If you would like the source code for an earlier release than the latest current release please write “source for firmware Version x.xx” in the memo line of your payment.

This offer is valid to anyone in receipt of this information.

The *console server* also embodies the *okvm* console management software. This is GPL code and the full source is available from http://okvm.sourceforge.net/.

The *console server* BIOS (boot loader code) is a port of *uboot* which is also a GPL package with source code openly available from http://denx.de/wiki/U-Boot/.

The *console server* CGIs (the html code, xml code and web config tools for the Management Console) are proprietary to Opengear. The code will be provided to customers, under NDA.

Also built-in to the *console server* is a Port Manager application and Configuration tools as documented in Chapters 13 and 14 above. These both are proprietary to Opengear, but open to customers under NDA, as above.

Appendix 2. Hardware specifications

Appendix 2.1. Physical dimensions

model	W x D x H (mm)	W x D x H (˝)	weight (kg)	weight (lb)
ACM5002/3/4(-2) (-M/W/G)	103 x 87 x 28	4.1 x 3.4 x 1.1	1.0	2.2
ACM5504/8-2/5(-M/G/W/I)	166 x 102 x 28	6.5 x 3.4 x 1.4	1.8	4.0
ACM7004/8-2-L/M (V/A/R/MA/MV/MCR/MCT)	130 x 120 x 35	5.1 x 4.8 x 1.4	0.6	1.3
IM7216/32/48	440 x 254 x 45	17.0 x 10.0 x 1.8	4.5	10.0
IM4208/16/32/48	432 x 313 x 45	17.0 x 12.0 x 1.8	5.4	11.8
IM4216-34	432 x 313 x 45	17.0 x 12.0 x 1.8	5.4	11.8
CM7116/32/48/96	440 x 170 x 45	17.0 x 6.9 x 1.8	4.0	9.0

Appendix 2.2. Operating ranges

measure	range
ambient operating temperatures	5°C – 50°C (41°F – 122°F)
non-operating storage temperatures	-30°C – 60°C (-20°F – 140°F)
operating humidity	5% – 90%
power	See section 1.2, ‘Power connection’, for details
power consumption	All less than 30 W
RJ45 serial ports	50 – 230,400 bps

DB9 serial port	2400 –115,200 bps

Appendix 2.3.CPUs

model	CPU
IM7200 series	1 GHz ARM SoC (Marvell 88F6283)
CM7100 series	800 MHz ARM SoC (Marvell 88F6W11)
ACM7000 series	800 MHz ARM SoC (Marvell 88F6W11)
ACM5000 & ACM5500 series	Micrel KSZ8692 ARM9
Other models	Micrel KS8695P controller

Appendix 2.4.Memory & storage

model	RAM (MB)	embedded Flash (MB)	Flash storage (GB)
ACM5002/3/4(M/W/G)(-2)	32	16	
ACM5504/8-2/5(-M/G/W/I)	64	16	4
ACM7004/8-L/M (V/A/R/MA/MV/MCR/MCT)	256	256	4
IM7216/32/48	256	64	16
IM4208/16/32/48	64	16	16
IM4216-34	64	16	16
CM7116/32/48	256	32	4
CM7196A-2-DAC-US	256	64	4

Appendix 2.5.USB Ports

model	USB 2.0	USB 3.0
ACM5002/3/4(M/W/G)(-2)	2 (and 2 internal)	
ACM5504/8-2/5(-M/G/W/I)	2	
ACM7004/8-L/M (V/A/R/MA/MV/MCR/MCT)	4	
IM7216/32/48		2
IM4208/16/32/48 & IM4216-34	3	
CM7116/32/48/96	2	

Appendix 2.6.Serial ports

model	RJ45 ports	DB-9	RJ45 console
ACM5002	2 x RS-232		
ACM5003-M/W	3 x RS-232		
ACM5004(-G/LR)(-2)	4 x RS-232		
ACM5004(-G/LR)-I	4 x selectable RS-232/422/485		
ACM5504-(2/5)-G(-W)-I(-P)	4 x RS-232		
ACM5508-2-I/M	4 x selectable RS-232/422/485		
ACM7004/8-2-L/M (V/A/R/MA/MV/MCR/MCT)	4 x RS-232		

IM7216-2	16 x RS-232		1
IM7232-2	32 x RS-232		1
IM7248-2	48 x RS-232		1
IM4208-2	8 x RS-232	1	
IM4216-2 & IM4216-34	16 x RS-232	1	
IM4232-2	32 x RS-232	1	
IM4248-2	48 x RS-232	1	
CM7116-2	16 x RS-232		1
CM7132-2	32 x RS-232		1
CM7148-2	48 x RS-232		1
CM7196A-2-DAC-US	96 x RS-232		1

Appendix 2.7.Ethernet ports

model	primary LAN	management LAN
ACM5002/3/4(-M/G/LR)(-I)	1 x 100Base-T	
ACM5004-2, ACM5504-2 and ACM5508-2	2 x 100Base-T	
IM7216/32/48	2 x 100Base-T or 2 x SFP	
IM4208/16/32/48-2	2 x 100Base-T	
IM4216-34	2 x 100Base-T	32 x 100Base-T
ACM5504-5-G-W-I & ACM5004-5-G-I	1 x 100Base-T	4 x 100Base-T
ACM7004, ACM7004-2-L (V/A/R/MA/MV/MCR/MCT)	2 x 1000Base-T	
ACM7008-2-M	2 x 1000Base-T or 2 x SFP	
CM7116/32/48/96	2 x 1000Base-T	
IM7216/32/48	2 x 1000Base-T	

Appendix 3. Safety & certifications

Appendix 3.1.Safety precautions

Take care to follow the safety precautions below when installing and operating the *console server*:

- Do not remove the metal covers.

  There are no operator serviceable components inside. Opening or removing the cover may expose you to dangerous voltage which may cause fire or electric shock. Refer all service to Opengear qualified personnel.

- To avoid electric shock, the power cord protective grounding conductor must be connected through to ground.
- Always pull on the plug, not the cable, when disconnecting the power cord from the socket.
- Do not connect or disconnect the console server during an electrical storm.

A surge suppressor or UPS to protect the equipment from transients is also recommended.

Appendix 3.2.FCC warning statement

This device complies with Part 15 of the FCC rules. Operation of this device is subject to the following conditions:

1. This device may not cause harmful interference, and

2. this device must accept any interference that may cause undesired operation.

Appendix 3.3.WEEE statement

The symbol on the product or its packaging indicates that this product must not be disposed of with your other household waste. Instead, it is your responsibility to dispose of your waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste for recycling, please contact your local authority, or where you purchased your product.

Appendix 4. Connectivity, TCP ports & serial I/O

Pin-out standards exist for DB9 and DB25 connectors. There are, however, no pin-out standards for serial connectivity using RJ45 connectors. Most *console servers*, serially-managed servers, routers, switches and power devices adopt their own unique pin-outs. Consequently, custom connectors and cables may be required to interconnect your *console server*.

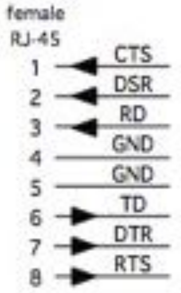
Appendix 4.1.Serial port pinouts

Opengear's console servers come with one to ninety-six serial connectors (notated SERIAL or SERIAL PORTS) for the RS232 serial ports.

- The RJ45 serial ports are located on the front face of the ACM5000 and ACM5500; on the front panel of the rack mount IM4200; on the rear panel of the rack-mount IM7200-series and CM7100-series (except the CM7196A-2-DAC-US, which has serial ports arrayed on both its front and back panels).
- The CM7100, ACM5000, ACM5500 and ACM7000 models and the IM4216-34 have Cisco Straight serial pinouts on their RJ45 connectors.
- The other IM4200 console servers are available with a selection of alternate RJ45 pinouts (which must be specified in the part number at the time of order). The IM4208-2, IM4216-2, IM4232-2 and IM4248-2 console servers have three RJ45 pinout configurations available: Opengear Classic, Cisco Straight or Cyclades/Cisco Rolled.
- The IM7200 has software selectable Cisco Straight or Cisco Rolled RJ45.

Cisco Straight RJ45 pinout (option -X2)

Straight through RJ-45 cable to equipment such as Cisco, Juniper, SUN, and more.



pin	signal	definition	direction
1	CTS	clear to send	input
2	DSR	data set ready	input
3	RXD	receive data	input
4	GND	signal ground	n/a
5	GND	signal ground	n/a
6	TXD	transmit data	output
7	DTR	data terminal ready	output
8	RTS	request to send	output

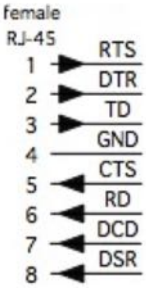
Opengear Classic (X0) RJ45 pinout

This is the same RJ45 pinout as the Avocent/Equinox brand *console server*.

pin	signal	definition	direction
1	RTS	clear to send	input
2	DSR	data set ready	input
3	DCD	receive data	input
4	RXD	signal ground	n/a
5	TXD	signal ground	n/a
6	GND	transmit data	output
7	DTR	data terminal ready	output
8	CTS	request to send	output

Cisco Roles RJ45 pinout (option -X1)

Easy to replace Avocent/Cyclades products, for use with rolled RJ-45 cable.



pin	signal	definition	direction
1	RTS	request to send	output
2	DTR	data terminal ready	output
3	TXD	transmit data	output
4	GND	signal ground	n/a
5	CTS	clear to send	input
6	RXD	receive data	input
7	DCD	data carrier detect	input
8	DSR	data set ready	input

Appendix 4.2.Local console port

Console servers with a dedicated LOCAL console/modem port use a standard DB9 connector for this port.

To connect to the LOCAL modem/console port on the console servers using a computer or terminal device use the 319001 or 319003 adaptors with standard UTP Cat 5 cable.

To connect the LOCAL console ports to modems (for out of band access) use the 319004 adaptor with standard UTP Cat 5 cable.

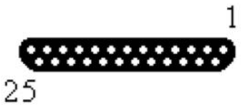
Each Opengear *console server* is supplied with UTP Cat 5 cables.

Appendix 4.3.RS232 standard pinouts

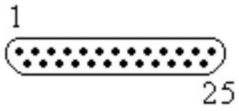
The RS232 pinout standards for the DB9 and DB25 connectors are tabled below.

db25	signal	db9	definition
1			protective ground
2	TXD	3	transmitted data
3	RXD	2	received data
4	RTS	7	request to send
5	CTS	8	clear to send
6	DSR	6	data set ready
7	GND	5	signal ground
8	CD	1	received line signal detector
9			reserved for data set testing
10			reserved for data set testing
11			unassigned
12	SCF		secondary received line signal detector
13	SCB		secondary clear to send
14	SBA		secondary transmitted data
15	DB		transmission signal timing
16	SBB		secondary received data
17	DD		receiver signal element timing
18			unassigned
19	SCA		secondary request to send
20	DTR	4	data terminal ready
21	CG		signal quality detector
22		9	ring indicator
23	CH/CI		data signal rate selector
24	DA		transmit signal element timing
25			unassigned

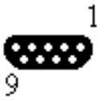
25-pin DB25 female



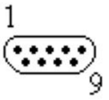
25-pin DB25 male



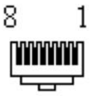
9-pin DB25 female



9-pin DB25 male



8-pin RJ45



Appendix 4.4.Connectors included in console server

The ACM5000, ACM5500, ACM7000, CM7100 and IM7200 families, and the IM4208/16/32/48-X2 and IM4216-34-X2, have the Cisco pinout by default and ship with cross-over/straight RJ45-DB9 connectors.

DB9F-RJ45S straight connector

RJ-45	wiring table	DB9 F
1 CTS	--------------------	8 CTS
2 DCD	--------------------	1 DCD
3 RXD	--------------------	2 RXD
4	N/C	

part #319014

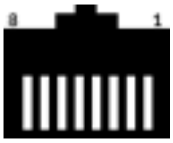
5	GND	--------------------	5	GND
6	TXD	--------------------	3	TXD
7	DTR	--------------------	4	DTR
8	RTS	--------------------	7	RTS

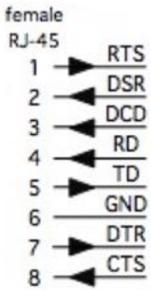
DB9F-RJ45S cross-over connector

part #319015

RJ-45		wiring table	DB9 F	
1	CTS	--------------------	7	RTS
2	DCD	--------------------	4	DTR
3	RXD	--------------------	3	TXD
4		N/C		
5	GND	--------------------	5	GND
6	TXD	--------------------	2	RXD
7	DTR	--------------|-----	1	DCD
		|-----	6	DSR
8	RTS	--------------------	8	CTS

The IM4208/16/32/48-X0 all have the Opengear Classic pinout and ship with a cross-over and a straight RJ45-DB9 connector for connecting to other vendor's products.





DB9F-RJ45S straight connector

part #319000

RJ-45		wiring table	DB9 F	
1	RTS	--------------------	7	RTS
2	DSR	--------------------	6	DSR
3	DCD	--------------------	1	DCD
4	RXD	--------------------	2	RXD
5	TXD	--------------------	3	TXD
6	GND	--------------------	5	GND
7	DTR	--------------------	4	DTR
8	CTS	--------------------	8	CTS
			9	CTS

DB9F-RJ45S cross-over connector

part #319001

RJ-45		wiring table	DB9 F	
1	RTS	--------------------	8	CTS
2	DSR	--------------------	4	DTR
3	DCD	--------------------	4	DTR
4	RXD	--------------------	3	TXD
5	TXD	--------------------	2	RXD
6	GND	--------------------	5	GND
7	DTR	--------------------	6	DSR
7	DTR	--------------------	1	DCD

8	CTS	--------------------	7	RTS
			9	RI

Appendix 4.5.Other available connectors & adapters

Opengear also supplies a range of cables and adapters that will enable you to easily connect to the more popular servers and network appliances. More detailed information can be found online at https://opengear.zendesk.com/forums/21087337-cabling.

Appendix 4.5.1.For Local/Console connection:

These adapters connect the *console server* LOCAL/Console port (via standard UTP Cat 5 cable) to modem devices (for out-of-band access):

319000 DB9F to RJ45 straight console server LOCAL Console Port to Modem.

319002 DB25M to RJ45 straight console server LOCAL Console Port to Modem.

For console server Serial Port connection, the Opengear connectors and adapters detailed below are specified to work with standard UTP Cat 5 cable.

Appendix 4.5.2.For console servers with Cisco pinouts

319014 DB9F to RJ45 straight *console server* with Cisco pinout to IP Power and other serial device.

319015 DB9F to RJ45 crossover DCE Adapter — *console server* with Cisco pinout to X86 and other.

319016 DB9M to RJ45 straight DTE Adapter — *console server* with Cisco pinout to Netscreen and Dell.

319004 DB9M to RJ45 straight DTE Adapter — *console server* OOB modem connection.

Appendix 4.5.3.For console servers with Opengear Classic pinouts

319000 DB9F to RJ45 straight Console server with Opengear classic pinout to IP Power and other serial device.

319001 DB9F to RJ45 crossover DCE Adapter — *console server* with Opengear classic pinout to X86 and other.

319002 DB25M to RJ45 straight DTE Adapter for *console server* with Opengear classic pinout.

319003 DB25M to RJ45 crossover DCE Adapter — *console server* with Opengear classic pinout to Sun and other.

319004 DB9M to RJ45 straight DTE Adapter — *console server* with Opengear classic pinout to Netscreen and Dell; and OOB modem connection.

319005 DB25F to RJ45 crossover DCE Adapter — *console server* with Opengear classic pinout to Cisco 7200 AUX.

440016 5ft Cat5 RJ-45 to RJ-45 cables.

Appendix 4.5.4.Extension cables

449016 RJ-45 plug to RJ-45 jack Adapter for console server with Opengear classic pinout to Cisco console (and to Netscreen with reversing cable).

449017 RJ-45 plug to RJ-45 jack Adapter for console server with Opengear classic pinout to Rackable Systems console.

Appendix 4.6.TCP & UDP port numbers

Port numbers are divided into three ranges: *Well Known Ports*, *Registered Ports* and *Dynamic & Private Ports*. Well Known Ports are those from 0 through 1023. Registered Ports are those from 1024 through 49151. Dynamic & Private Ports are those from 49152 through 65535.

Well Known Ports are assigned by IANA, and on most systems, can only be used by system processes or by programs executed by privileged users. The table below shows some of the well-known port numbers. For more details, please visit the IANA website: http://www.iana.org/assignments/port-numbers.

port number	protocol	tcp/udp
21	FTP (File Transfer Protocol)	TCP
22	SSH (Secure Shell)	TCP
23	Telnet	TCP
25	SMTP (Simple Mail Transfer Protocol)	TCP
37	Time	TCP, UDP
39	RLP (Resource Location Protocol)	UDP
49	TACACS, TACACS+	UDP
53	DNS	UDP
67	BootP server	UDP
68	BootP client	UDP
v69	TFTP	UDP
70	Gopher	TCP
79	Finger	TCP
80	HTTP	TCP
110	POP3	TCP
119	NNTP (Network News Transfer Protocol)	TCP
161/162	SNMP	UDP
443	HTTPS	UDP

Appendix 4.7.Serial port pinouts: ACM5004-20-I, ACM5504-G-I, & ACM5508-2-I

Each serial RJ-45 ports on these models can be software selected to be RS-232, RS-422 or RS-485.

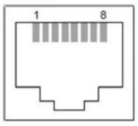
- For RS232 they have the Cisco pinout.
- For RS-422 mode it’s 4-wire full duplex transmit on TX+/TX- pair, receive on RX+/RX- pair with the following pinout.
- For RS-485 it’s 2-wire half duplex.

For the RS-485 option, to provide half duplex 'party-line' communications over a 2-wire bus (D+/D-), two short cable loops are required between the RX+/TX+ pins (pins 1 and 6) and RX-/TX- pins (pins 3 and 8) on the serial RJ-45 cable connector.

This is because the -I model uses universal differential transceivers that support 4-wire (RS-422) and 2-wire (RS-485) operation.

In RS-485 mode, the -I model listens on the 2-wire bus for receive data until it is required to send data. In RS-485 send mode it stops receiving, enables its transmitters when there is data to be sent, transmits the data and returns to receive mode.

This eliminates the possibility of collisions with other devices which share the RS-485 bus and avoids receiving bogus stale echoed data.



pin	signal	direction	rs422 signal description
1	RX+	input	receive data
2	N/C		receive data
3	RX-	input	
4	GND		
5	GND		
6	TX+	output	transmit data
7	N/C		
8	N/C	output	transmit data

Appendix 5. Terminology

term	meaning
3G	Third-generation cellular technology. The standards that determine 3G call for greater bandwidth and higher speeds for cellular networks.
AES	The Advanced Encryption Standard (AES) is a new block cipher standard to replace DES, developed by NIST, the US National Institute of Standards and Technology. AES ciphers use a 128-bit block and 128-, 192-, or 256-bit keys. The larger block size helps resist birthday attacks while the large key size prevents brute force attacks.
APN	Access Point Name (APN) is used by carriers to identify an IP packet data network that a mobile data user wants to communicate with and the type of wireless service.
Authentication	Authentication is the technique by which a process verifies that its communication partner is who it is supposed to be and not an imposter. Authentication confirms that data is sent to the intended recipient and assures the recipient that the data originated from the expected sender and has not been altered on route.
BIOS	Basic Input/Output System is the built-in software in a computer that are executed on startup (boot) and that determine what the computer can do without accessing programs from a disk. On PCs, the BIOS contains all the code required to control the keyboard, display screen, disk drives, serial communications, and a number of miscellaneous functions.

Bonding	Ethernet Bonding or Failover is the ability to detect communication failure transparently, and switch from one LAN connection to another.
BOOTP	Bootstrap Protocol. A protocol that allows a network user to automatically receive an IP address and have an operating system boot without user interaction. BOOTP is the basis for the more advanced DHCP.
Certificates	A digitally signed statement that contains information about an entity and the entity's public key, thus binding these two pieces of information together. A certificate is issued by a trusted organization (or entity) called a Certification Authority (CA) after the CA has verified that the entity is who it says it is.
Certificate Authority	A Certificate Authority is a trusted third party, which certifies public key's to truly belong to their claimed owners. It is a key part of any Public Key Infrastructure, since it allows users to trust that a given public key is the one they wish to use, either to send a private message to its owner or to verify the signature on a message sent by that owner.
Certificate Revocation List	A list of certificates that have been revoked by the CA before they expired. This may be necessary if the private key certificate has been compromised or if the holder of the certificate is to be denied the ability to establish a connection to the *console server*.
CHAP	Challenge-Handshake Authentication Protocol (CHAP) is used to verify a user's name and password for PPP Internet connections. It is more secure than PAP, the other main authentication protocol.
DES	The Data Encryption Standard is a block cipher with 64-bit blocks and a 56-bit key.
DHCP	Dynamic Host Configuration Protocol. A communications protocol that assigns IP addresses to computers when they are connected to the network.
DNS	The Domain Name System allocates Internet domain names and translates them into IP addresses. A domain name is a meaningful and easy to remember name for an IP address.
DUN	Dial-up Networking.
Encryption	The technique for converting a readable message (plaintext) into apparently random material (ciphertext) which cannot be read if intercepted. The proper decryption key is required to read the message.
Ethernet	A physical network layer protocol based upon IEEE standards.
Firewall	A network gateway device that protects a private network from users on other networks. A firewall is usually installed to allow users on an intranet access to the public Internet without allowing public Internet users access to the intranet.
Gateway	A machine that provides a route (or pathway) to the outside world.
Hub	A network device that allows more than one computer to be connected as a LAN, usually using UTP cabling.
Internet	A worldwide system of computer networks - a public, cooperative, and self-sustaining network of networks accessible to hundreds of millions of people worldwide. The Internet is technically distinguished because it uses the TCP/IP set of protocols.
Intranet	A private TCP/IP network within an enterprise.

IP address	Fundamental internet addressing method that uses the form *nnn.nnn.nnn.nnn*.
IPMI	Intelligent Platform Management Interface (IPMI) is a set of common interfaces to a computer system which system administrators can use to monitor system health and manage the system. The IPMI standard defines the protocols for interfacing with a service processor embedded into a server platform.
Key lifetimes	The length of time before keys are re-negotiated.
LAN	Local Area Network.
LDAP	The Lightweight Directory Access Protocol (LDAP) is based on the X.500 standard, but significantly simpler and more readily adapted to meet custom needs. The core LDAP specifications are all defined in RFCs. LDAP is a protocol used to access information stored in an LDAP server.
LED	Light-Emitting Diode.
MAC address	Every piece of Ethernet hardware has a unique number assigned to it called its MAC address. Ethernet is used locally to connect the console server to the Internet, and it may share the local network with many other appliances. The MAC address is used by the local Internet router in order to direct *console server* traffic to it rather than something else in the local area. It is a 48-bit number usually written as a series of 6 hexadecimal octets. For example: *00:d0:cf:00:5b:da*. A *console server* has a MAC address listed on a label underneath the device.
MSCHAP	Microsoft Challenge Handshake Authentication Protocol (MSCHAP) is authentication for PPP connections between a computer using a Microsoft Windows operating system and a network access server. It is more secure than PAP or CHAP, and is the only option that also supports data encryption.
NAT	Network Address Translation. The translation of an IP address used on one network to an IP address on another network. Masquerading is one particular form of NAT.
Net mask	The way that computers know which part of a TCP/IP address refers to the network, and which part refers to the host range.
NFS	Network File System is a protocol that allows file sharing across a network. Users can view, store, and update files on a remote computer.
Out-of-band (OOB)	Out-of-Band (OOB) management is any management done over channels and interfaces that are separate from those used for user/customer data. Examples would include a serial console interface or a network interface connected to a dedicated management network that is not used to carry customer traffic, or to a BMC/service processor. Any management done over the same channels and interfaces used for user/customer data is In Band.
PAP	Password Authentication Protocol (PAP) is the usual method of user authentication used on the internet: sending a username and password to a server where they are compared with a table of authorized users. Whilst most common, PAP is the least secure of the authentication options.

PPP	Point-to-Point Protocol. A networking protocol for establishing simple links between two peers.
RADIUS	The Remote Authentication Dial-In User Service (RADIUS) protocol was developed by Livingston Enterprises as an access server authentication and accounting protocol. The RADIUS server can support a variety of methods to authenticate a user. When it is provided with the username and original password given by the user, it can support PPP, PAP or CHAP, UNIX login, and other authentication mechanisms.
Router	A network device that moves packets of data. A router differs from a hub or a switch because it is *intelligent* and can route packets to their final destination.
SIM	Subscriber Identity Module (SIM) card stores unique serial numbers and security authentication used to identify a subscriber on mobile telephony devices.
SMASH	Systems Management Architecture for Server Hardware is a standards-based protocols aimed at increasing productivity of the management of a data center. The SMASH Command Line Protocol (SMASH CLP) specification provides an intuitive interface to heterogeneous servers independent of machine state, operating system or OS state, system topology or access method. It is a standard method for local and remote management of server hardware using out-of-band communication.
SMTP	Simple Mail Transfer Protocol. console server includes, SMTPclient, a minimal SMTP client that takes an email message body and passes it on to a SMTP server (default is the MTA on the local host).
SOL	Serial Over LAN (SOL) enables servers to transparently redirect the serial character stream from the baseboard universal asynchronous receiver/transmitter (UART) to and from the remote-client system over a LAN. With SOL support and BIOS redirection (to serial) remote managers can view the BIOS/POST output during power on, and reconfigured.
SSH	Secure Shell is secure transport protocol based on public-key cryptography.
SSL	Secure Sockets Layer is a protocol that provides authentication and encryption services between a web server and a web browser.
TACACS+	The Terminal Access Controller Access Control System (TACACS+) security protocol is a more recent protocol developed by Cisco. It provides detailed accounting information and flexible administrative control over the authentication and authorization processes. TACACS+ allows for a single access control server (the TACACS+ daemon) to provide authentication, authorization, and accounting services independently. Each service can be tied into its own database to take advantage of other services available on that server or on the network, depending on the capabilities of the daemon. There is a draft RFC detailing this protocol.
TCP/IP	Transmission Control Protocol/Internet Protocol. The basic protocol for Internet communication.
Telnet	Telnet is a terminal protocol that provides an easy-to-use method of creating terminal connections to a network.

UDP	User Datagram Protocol.
UTC	Co-ordinated Universal Time (equivalent to and replacement for GMT or Greenwich Mean Time).
UTP	Unshielded Twisted Pair cabling. A type of Ethernet cable that can operate up to 100Mb/s. Also known as Category 5 or CAT 5.
VNC	Virtual Network Computing (VNC) is a desktop protocol to remotely control another computer. It transmits the keyboard presses and mouse clicks from one computer to another relaying the screen updates back in the other direction, over a network.
VPN	Virtual Private Network (VPN) a network that uses a public telecommunication infrastructure and Internet, to provide remote offices or individual users with secure access to their organization's network.
WAN	Wide Area Network.
WINS	Windows Internet Naming Service (WINS) that manages the association of workstation names and locations with IP addresses.

Appendix 6. End-user license agreements

Appendix 6.1. Opengear end-user license agreement

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