Console Server User Guide

Version 5.2.2 – 2025.4

ACM7000 Remote Site Gateway
ACM7000-L Resilience Gateway
IM7200 Infrastructure Manager
CM7100 Console Servers

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 orelectric 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. Also use a surge suppressor or UPS to protect the equipment from transients.

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 acceptany interference that may cause undesired operation.

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 responsibilityof 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 or 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 and all the communication wirings are limited to inside of the building.

Copyright

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1. THIS MANUAL

This User Manual explains installing, operating, and managing Opengear console servers. This manual assumes you are familiar with the Internet and IP networks, HTTP, FTP, basic security operations, and your organization's internal network.

1.1 Types of users

The console server supports two classes of users:

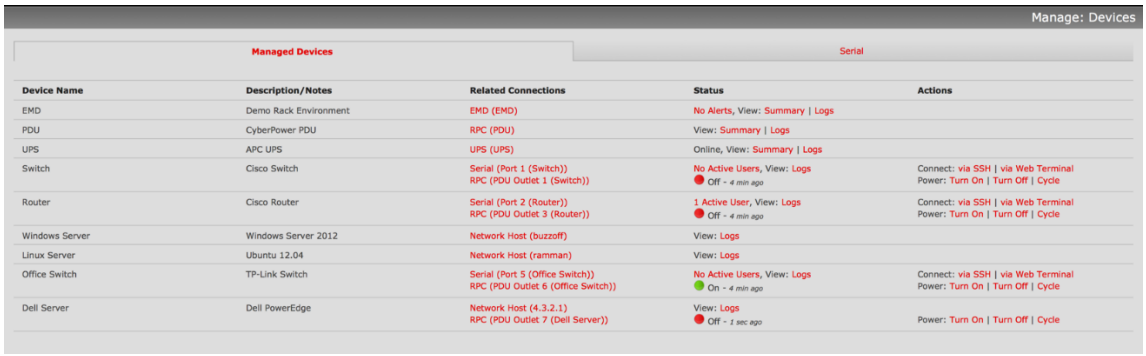
- Administrators who have unlimited configuration and management privileges over the console server and connected devices as well as all services and ports to control all the serial connected devices and network connected devices (hosts). Administrators are set up as members of the admin user group. An administrator can access and control the console server using the config utility, the Linux command line or the browser-based Management Console.

- Users who have been set up by an administrator with limits of their access and control authority. Users have a limited view of the Management Console and can only access authorized configured devices and review port logs. These users are set up as members of one or more of the pre- configured user groups such as PPTPD, dialin, FTP, pmshell, users, or user groups the administrator may have created. They are only authorized to perform specified controls on specific connected devices. Users, when authorized, can access and control serial or network connected devices using specified services (e.g. Telnet, HHTPS, RDP, IPMI, Serial over LAN, Power Control).

Remote users are users who are not on the same LAN segment as the console server. A remote usermay be on the road connecting to managed devices over the public Internet, an administrator in another office connecting to the console server over the enterprise VPN, or in the same room or the same office but connected on a separate VLAN to the console server.

1.2 Management Console

The Opengear Management Console allows you to configure and monitor the features of your Opengearconsole server. The Management Console runs in a browser and provides a view of the console server and all connected devices.



Administrators can use the Management Console to configure and manage the console server, users, ports, hosts, power devices, and associated logs and alerts. Non-admin users can use the Management Console with limited menu access to control select devices, review their logs, and access them using thebuilt-in Web terminal.

The console server runs an embedded Linux operating system, and can be configured at the command line. You can get command line access by cellular / dial-in, directly

connecting to the console server's serial console/modem port, or by using SSH or Telnet to connect to the console server over the LAN (orconnecting with PPTP, IPsec or OpenVPN).

For command line interface (CLI) commands and advanced instructions, download the **Opengear CLI andScripting Reference.pdf** from:

https://ftp.opengear.com/download/documentation/manual/current/IM_ACM_and_CM7100/Opengear%20CLI%20and%20Scripting%20Reference.pdf

1.3 More information

For more information, consult:

- Opengear Products Web Site: See https://opengear.com/products. To get the most up-to-date information on what's included with your console server, visit the **What's included** section for yourparticular product.
- Quick Start Guide: To get the Quick Start Guide for your device see https://opengear.com/support/documentation/.
- Opengear Knowledge Base: Visit https://portal.opengear.com/s/knowledgebase to access technical how-toarticles, tech tips, FAQs, and important notifications.
- Opengear CLI and Scripting Reference: https://ftp.opengear.com/download/documentation/manual/current/IM_ACM_and_CM7100/Opengear%20CLI%20and%20Scripting%20Reference.pdf

2. SYSTEM CONFIGURATION

This chapter provides step-by-step instructions for the initial configuration of your console server andconnecting it to the Management or Operational LAN. The steps are:

- Activate the Management Console.
- Change the administrator password.
- Set the IP address console server's principal LAN port.
- Select the services to be enabled and access privileges.

This chapter also discusses the communications software tools that an administrator may use to accessthe console server, and the configuration of the additional LAN ports.

2.1 Management Console Connection

Your console server comes configured with a default IP Address *192.168.0.1* and subnet mask *255.255.255.0* for NET1 (WAN).

For initial configuration, we recommend that you connect a computer directly to the console. If you dochoose to connect your LAN before completing the initial setup steps, make sure that:

- There are no other devices on the LAN with an address of 192.168.0.1.
- The console server and the computer are on the same LAN segment, with no interposed router appliances.

2.1.1 Connected computer set up

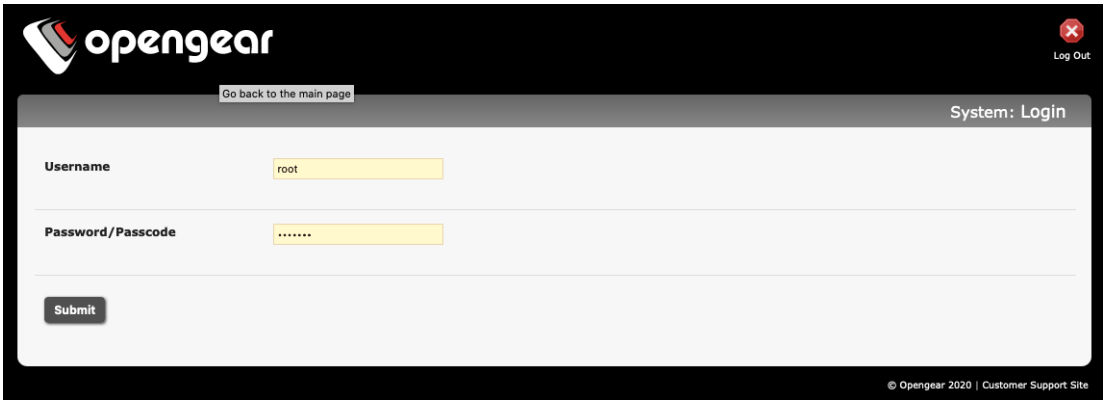
To configure the console server with a browser, the connected computer should have an IP address in thesame range as the console server (for example, 192.168.0.100):

- To configure the IP Address of your Linux or Unix computer, run ifconfig.
- For Windows PCs:

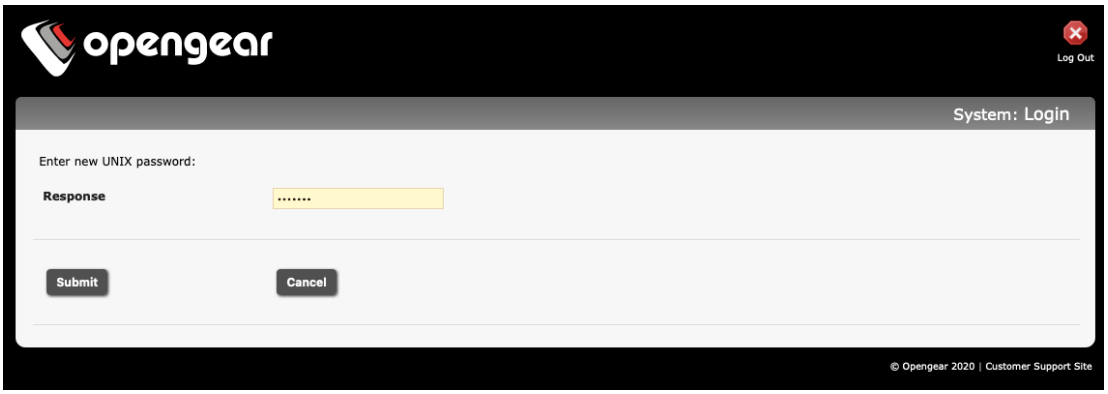
1. Click Start > Settings > Control Panel and double click Network Connections.
2. Right-click on Local Area Connection and select Properties.
3. Select Internet Protocol (TCP/IP) and click Properties.
4. Select **Use the following IP address** and enter the following details:
    - IP address: 192.168.0.100
    - Subnet mask: *255.255.255.0*
5. If you want to retain your existing IP settings for this network connection, click **Advanced** and **Add** the above as a secondary IP connection.

2.1.2 Browser connection

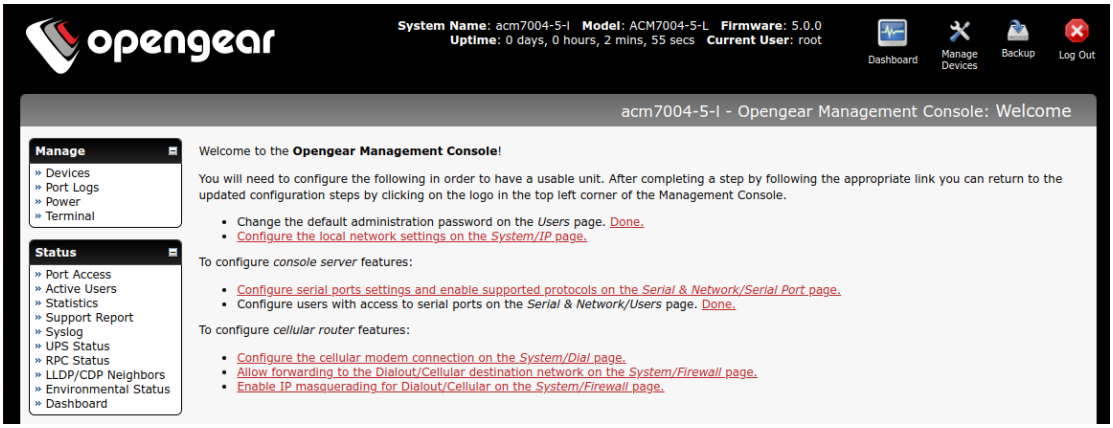
1. Open a browser on the connected PC / workstation and enter **https://192.168.0.1**.Log in with:
   - Username> **root**
   - Password> **default**



2. The first time you log in, you are required to change the root password, click **Submit**.



3. To complete the change, enter the new password again, then click **Submit**.
   The **Welcome** screen appears.



If your system has a cellular modem you will be given the steps to configure the cellular router features:

- 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 you complete each of the above steps, you can return to the configuration list by clicking the Opengearlogo in the top left corner of the screen.

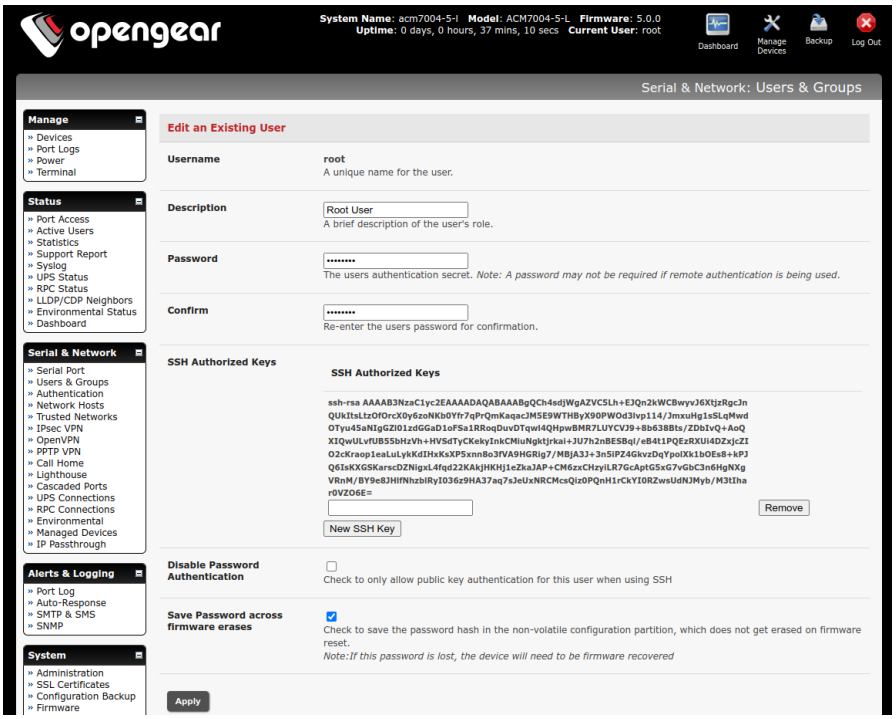
> **NOTE:** If you are not able to connect to the Management Console at 192.168.0.1 or if the defaultUsername / Password are not accepted, reset your console server (See Chapter 10).

2.2 Administrator Set Up

2.2.1 Change default root System Password

You are required to change the root password when you first log in to the device. You can change thispassword at any time.

1. Click **Serial & Network > Users & Groups** or, on the **Welcome** screen, click Change defaultadministration password.
2. Scroll down and locate the **root** user entry under **Users** and click **Edit.**
3. Enter the new password in the **Password** and **Confirm** fields.



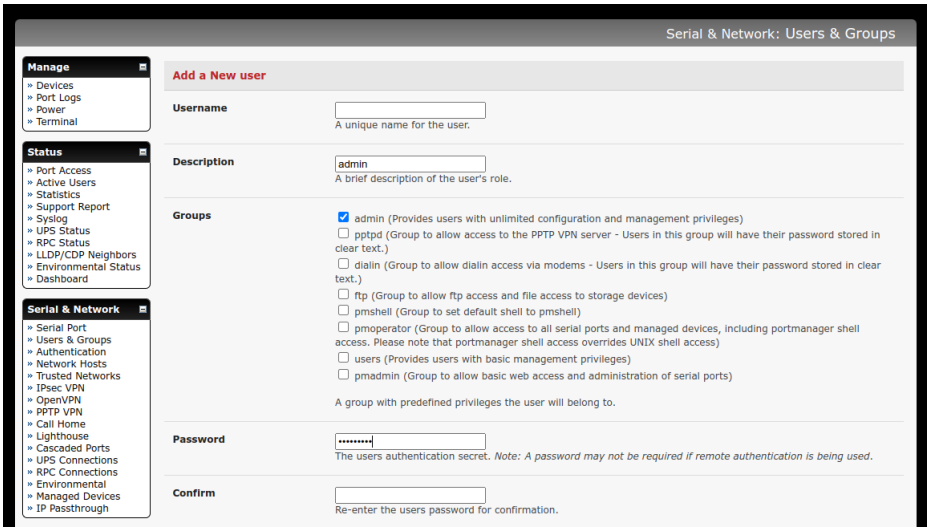
> **NOTE:** Checking **Save Password across firmware erases** saves the password so it does not get erased when the firmware is reset. If this password is lost, the device will need to be firmware recovered.

4. Click **Apply**.
5. Log in with the new password.

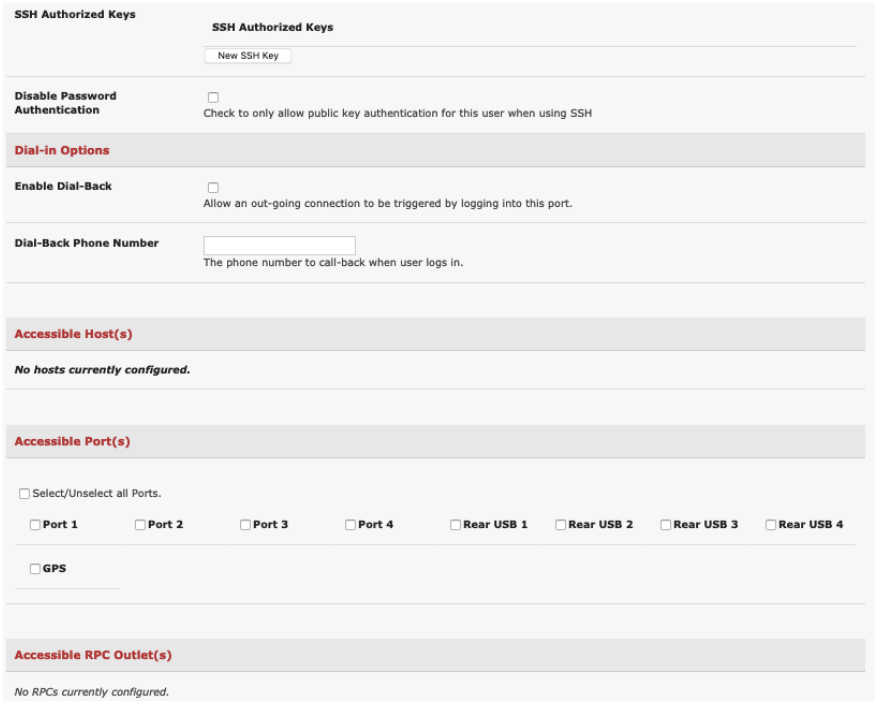
2.2.2 Set up a new administrator

Create a new user with administrative privileges and log in as this user for administration functions, ratherthan using **root**.

1. Click Serial & Network > Users & Groups.
2. Scroll to the bottom of the page and click the **Add User** button.
3. Enter a **Username**.
4. In the **Groups** section, check the **admin** box.
5. Enter a password in the **Password** and **Confirm** fields.



6. You can also add SSH Authorized Keys and choose to Disable Password Authentication for thisuser.



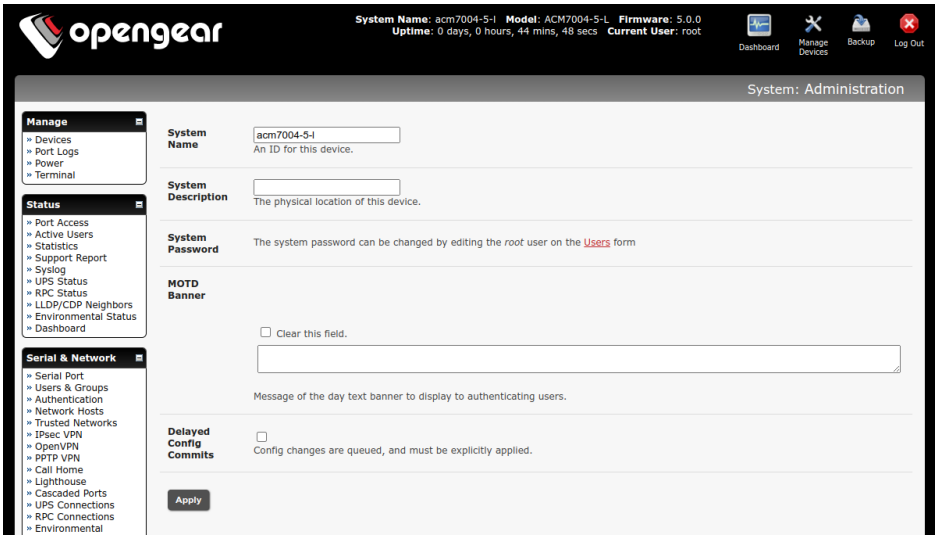
Additional options for this user can be set on this page including **Dial-in Options**, **AccessibleHosts**, **Accessible Ports**, and **Accessible RPC Outlets**.

7. Click the **Apply** button at the bottom of the screen to create this new user.

2.2.3 Add System Name, System Description, and MOTD.

1. Select **System > Administration**.

2. Enter a **System Name** and **System Description** for the console server to give it a unique ID and make it easier to identify.
System Name can contain from 1 to 64 alphanumeric characters and the special characters underscore (_), minus (-), and period (.). **System Description** can contain up to 254 characters.



The **MOTD Banner** can be used to display a message of the day text to users. It appears on theupper left of the screen below the Opengear logo.

3. Click **Apply**.

> **NOTE:** For information on **Delayed Config Commits**, see section 10.5.

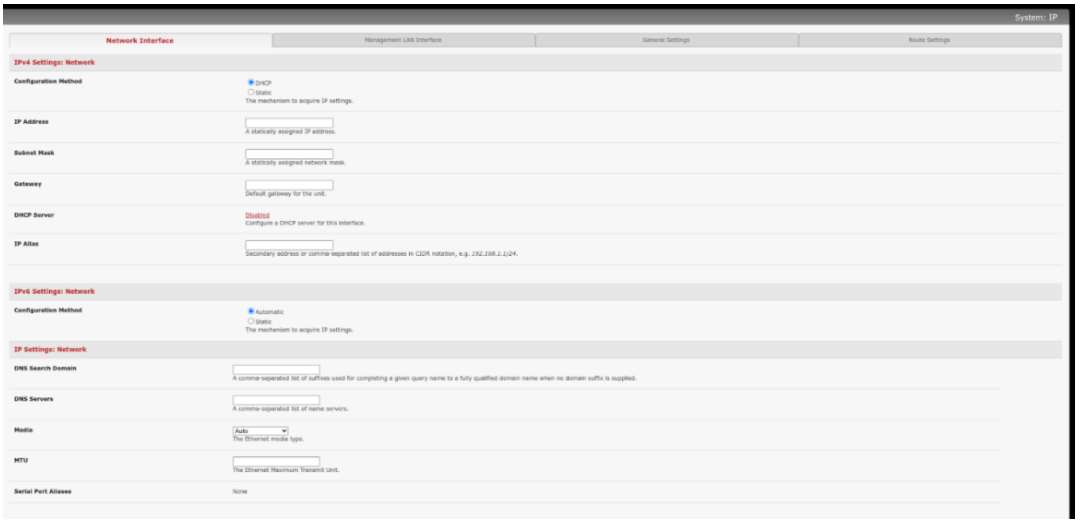
2.3 Network Configuration

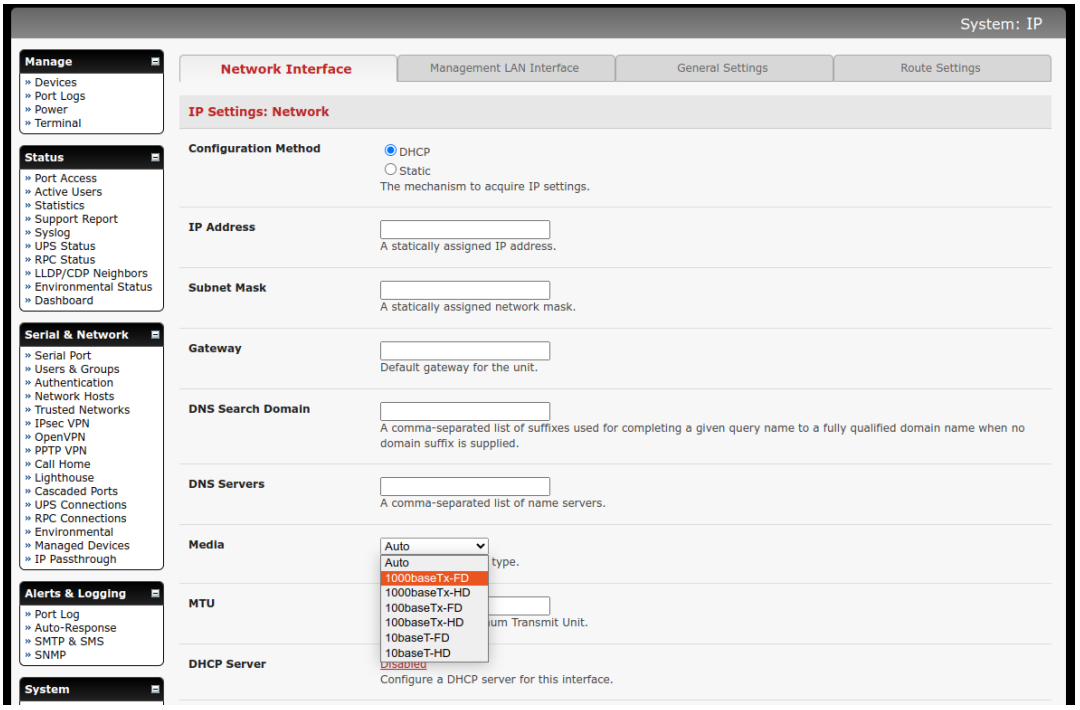
Enter an IP address for the principal Ethernet (*LAN/Network/Network1*) port on the console server or enable its DHCP client to automatically obtain an IP address from a DHCP server. By default, the console server has its DHCP client enabled and automatically accepts any network IP address assigned by a DHCP server on your network. In this initial state, the console server will respond to both its default Staticaddress *192.168.0.1* and its DHCP address.

1. Click System > IP and click the Network Interface tab.

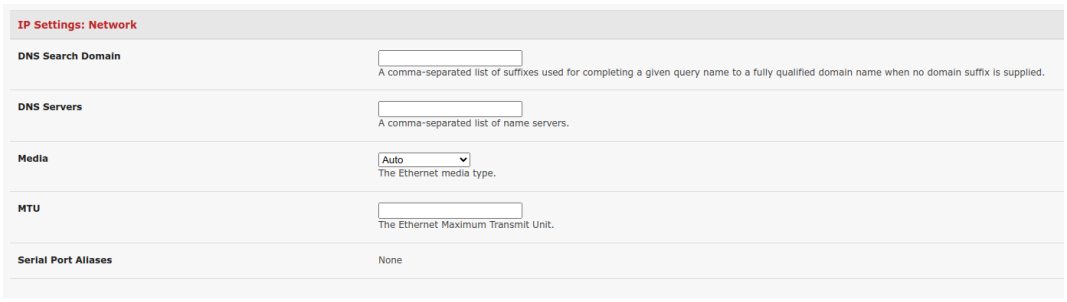
2. Choose either DHCP or Static for the Configuration Method.

   If you choose **Static**, enter the **IP Address**, **Subnet Mask**, **Gateway** and **DNS** server details. Thisselection disables the DHCP client.





3. DNS, Media, MTU and Serial Port Aliases also apply to IPV6 Settings and are now grouped together and located after the IPv4 and IPv6 settings.



4. The console server LAN port automatically detects the Ethernet connection speed. Use the**Media** drop-down list to lock the Ethernet to 10 Mb/s or 100Mb/s and to Full Duplex or HalfDuplex.

   If you encounter packet loss or poor network performance with the **Auto** setting, change the Ethernet Media settings on the console server and the device it is

connected to. In most cases,change both to *100baseTx-FD* (100 megabits, full duplex).

5. If you select **DHCP,** the console server will look for configuration details from a DHCP server.
   This selection disables any static address. The console server MAC address can be found on alabel on the base plate.

6. You may enter a secondary address or comma-separated list of addresses in CIDR notation, e.g. *192.168.1.1/24* as an **IP Alias.**

7. Click **Apply**.

8. Reconnect the browser on the computer that is connected to the console server by entering **http://your new IP address.**

   If you change the console server IP address, you need to reconfigure your computer to have an IPaddress in the same network range as the new console server address.

You can set the MTU on Ethernet interfaces. This is an advanced option to be used if your deployment scenario doesn't work with the default MTU of 1500 bytes.

To set the MTU, click **System > IP** and click the **Network Interface** tab. Scroll down to the **MTU** field and enter the desired value. Valid values are from 1280 to 1500 for 100-megabit interfaces, and 1280to 9100 for gigabit interfaces

If bridging or bonding is configured, the MTU set on the Network Interface page will be set on theinterfaces that are part of the bridge or the bond.

> **NOTE:** In some cases, the user specified MTU may not take effect. Some NIC drivers may round oversizedMTUs to the maximum allowed value and others will return an error code.

You can also use a CLI command to manage MTU Size:

configure

 # config -s config.interfaces.wan.mtu=1380

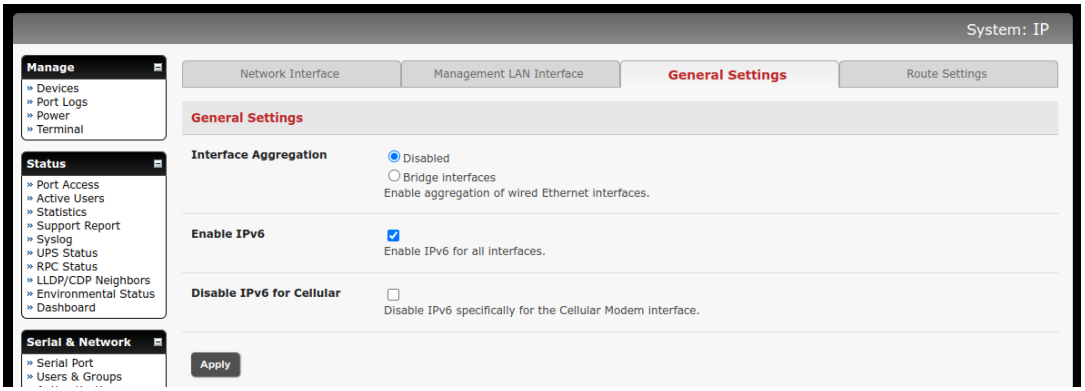
check

 # config -g config.interfaces.wan
config.interfaces.wan.address 192.168.2.24
config.interfaces.wan.ddns.provider none
config.interfaces.wan.gateway 192.168.2.1
config.interfaces.wan.ipv6.mode stateless
config.interfaces.wan.media Auto
config.interfaces.wan.mode static
config.interfaces.wan.mtu 1380
config.interfaces.wan.netmask 255.255.255.0

2.1.3 IPv6 configuration

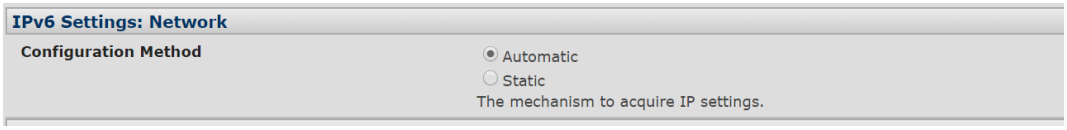
The console server Ethernet interfaces support IPv4 by default. They can be configured for IPv6 operation:

1. Click **System > IP**. Click the **General Settings** tab and check **Enable IPv6**. If required, click the Disable IPv6 for Cellular checkbox.



2. Configure the IPv6 parameters on each interface page.

   IPv6 can be configured for either **Automatic** mode, which will use SLAAC or DHCPv6 to configureaddresses, routes, and DNS, or **Static** mode, which allows the address information to be manuallyentered.



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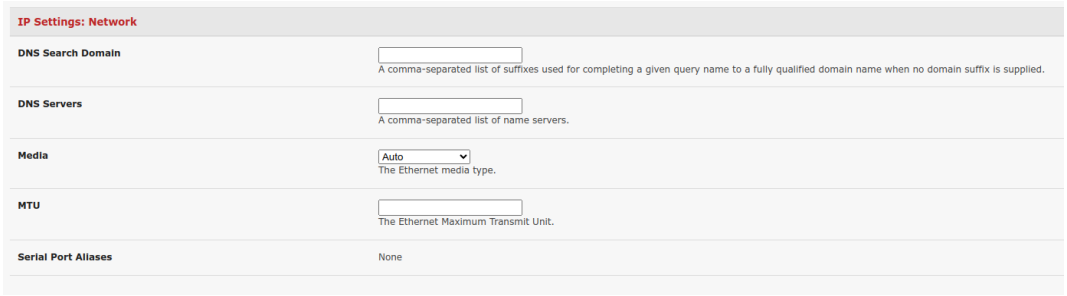


2.1.4 Dynamic DNS (DDNS) configuration

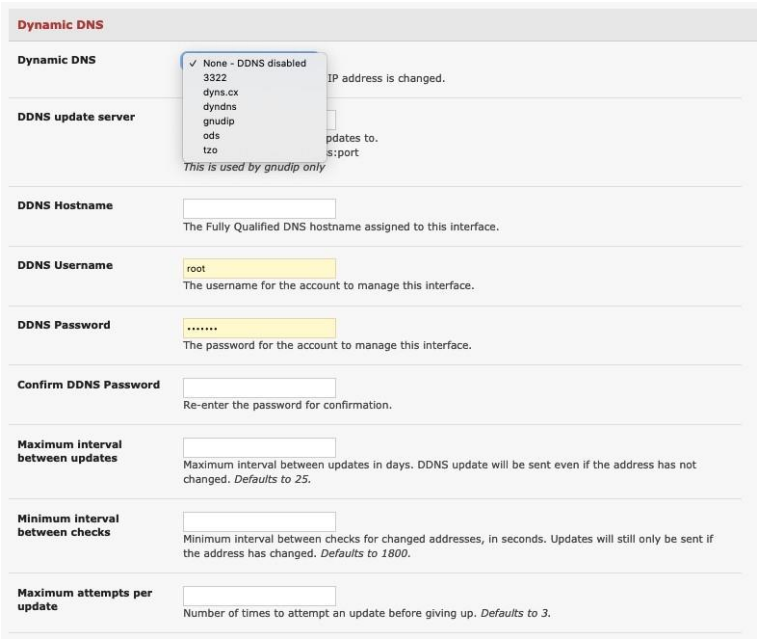
With Dynamic DNS (DDNS), a console server whose IP address is dynamically assigned can be locatedusing a fixed host or domain name.

Create an account with the supported DDNS service provider of your choice. When you set up your DDNSaccount, you choose a username, password, and hostname that you will use as the DNS name. DDNS service providers let you choose a hostname URL and set an initial IP address to correspond to that hostname URL.

To enable and configure DDNS on any of the Ethernet or cellular network connections on the console server.

1. Click **System > IP** and scroll down the **Dynamic DNS** section. Select your DDNS service

provider from the drop-down **Dynamic DNS** list.
You can also set the DDNS information under the CellularModem tab under **System > Dial**.



2. In **DDNS Hostname,** enter the fully qualified DNS hostname for your console server e.g. *your-hostname.dyndns.org.*

3. Enter the **DDNS Username** and **DDNS Password** for the DDNS service provider account.

4. Specify the **Maximum interval between updates** in *days*. A DDNS update will be sent even if theaddress has not changed.

5. Specify the **Minimum interval between checks** for changed addresses in *seconds*. Updates willbe sent if the address has changed.

6. Specify the **Maximum attempts per update** which is the number of times to attempt an updatebefore giving up. This is 3 by default.

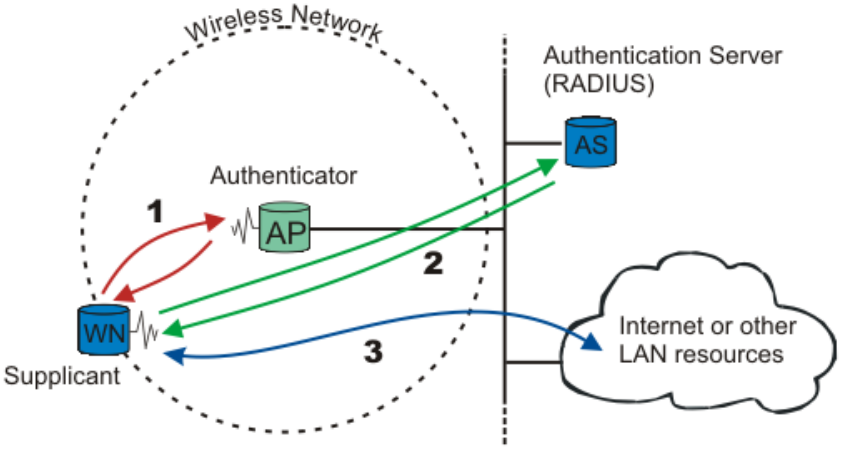
7. Click **Apply**.

2.3.1 EAPoL mode for WAN, LAN and OOBFO

(OOBFO is applicable to the IM7216-2-24E-DAC only)

Overview of EAPoL

IEEE 802.1X, or PNAC (Port-based Network Access Control) makes use of the physical access characteristics of IEEE 802 LAN infrastructures in order to provide a means of authenticating and authorizing devices attached to a LAN port that has point-to-point connection characteristics, and of preventing access to that port in cases which the authentication and authorization fails. A port in this context is a single point of attachment to the LAN infrastructure.



When a new wireless or **wired** node (WN) requests access to a LAN resource, the access point (AP) asks for the WN's identity. *No other traffic than EAP is allowed before the WN is authenticated (the "port" is closed, or "***unauthenticated***").*

The wireless node that requests authentication is often called *Supplicant*, the Supplicant is responsible for responding to Authenticator data that will establish its credentials. The same goes for the access point; the *Authenticator is* not the access point. Rather, the access point contains an Authenticator. The Authenticator does not need to be in the access point; it can be an external component.

The following Authentication methods are implemented:

- EAP-MD5 supplicant
    - The EAP MD5-Challenge method uses plain username/password
- EAP-PEAP-MD5
    - EAP PEAP (Protected EAP) MD5 authentication method uses user credentials and CA certificate
- EAP-TLS
    - EAP TLS (Transport Layer Security) authentication method requires CA certificate, client certificate and a private key.

The EAP protocol, which is used for authentication, was originally used for dial-up PPP. The identity was the username, and either PAP or CHAP authentication was used to check the user's password. As the identity is sent in clear (not encrypted), a malicious sniffer may learn the user's identity. "Identity hiding" is therefore used; the real identity is not sent before the encrypted TLS tunnel is up.

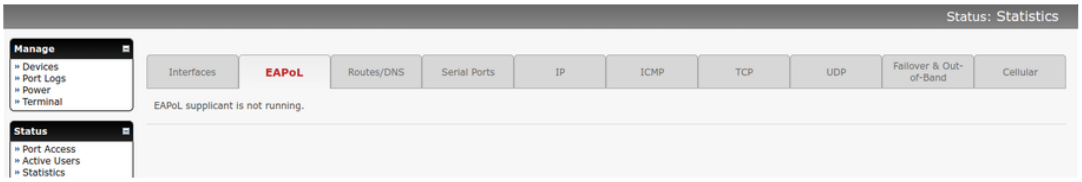
After the identity has been sent, the authentication process begins.

The protocol used between the Supplicant and the Authenticator is EAP, (or EAPoL). The Authenticator re-encapsulates the EAP messages to RADIUS format, and passes them to the Authentication Server.

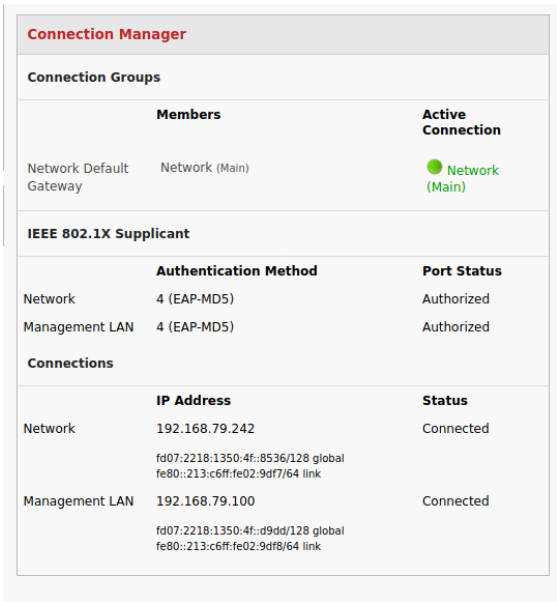
During authentication, the Authenticator relays packets between the Supplicant and the Authentication Server. When the authentication process completes, the Authentication Server sends a success message (or failure, if the authentication failed). The Authenticator then opens the "port" for the Supplicant.

Authentication settings can be accessed from the EAPoL Supplicant Settings page.

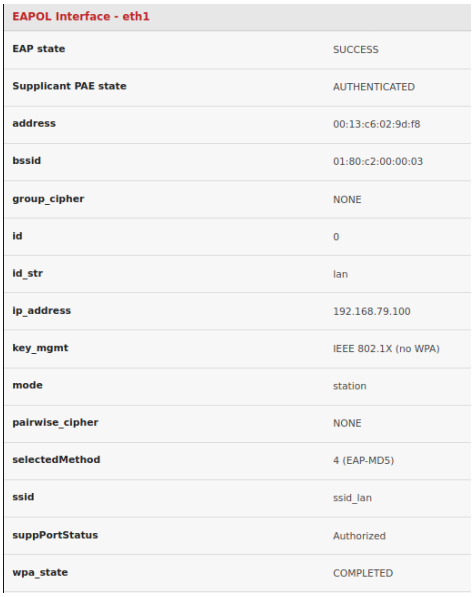
The status of current EAPoL are displayed in detail on the Status → Statistics page on the EAPoL tab:



An abstraction of EAPoL on network ROLEs is displayed in the “Connection Manager“ section on the Dashboard interface.

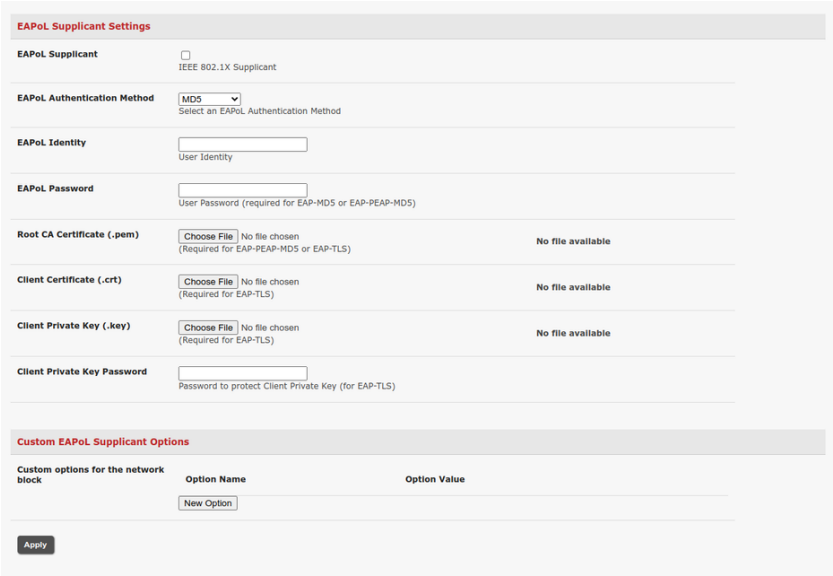


Shown below is an example of successful authentication:



IEEE 802.1x (EAPOL) support on the switch ports of IM7216-2-24E-DAC and ACM7004-5:

To avoid loops, users should not plug more than one switch port to the same upper-level switch.

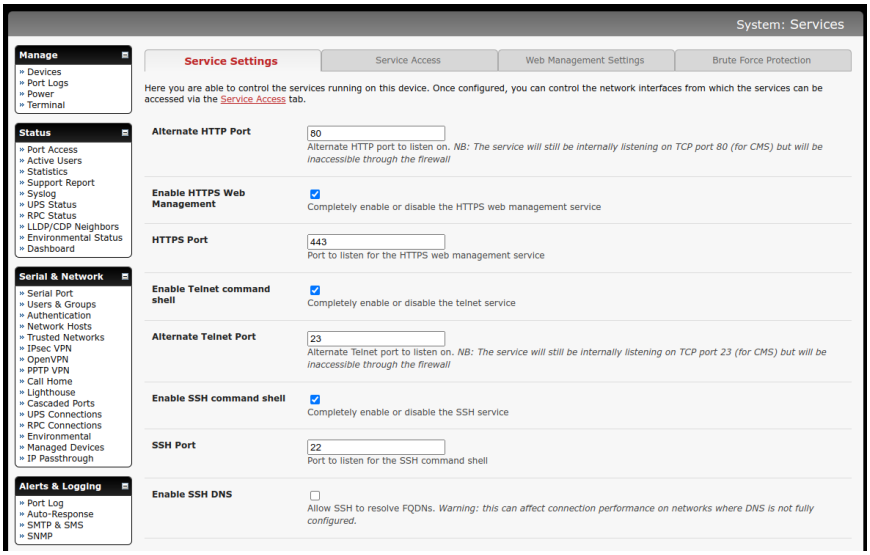


2.4 Service Access and Brute Force Protection

The administrator can access the console server and connected serial ports and managed devices usinga range of access protocols/services. For each access

- The service must first be configured and enabled to run on the console server.
- Access through the firewall must be enabled for each network connection. To enable and configure a service:

1. Click System > Services and click the Service Settings tab.



2. Enable and configure basic services:

HTTP By default, HTTP service is running and cannot be fully disabled. By default, HTTP access is disabled on all interfaces. We recommend this access

remain disabled if theconsole server is accessed remotely over the Internet.

Alternate HTTP lets you to configure an alternate HTTP port to listen on. The HTTPservice will continue listening on TCP port 80 for CMS and connector communications but will be inaccessible through the firewall.

HTTPS By default, HTTPS service is running and enabled on all network interfaces. It is recommended that only HTTPS access be used if the console server is to be managedover any public network. This ensures administrators have secure browser access to all the menus on the console server. It also allows appropriately configured users secure browser access to selected **Manage** menus.

The HTTPS service can be disabled or reenabled by checking **HTTPS Web Management** and an alternate port specified (default port is 443).

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

Telnet can be used to give an administrator access to the system command line shell.This service may be useful for local administrator and the user access to selected serial consoles. We recommended that you disable this service if the console server isremotely administered.

The **Enable Telnet command shell** checkbox will enable or disable the Telnet service.An alternate Telnet port to listen on can be specified in **Alternate Telnet Port** (defaultport 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 an 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 enable or disable this service. An alternate SSH port to listen on can be specified in **SSH command shell port** (defaultport is 22).

3. Enable and configure other services:

TFTP/FTP If a USB flash card or internal flash is detected on an console server, checking **EnableTFTP (FTP) service** enables 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 disable the TFTP (FTP)service.

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

Web Terminal Checking **Enable Web Terminal** allows web browser access to the systemcommand line shell via **Manage > Terminal**.

4. Specify alternate port numbers for Raw TCP, direct Telnet/SSH and unauthenticated Telnet/SSHservices.

The console server uses specific ranges for the TCP/IP ports for the various access services that users can use to access devices attached to serial ports (as covered in *Chapter 3 –Configure Serial Ports*). The administrator can set alternate ranges for these services and these secondary ports will 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 #) *i.e.* 2001 – 2048. If an administrator were to set 8000 as asecondary base for Telnet, serial port #2 on the console server can be Telnet accessed at IP Address:2002 and at IP Address:8002. The default base for SSH is 3000; for Raw TCP is 4000;and for RFC2217 it is 5000

5. Other services can be enabled and configured from this menu by selecting *Click here to configure:*

   Nagios Access to the Nagios NRPE monitoring daemons

   NUT Access to the NUT UPS monitoring daemon

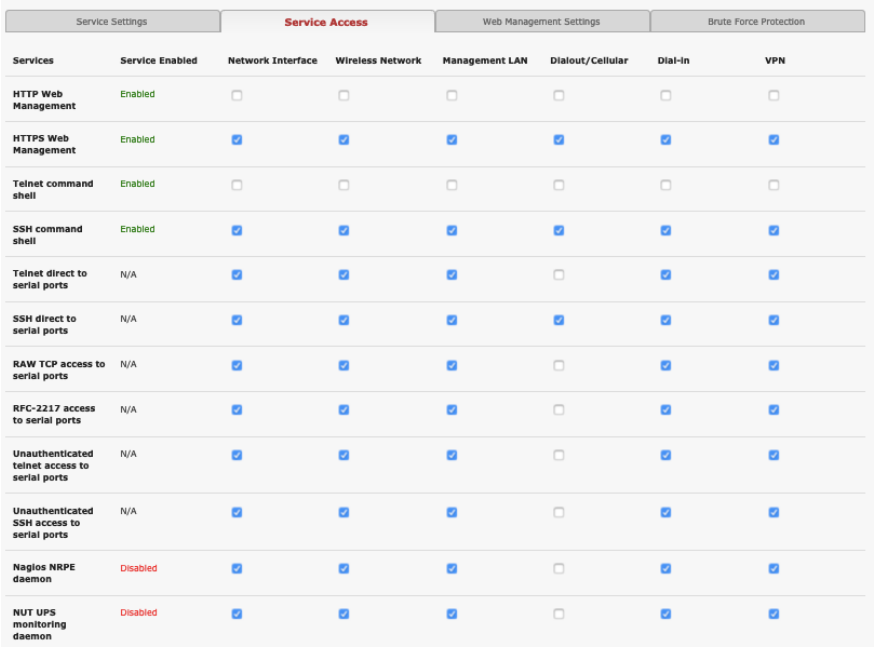
   SNMP Enables *snmp* in the console server. SNMP is disabled by default

   NTP

6. Click **Apply**.
   A confirmation message appears: *Message Changes to configuration succeeded.*

The Services Access settings can be set to allow or block access. This specifies which enabled servicesadministrators can use over each network interface to connect to the console server and through the console server to attached serial and network connected devices.

1. Select the Service Access tab on the System > Services page.



2. This displays the enabled services for the console server's network interfaces. Depending on theparticular 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)
- VPN (IPsec or Open VPN connection over any network interface)

3. Check/uncheck for each network which service access is to be enabled /disabled

   The **Respond to ICMP echoes** (i.e. *ping*) service access options that can be configured at this stage. This allows the console server to respond to incoming ICMP echo requests. Ping is enabledby default. For increased security, you should disable this service when you complete initial configuration

   You can allow serial port devices to be accessed from nominated network interfaces using RawTCP, direct Telnet/SSH, unauthenticated Telnet/SSH services, etc.

4. Click **Apply**.

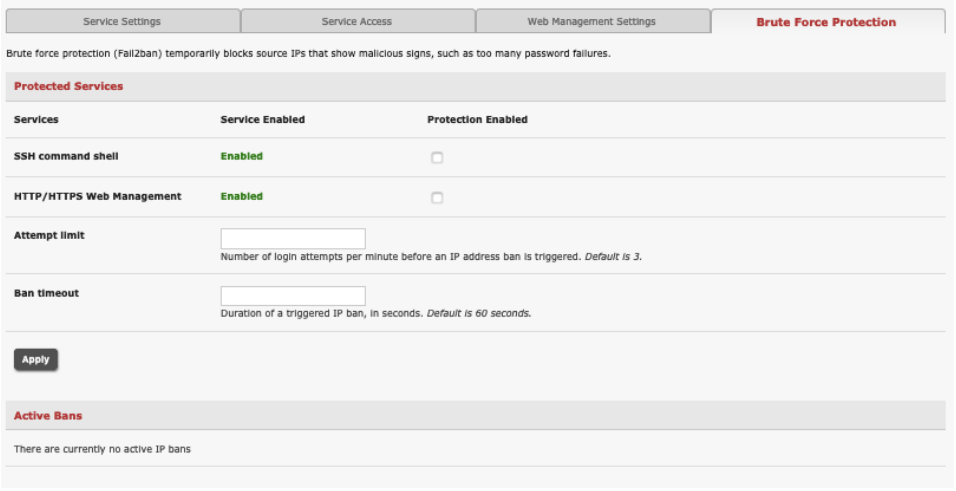
Web Management Settings

The **Enable HSTS** checkbox enables strict HTTP strict transport security. HSTS mode means that a Strict-Transport-Security header should be sent over HTTPS transport. A compliant web browser remembers this header, and when asked to contact the same host over HTTP (plain) it will automatically switch to

HTTPS before attempting HTTP, as long as the browser has accessed the secure site once and seen theS-T-S header.

Brute Force Protection

Brute force protection (Micro Fail2ban) temporarily blocks source IPs that show malicious signs, such astoo many password failures. This may help when the 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.



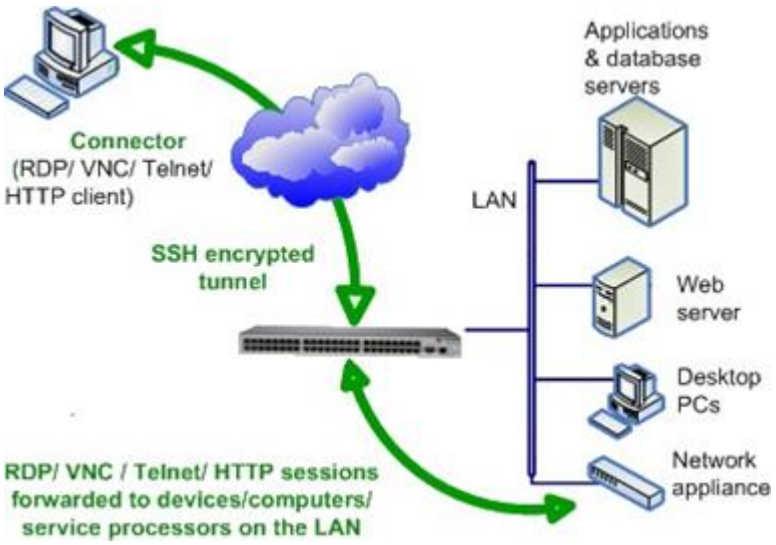
Brute Force Protection may be enabled for the listed services. By default, once protection is enabled 3 or more failed connection attempts within 60 seconds from a specific source IP trigger it to be banned from connecting for a configurable time period. **Attempt limit** and **Ban timeout** may be customized. Active Bansare also listed and may be refreshed by reloading the page.

NOTE: When running on an untrusted network, consider using a variety of strategies are used

to lock down remote access. This includes SSH public key authentication, VPN, and Firewall Rules to allowlist remote access from trusted source networks only. See the Opengear Knowledge Basefor details.

2.5 Communications Software

You have configured access protocols for the administrator client to use when connecting to the consoleserver. User clients also use these protocols when accessing console server serial attached devices and network attached hosts. You need communications software tools set up on the administrator and user client's computer. To connect you may use tools such as *PuTTY* and *SSHTerm*.



Commercially available connectors couple the trusted SSH tunneling protocol with popular access tools such as Telnet, SSH, HTTP, HTTPS, VNC, RDP to provide point-and-click secure remote management access to all the systems and devices being managed.

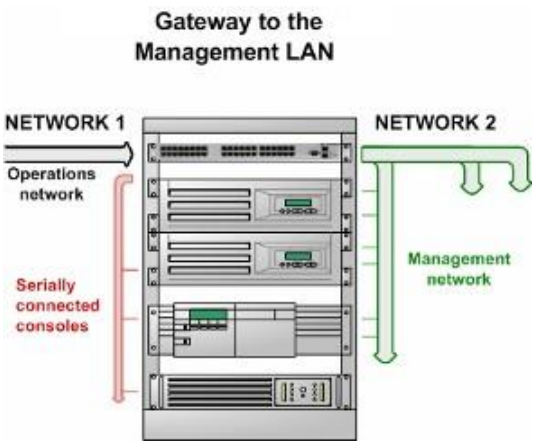
Information on using connectors for browser access to the console server's Management Console,Telnet/SSH access to the console server command line, and TCP/UDP connecting to hosts that are network connected to the console server can be found in *Chapter 5*.

Connectors can be installed on Windows PCs, Mac OS X and on most Linux, UNIX and Solaris systems.

2.6 Management Network Configuration

Console servers have additional network ports that can be configured to provide management LANaccess and/or failover or out-of-band access.

2.6.1 Enable the Management LAN



Console servers can be configured so the second Ethernet port provides a management LAN gateway. The gateway has firewall, router and DHCP server features. You need to connect an external LAN switchto Network 2 to attach hosts to this management LAN:

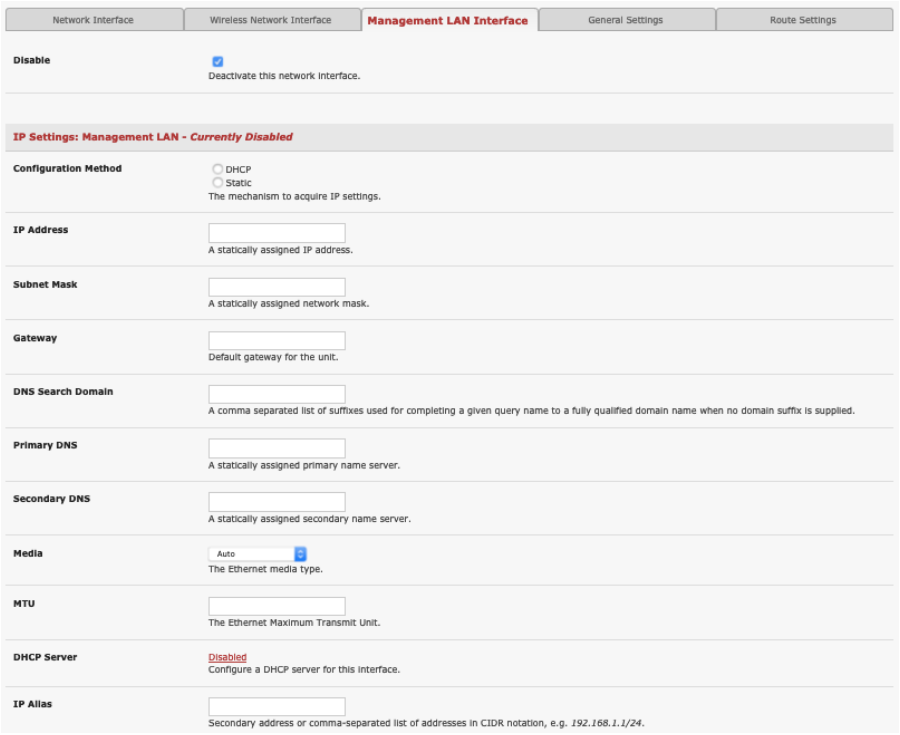
> **NOTE:** The second Ethernet port can be configured as either a Management LAN gateway port or as anOOB/Failover port. Ensure you did not allocate **NET2** as the **Failover Interface** when you configured the principal **Network** connection on the **System > IP** menu.

To configure the Management LAN gateway:

1. Select the **Management LAN Interface** tab on the **System > IP** menu and uncheck **Disable**.

2. Configure the **IP Address** and **Subnet Mask** for the Management LAN. Leave the **DNS** fields blank.

3. Click **Apply**.



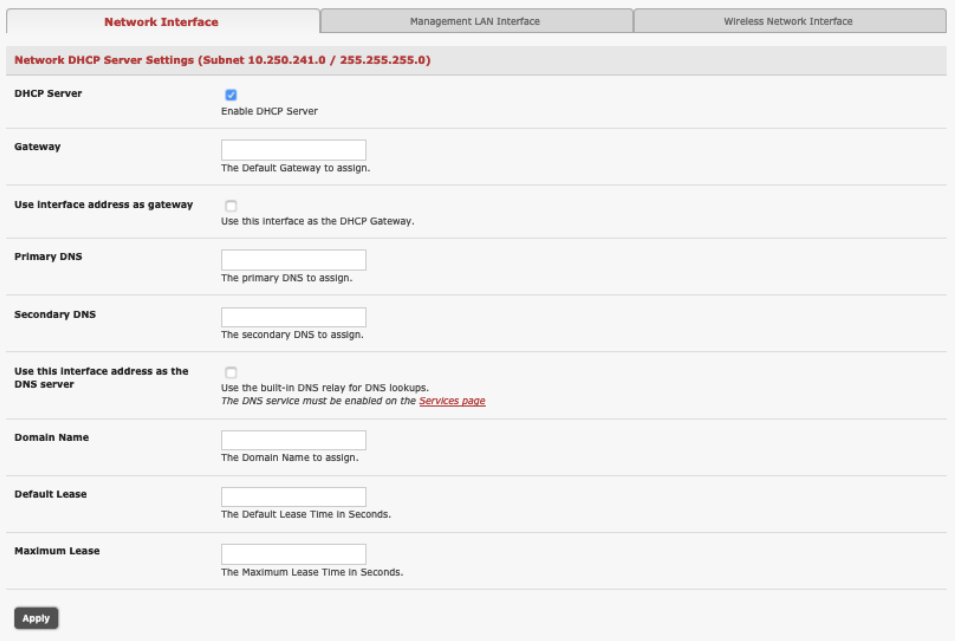
The management gateway function is enabled with default firewall and router rules configured so theManagement LAN is only accessible by SSH port forwarding. This ensures the remote and local connections to Managed devices on the Management LAN are secure. The LAN ports can also be configured in bridged or bonded mode or manually configured from the command line.

2.6.2 Configure the DHCP server

The DHCP server enables the automatic distribution of IP addresses to devices on the Management LANthat are running DHCP clients. To enable the DHCP server:

1. Click **System > DHCP Server**.

2. On the **Network Interface** tab, check **Enable DHCP Server**.



3. Enter the **Gateway** address to be issued to the DHCP clients.
   If this field is left blank, theconsole server's IP address is used.

4. Enter the **Primary DNS** and **Secondary DNS** address to issue the DHCP clients.
   If this field isleft blank, console server's IP address is used.

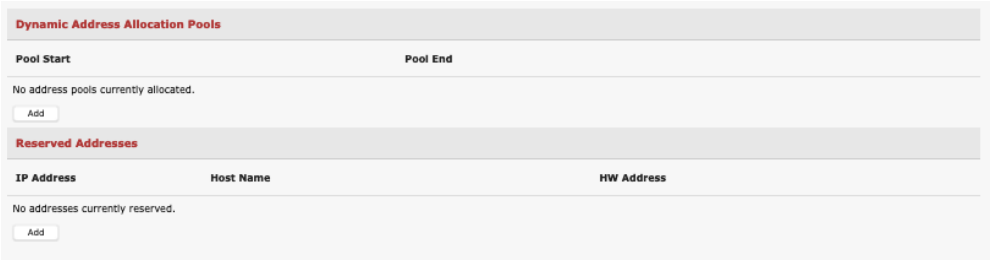
5. Optionally enter a **Domain Name** suffix to issue DHCP clients.

6. Enter the **Default Lease** time and **Maximum Lease** time in seconds.
   This is the amount of timethat a dynamically assigned IP address is valid before the client must request it again.

7. Click **Apply.**

The DHCP server issues IP addresses from specified address pools:

1. Click **Add** in the **Dynamic Address Allocation Pools** field.



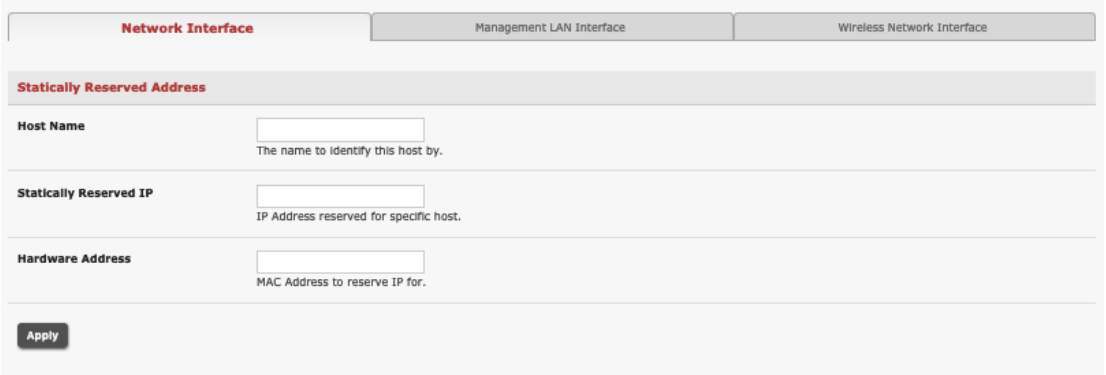
2. Enter the **DHCP Pool Start Address** and **End Address**.

3. Click **Apply**.

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

1. Click **Add** in the **Reserved Addresses** field.

2. Enter the **Hostname,** the **Hardware Address** (MAC) and the **Statically Reserved IP** address forthe DHCP client and click **Apply.**



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

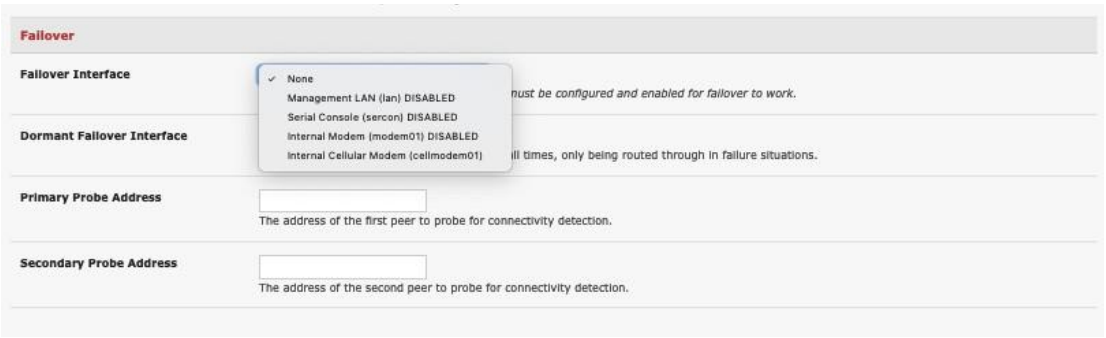
2.6.3 Select Failover or broadband OOB

Console servers provide a failover option so in the event of a problem using the main LAN connection foraccessing the console server an alternate access path is used.

To enable failover:

1. Select the **Network Interface** page on the **System > IP** menu.

2. Select the **Failover Interface** to be used in the event of an outage on the main network.

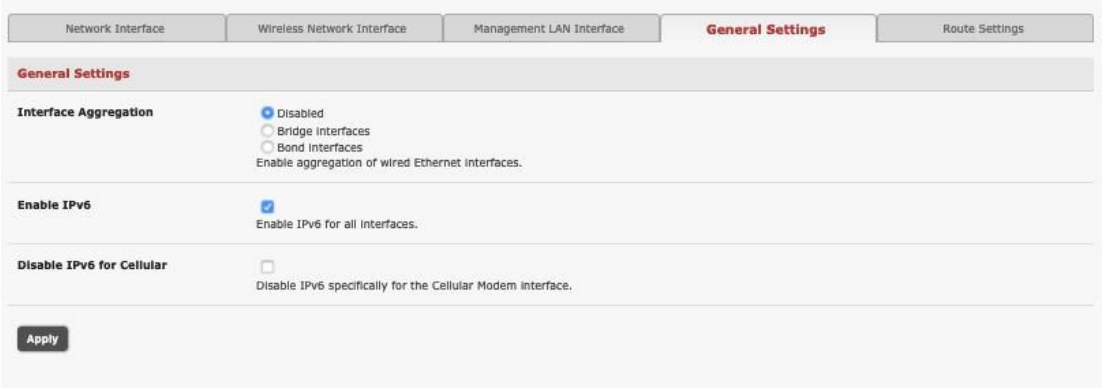


3. Click **Apply**. Failover becomes active after you specify the external sites to be probed to triggerfailover and set up the failover ports.

2.6.4 Aggregating the network ports

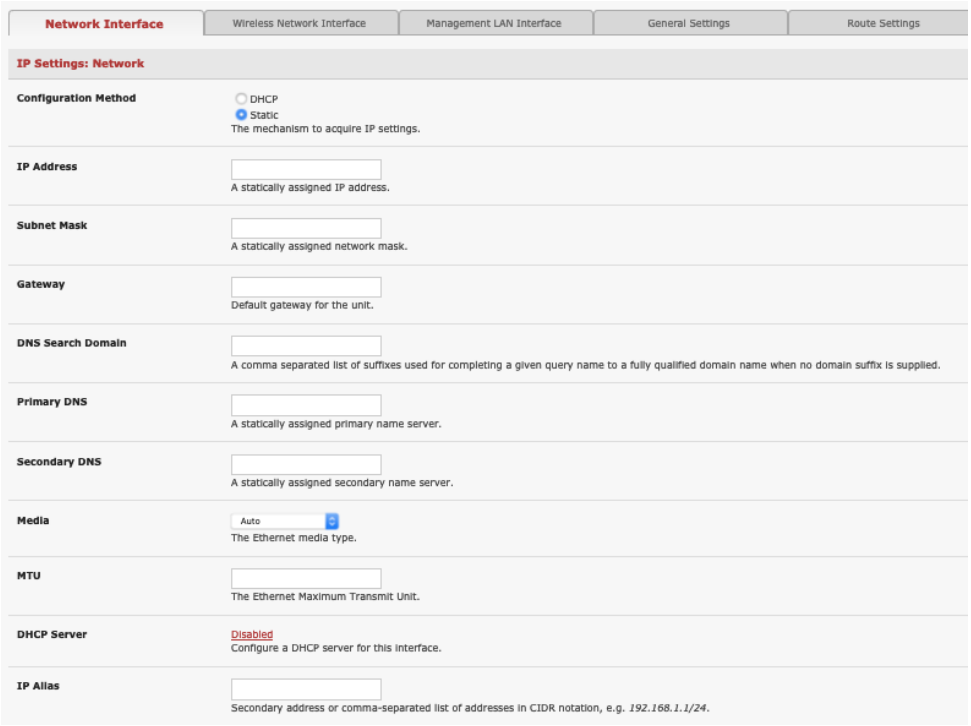
By default, the console server's Management LAN network ports can be accessed using SSH tunneling /port forwarding or by establishing an IPsec VPN tunnel to the console server.

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



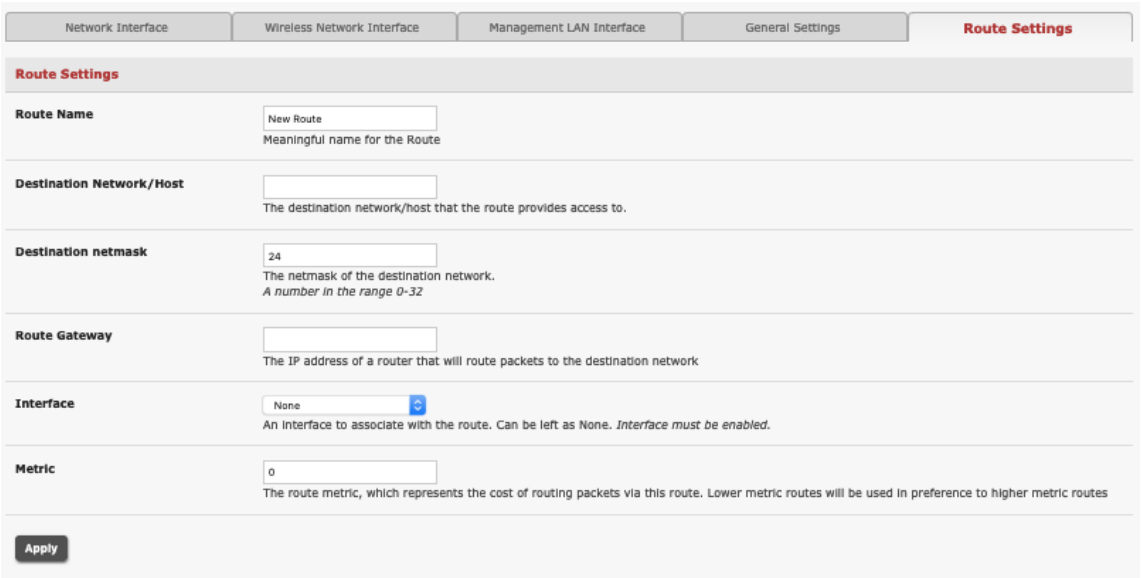
- By default, Interface Aggregation is disabled on the System > IP > General Settings menu
- Select Bridge Interfaces or Bond Interfaces:
    - When bridging is enabled, network traffic is forwarded across all Ethernet ports with no firewall restrictions. All the Ethernet ports are all transparently connected at the data linklayer (layer 2) so they retain their unique MAC addresses.
    - With bonding, the network traffic is carried between the ports but present with one MACaddress.

  Both modes remove all the Management LAN Interface and Out-of-Band/Failover Interface functions and disable the **DHCP Server.**
- In aggregation mode all Ethernet ports are collectively configured using the **Network Interface** menu.



2.6.5 Static routes

Static routes provide a very quick way to route data from one subnet to different subnet. You can hard code a path that tells the console server/router to get to a certain subnet using a certain path. This may beuseful for accessing various subnets at a remote site when using the cellular OOB connection.



To add to the static route to the route table of the System:

1. Select the **Route Settings** tab on the **System > IP General Settings** menu.
2. Click New Route.
3. Enter a **Route Name** for the route.
4. In the **Destination Network/Host** field, enter the IP address of the destination

network/host thatthe route provides access to.

5. Enter a value in the **Destination netmask** field that identifies the destination network or host.
   Anynumber between 0 and 32. A subnet mask of 32 identifies a host route.

6. Enter **Route Gateway** with the IP address of a router that will routes packets to the destinationnetwork.
   This may be left blank.

7. Select the **Interface** to use to reach the destination, may be left as **None.**

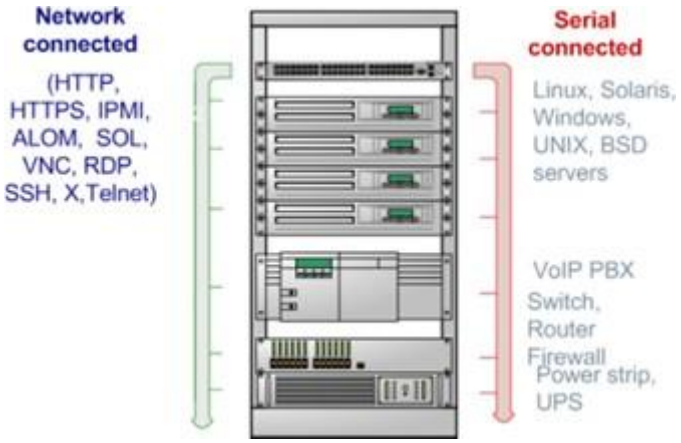
8. Enter a value in the **Metric** field that represents the metric of this connection.
   Use any numberequal to or greater than 0. This only has to be set if two or more routes conflict or have overlapping targets.

9. 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 established via that device. A route can be specified with a gateway, an interface or both. If the specified interfaceis not active, routes configured for that interface will not be active.

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 specifyeach user's individual access and control privileges.



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

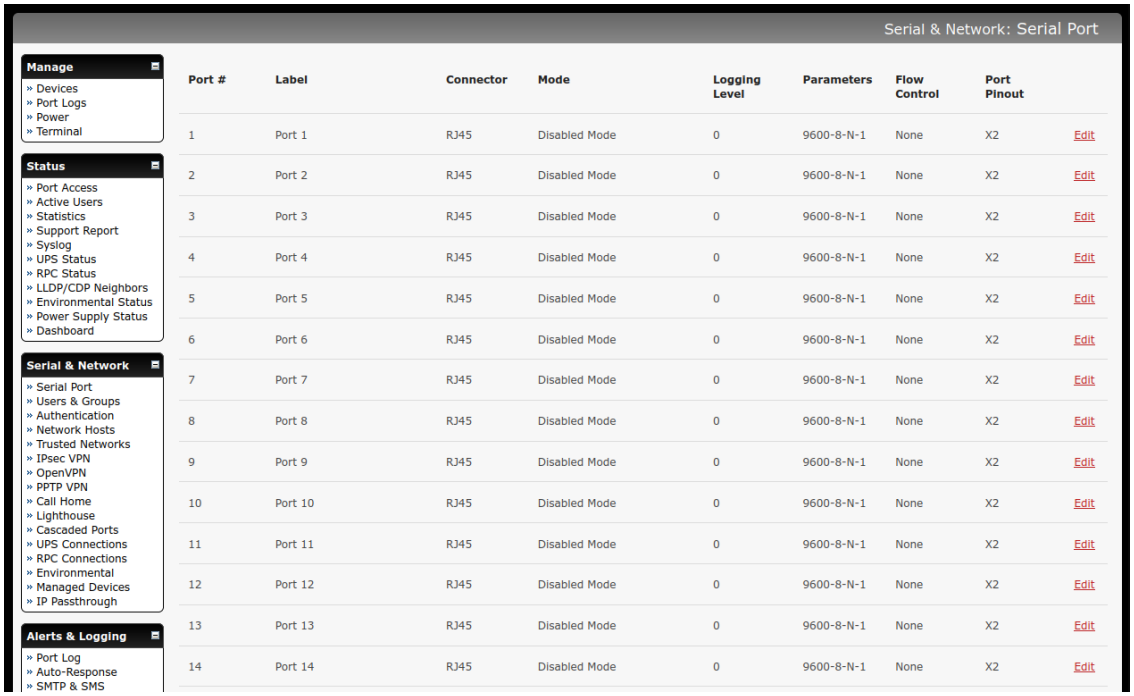
- Serial Ports – setting up protocols used serially connected devices
- Users & Groups – setting up users and defining the access permissions for each of theseusers
- Authentication – this is covered in more detail in Chapter 8
- Network Hosts – configuring access to local network connected computers or appliances(hosts)
- Configuring Trusted Networks - nominate IP addresses that trusted users access from
- Cascading and Redirection of Serial Console Ports
- Connecting to power (UPS, PDU, and IPMI) and environmental monitoring (EMD) devices
- Serial Port Redirection – using the PortShare windows and Linux clients
- Managed Devices - presents a consolidated view of all the connections
- IPSec – enabling VPN connection
- 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 theRS232 parameters that are to be used for the data connection to that port (e.g. baud rate).

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

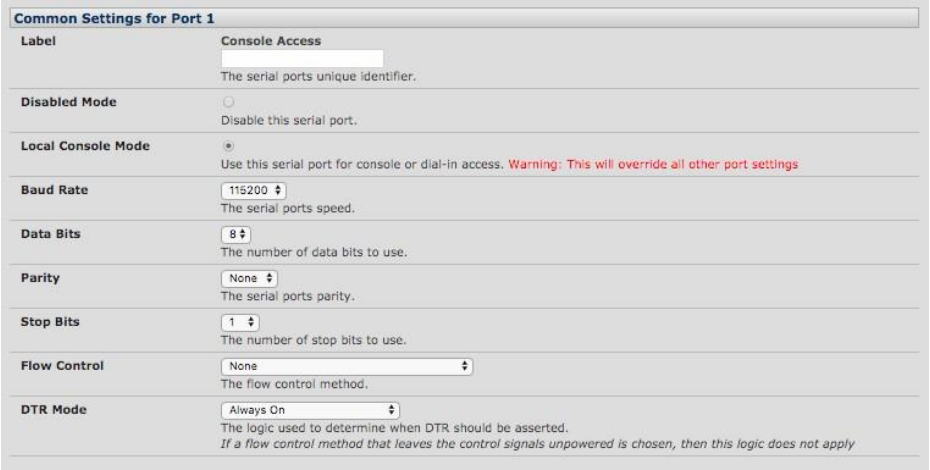
- Disabled mode is the default, the serial port is inactive
- Console server mode enables general access to serial console port on the serially attached devices
- Device mode sets the serial port up to communicate with an intelligent serial controlled PDU, UPS or Environmental Monitor Devices (EMD)
- Terminal Server mode sets the serial port to await an incoming terminal login session
- Serial Bridge mode enables the transparent interconnection of two serial port devices over a network.



1. Select **Serial & Network > Serial Port** to display serial port details.
2. By default, each serial port is set in Console server mode. Click **Edit** next to the port to be reconfigured, or click **Edit Multiple Ports** and select which ports you want to configure as agroup.
3. When you have reconfigured the common settings and the mode for each port, set up anyremote syslog (see the following sections for specific information).
4. Click **Apply**
5. If the console server has been configured with distributed Nagios monitoring enabled, use **Nagios Settings** options to enable nominated services on the Host to be monitored.

3.1.1 Common Settings

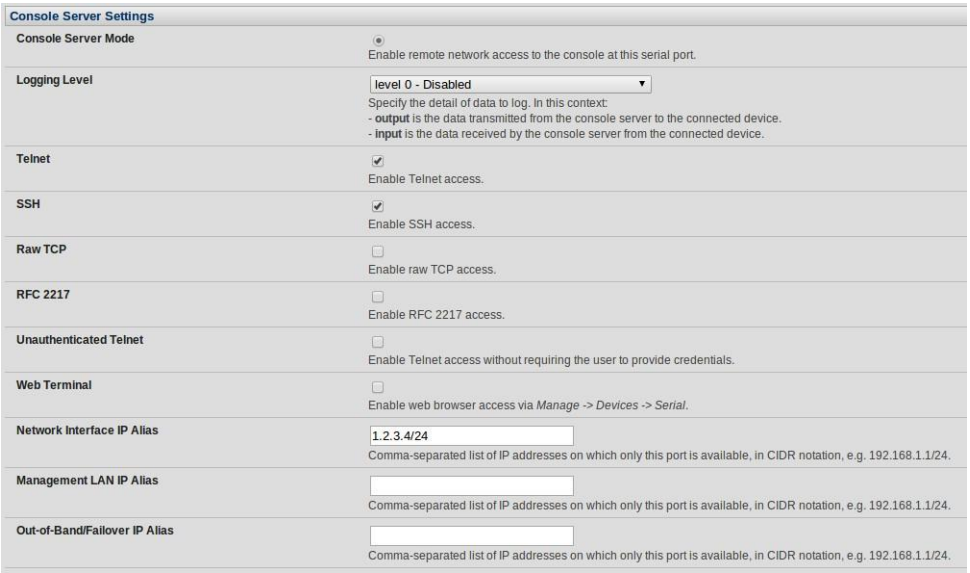
There are a number of common settings that can be set for each serial port. These are independent of themode in which the port is being used. These serial port parameters must be set so they match the serial port parameters on the device you attach to that port:



- Type in a label for the port.
- Select the appropriate **Baud Rate**, **Parity**, **Data Bits**, **Stop Bits** and **Flow Control** for each port.
- Set the **Port Pinout**. This menu item appears for IM7200 ports where pin-out for each RJ45 serial port can be set as either X2 (Cisco Straight) or X1 (Cisco Rolled).
- Set the **DTR mode**. This allows you to choose if DTR is always asserted or only asserted when there is an active user session.
- Before you proceed 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 isattached to this serial port:



Logging Level This specifies the level of information to be logged and monitored:

Level 0: Disable logging (default)

Level 1: Log LOGIN, LOGOUT and SIGNAL events

Level 2: Log LOGIN, LOGOUT, SIGNAL, TXDATA and RXDATA events.

Level 3: Log LOGIN, LOGOUT, SIGNAL and RXDATA events Level 4: Log LOGIN, LOGOUT, SIGNAL and TXDATA events.

Input/RXDATA is data received by the Opengear device from the connected serial device, and output/TXDATA is data sent by the Opengear device (e.g. typed by the user) to the connected serial device.

Device consoles typically echo back characters as they are typed so TXDATA typed by a user is subsequently received as RXDATA, displayed on their terminal.

> **NOTE:** After prompting for a password, the connected device sends * characters to prevent thepassword from being displayed.

Telnet When the Telnet service is enabled on the console server, a Telnet client on a user's computer canconnect to a serial device attached to this serial port on the console server. Because Telnet communications are unencrypted, this protocol is only recommended for local or VPN tunneled connections.

If the remote communications are being tunneled with a connector, Telnet can be used forsecurely accessing these attached devices.

> **NOTE:** In console server mode, users can use a connector to set up secure Telnet connections thatare SSH tunneled from their client computers to the serial port on the console server. Connectors can be installed on Windows PCs and most Linux platforms and it enables secure Telnet connections to be selected with point-and-click.

To use a connector to access consoles on the console server serial ports, configure the connector with the console server as a gateway, and as a host, and enable Telnet service on Port(2000 + serial port #) i.e. 2001–2048.

You can also use standard communications packages like PuTTY to set a direct Telnet or SSH connectionto the serial ports.

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

SSH It is recommended that you use SSH as the protocol when users connect to the console server(or connect through the console server to the attached serial consoles) over the Internet or anyother public network.

For SSH access to the consoles on devices attached to the console server serial ports, you canuse a connector. Configure the connector with the console server as a gateway, and as a host, and enable SSH service on Port (3000 + serial port #) i.e. 3001-3048.

You can also use common communications packages, like PuTTY or SSHTerm to SSH connect to port address IP Address _ Port (3000 + serial

port #) i.e. 3001–3048

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

<username>:<portXX>

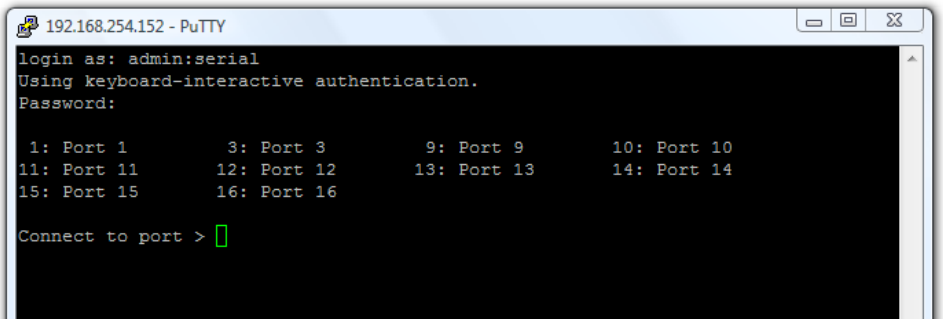
<username>:<port label>

<username>:<ttySX>

<username>:<serial>

For a user named chris to access serial port 2, when setting up the SSHTerm or the PuTTY SSH client, instead of typing username = chris and ssh port = 3002, the alternate is to type username = chris:port02 (or username = chris:ttyS1) and ssh port = 22.

Or by typing username=chris:serial and ssh port = 22, the user is presented with a port selection option:



This syntax enables users to set up SSH tunnels to all serial ports with a single IP port 22having to be opened in their firewall/gateway

> **NOTE:** In server mode, you connect to a serial port via pmshell. To generate a BREAK on theserial port, type the character sequence ~b. If you're doing this over OpenSSH, type ~~b.

TCP

RAW TCP allows connections to a TCP socket. While communications programs like *PuTTY* also support RAW TCP, this protocol is usually used by a custom application.

For RAW TCP, the default port address is IP Address _ Port (4000 + serial port #) i.e. 4001 – 4048.

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

RFC2217

Selecting RFC2217 enables serial port redirection on that port. For RFC2217, the default portaddress is IP Address _ Port (5000 + serial port #) i.e. 5001 – 5048.

Special client software is available for Windows UNIX and Linux that supports RFC2217 virtual com ports, so a remote host can monitor and manage remote serially attached devices as though they are connected to the local serial port (see Chapter 3.6 – Serial Port Redirection for details).

RFC2217 also enables the serial port to be tunneled to a remote console server, so two serial port devices can transparently interconnect over a network (see Chapter 3.1.6 – Serial Bridging).

Unauthenticated Telnet This 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 given a login prompt. 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 allows connection.

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

Logging into a device connected to the console server may require authentication.

For Unauthenticated Telnet the default port address is IP Address _ Port (6000 + serial port #) i.e. 6001 – 6048

Unauthenticated SSH This enables SSH access to the serial port without authentication credentials. Whena user accesses the console server to Telnet to a serial port, they are given a login prompt.

With unauthenticated SSH they connect directly through to the port without any console server login challenge.

This mode is used when you have another system managing user authentication and access privileges at the serial device level but wish to encrypt the session across the network.

Logging into a device connected to the console server may require authentication.

For Unauthenticated Telnet the default port address is IP Address _ Port (7000 + serial port #) i.e. 7001 – 7048.

The <username>: method of port access (as described in the above SSH section) always requires authentication.

Web Terminal This enables web browser access to the serial port via **Manage > Devices: Serial** using theManagement Console's built in AJAX terminal. Web Terminal connects as the currently authenticated Management Console user and does not re-authenticate. See section 12.3 for more details.

IP Alias Enable 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 theinternal 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).

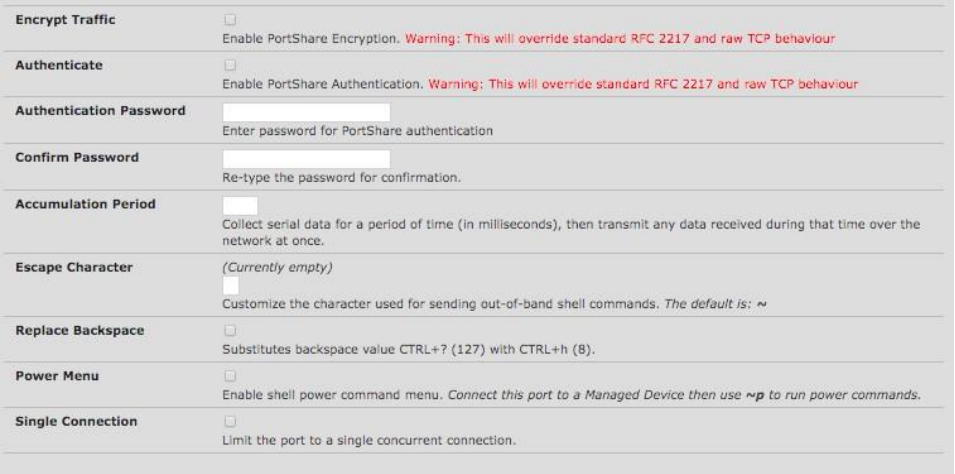
This feature can also be configured via the multiple port edit page. In this case the IP addresses are applied sequentially, with the first selected port getting the IP entered and subsequent ones getting incremented, with numbers being skipped for any unselected ports.For example, if ports 2, 3 and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

Port 2: 10.0.0.1/24

Port 3: 10.0.0.2/24

Port 5: 10.0.0.4/24

IP Aliases also support IPv6 alias addresses. The only difference is that addresses are hexadecimal numbers, so port 10 may correspond to an address ending in A, and 11 to one ending in B, rather than 10 or 11 as per IPv4.



Encrypt Traffic / Authenticate Enable trivial encryption and authentication of RFC2217 serialcommunications using Portshare (for strong encryption use VPN).

Accumulation Period When 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 specifies a period that incoming characters are collected before being sent as apacket over the network.

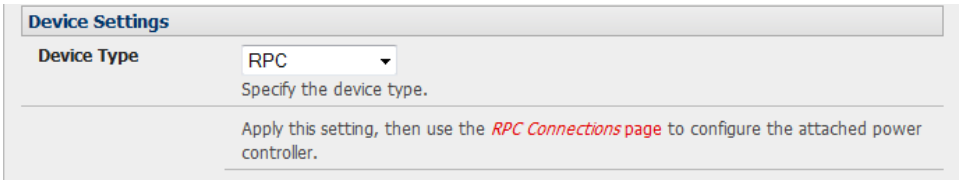
Escape Character Change the character used for sending escape characters. The default is **~.Replace Backspace** Substitute the default backspace value of CTRL+? (127) with CTRL+h (8).

Power Menu The command to bring up the power menu is **~p** and enables the shell power command so a user can control the power connection to a managed device from command line when they areTelnet or SSH connected to the device. The managed device must be set up with both its Serialport connection and Power connection configured.

Single Connection This limits the port to a single connection so if multiple users have access privilegesfor a particular port only one user at a time can access that port (i.e. port snooping is not permitted).

3.1.3 Device (RPC, UPS, Environmental) Mode

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



1. Select the desired **Device Type** (UPS, RPC, or Environmental).

2. Proceed to the appropriate device configuration page (**Serial & Network > UPS Connections,RPC Connection** or **Environmental**) as detailed in Chapter 7.

3.1.4 Terminal Server Mode

Select **Terminal Server Mode** and the **Terminal Type** (vt220, vt102, vt100, Linux or ANSI) to enablea getty on the selected serial port.

The getty configures the port and wait for a connection to be made. An active connection on a serial device is indicated by the raised Data Carrier Detect (DCD) pin on the serial device. When a connection isdetected, the getty program issues a login: prompt, and invokes the login program to handle the system login.

NOTE: Selecting Terminal Server mode disables Port Manager for that serial port, so data is no longerlogged for alerts etc.

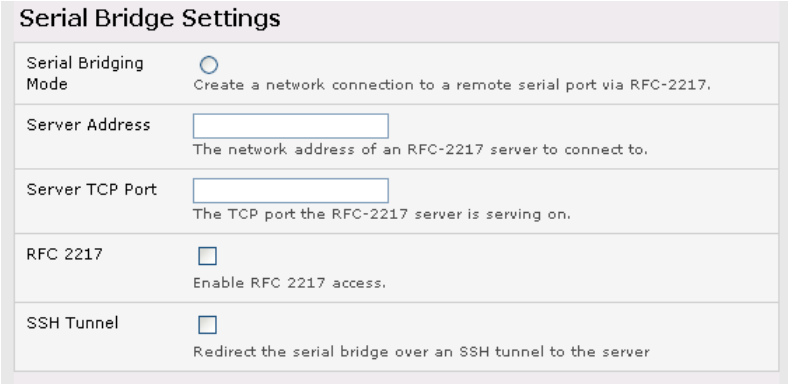
3.1.5 Serial Bridging Mode

With serial bridging, the serial data on a nominated serial port on one console server is encapsulated intonetwork packets and transported over a network to a second console

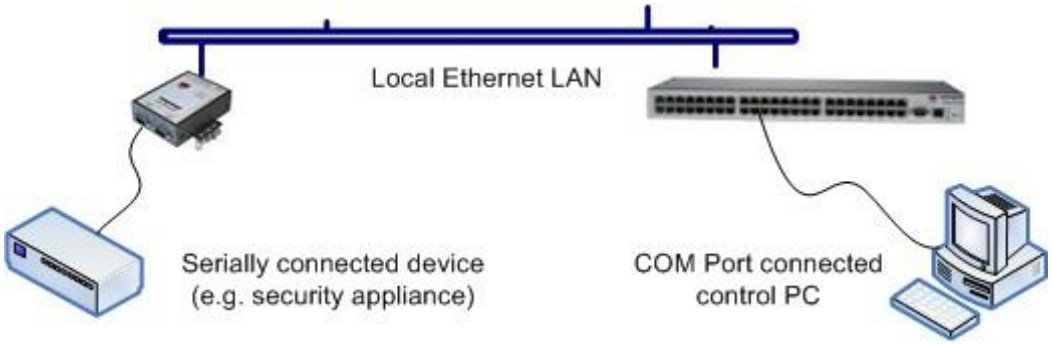
server where it is represented as serial data. The two console servers act as a virtual serial cable over an IP network.

One console server is configured to be the Server. The Server serial port to be bridged is set in Consoleserver mode with either RFC2217 or RAW enabled.

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



- Select **Serial Bridging Mode** and specify the IP address of the Server console server and the TCPport address of the remote serial port (for RFC2217 bridging this will be 5001-5048).



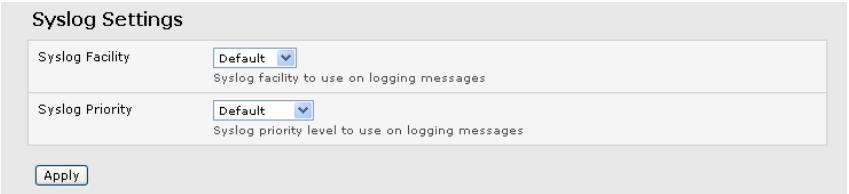
- By default, the bridging client uses RAW TCP. Select RFC2217 if this is the console server. modeyou have specified on the server console server

- You can secure the communications over the local Ethernet by enabling SSH. Generate andupload keys.

3.1.6 Syslog

In addition to inbuilt logging and monitoring which can be applied to serial-attached and network-attachedmanagement accesses, as covered in Chapter 6, the console server can also be configured to support theremote syslog protocol on a per serial port basis:

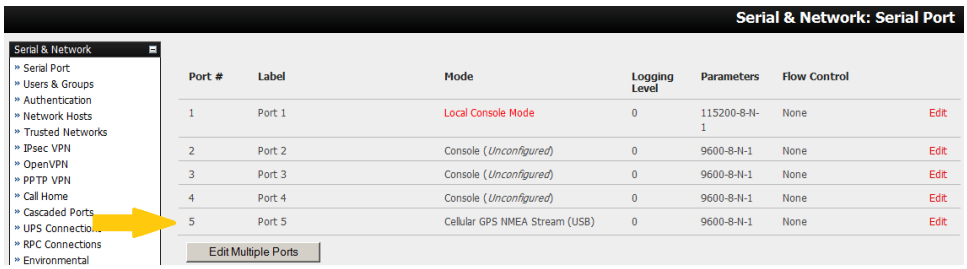
- Select the **Syslog Facility/Priority** fields to enable logging of traffic on the selected serial port to asyslog server; and to sort and act on those logged messages (i.e. redirect them / send alert email.)



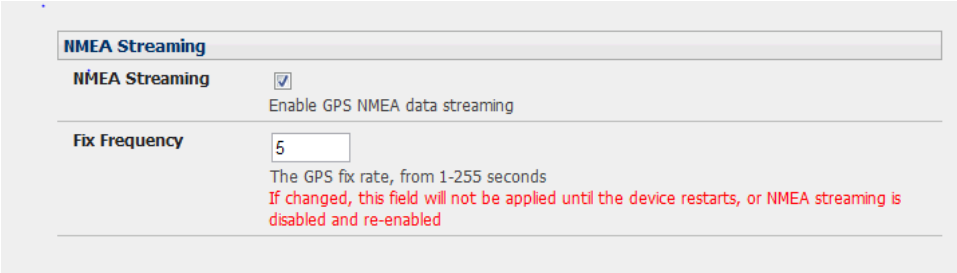
For example, if the computer attached to serial port 3 should never send anything out on its serial consoleport, the administrator can set the **Facility** for that port to local0 (local0 .. local7 are meant for site local values), and the **Priority** to critical. At this priority, if the console server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

3.1.7 NMEA Streaming

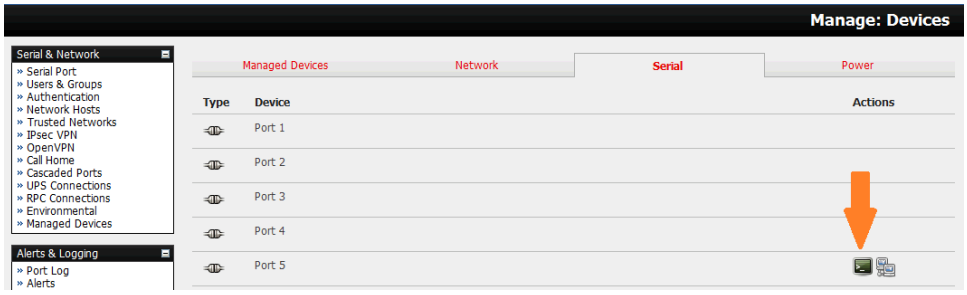
The ACM7000-L can provide GPS NMEA data streaming from the internal GPS /cellular modem. This datastream presents as a serial data stream on port 5 on the ACM models.



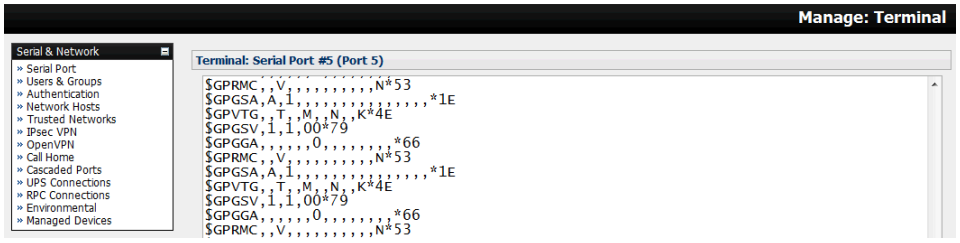
The Common Settings (baud rate etc.) are ignored when configuring the NMEA serial port. You can specify the **Fix Frequency** (i.e. this GPS fix rate determines how often GPS fixes are obtained). You canalso apply all the Console Server Mode, Syslog and Serial Bridging settings to this port.



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



For example, using the Web Terminal:



3.1.8 USB Consoles

Console servers with USB ports support USB console connections to devices from a wide range of vendors, including Cisco, HP, Dell and Brocade. These USB ports can also function as plain RS-232 serialports when a USB-to-serial adapter is connected.

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

The ACM7008-2 has eight RJ45 serial ports on the rear of the console server and four USB ports on thefront. 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.

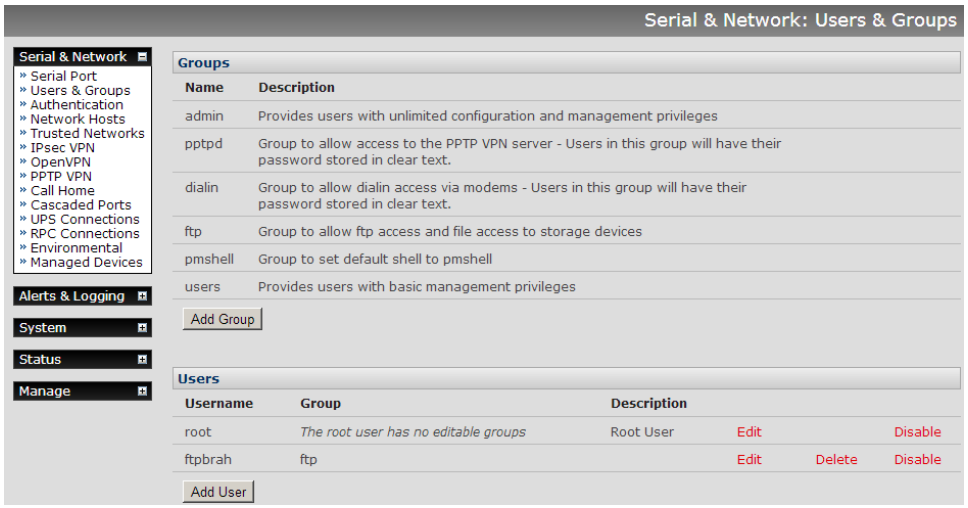
The 7216-24U has 16 RJ45 serial ports and 24 USB ports on its rear-face as well as two front-facing USBports and (in the cellular model) a GPS.

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 ispresented at port number 43.

The common settings (baud rate, etc.) are used when configuring the ports, but some operations may notwork depending on the implementation of the underlying USB serial chip.

3.2 Add and Edit Users

The administrator uses this menu selection to create, edit and delete users and to define the accesspermissions for each of these users.



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).

Users can be added to groups. Six groups are set up by default:

admin Provides unlimited configuration and management privileges.

pptpd Allows access to the PPTP VPN server. Users in this group have their passwordstored in clear text.

dialin Allows dialin access via modems. Users in this group have their password storedin clear text.

ftp Allows ftp access and file access to storage devices.

pmshellSets default shell to pmshell.

users Provides users with basic management privileges.

The **admin** group provides members full administrator privileges. The admin user can access the consoleserver using any of the services which have been enabled in **System > Services** They can also access anyof the connected Hosts or serial port devices using any of the services that have been enabled for these connections. Only trusted users should have administrator access

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

Users in the **pptd, dialin, ftp** or **pmshell** groups have restricted user shell access to the nominated managed devices but they will not have any direct access to the console server. To add this the usersmust also be a member of the **users** or **admin** groups

The administrator can set up additional groups with specific power device, serial port and host access permissions. Users in these additional groups don't have any access to the Management Console menunor do they have any command line access to the console server.

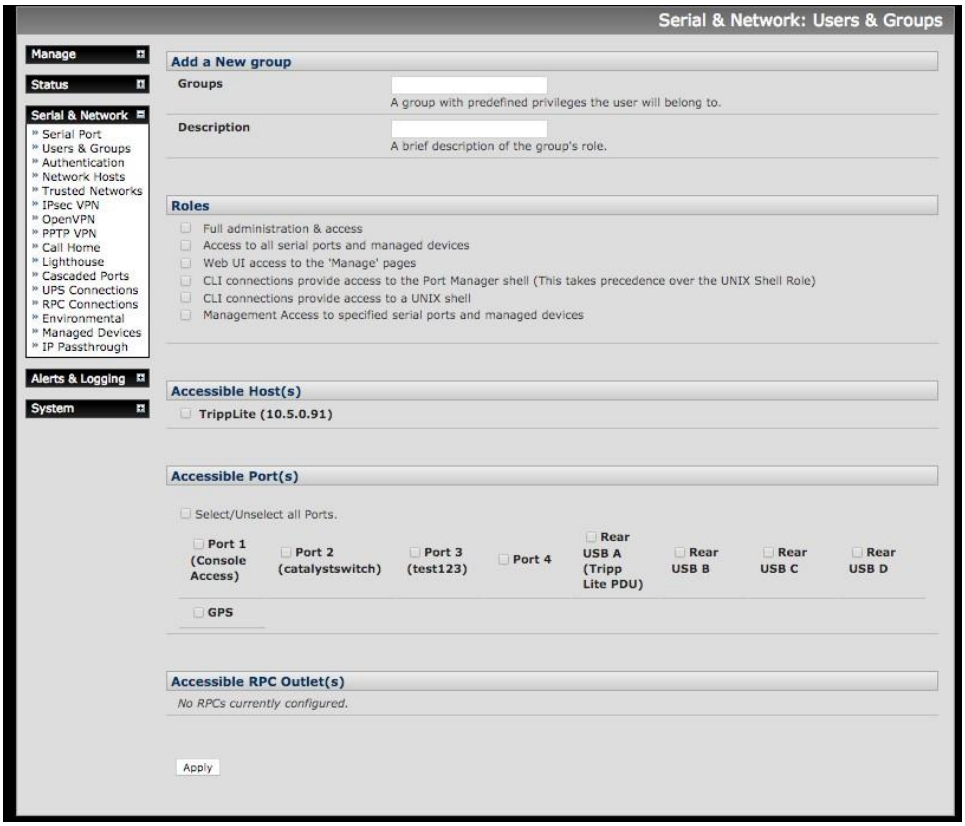
The administrator can set up users with specific power device, serial port and host access permissionswho are not a member of any groups. These users don't have any access to

the Management Console menu nor command line access to the console server.

3.2.1 Set up new group

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

1. Select **Serial & Network > Users & Groups** to display all groups and users.
2. Click **Add Group** to add a new group.

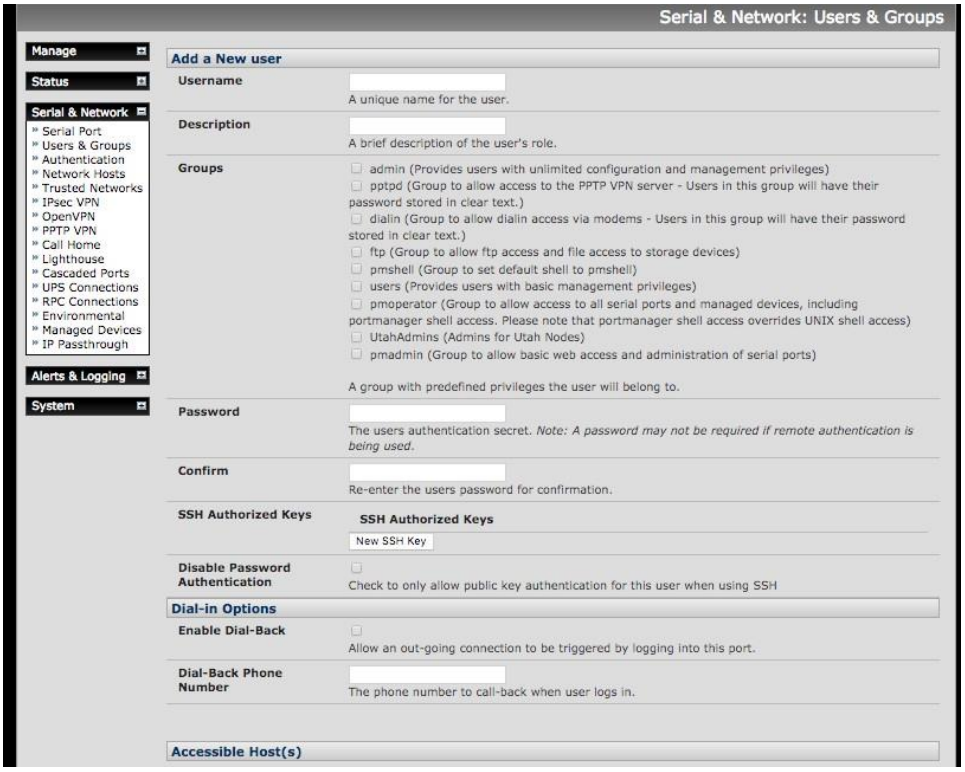


3. Add a **Group** name and **Description** for each new group, and nominate the **Accessible Hosts, Accessible Ports** and **Accessible RPC Outlets** that users in this new group will be able to access.
4. Click **Apply**.
5. The administrator can **Edit** or **Delete** any added group.

3.2.2 Set up new users

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

1. Select **Serial & Network > Users & Groups** to display all groups and users.
2. Click **Add User**.



3. Add a **Username** for each new user.
   You may also include information related to the user (e.g. contact details) in the **Description** field. The Username can contain from 1 to 127 alphanumericcharacters and the characters "-" "_" and ".".

4. Specify the **Groups** to which you want the user to be a member.

5. Add a confirmed **Password** for each new user.
   All characters are allowed.

6. SSH pass-key authentication can be used. Paste the public keys of authorized public/privatekeypairs for this user in the **Authorized SSH Keys** field.

7. Check **Disable Password Authentication** to only allow public key authentication for this userwhen using SSH.

8. Check **Enable Dial-Back** in the **Dial-in Options** menu to allow an out-going dial-back connectionto be triggered by logging into this port.

9. Enter the **Dial-Back Phone Number** with the phone number to call-back when user logs in.

10. Check **Accessible Hosts** and/or **Accessible Ports** to nominate the serial ports and network connected hosts to which you want the user to have access privileges.

11. If there are configured RPCs, check **Accessible RPC Outlets** to specify which outlets the user can control (i.e. Power On/Off).

12. Click **Apply**.

The new user will be able to access the accessible Network Devices, Ports and RPC Outlets. If the user isa group member, they can also access any other device/port/outlet accessible to the group

There are no limits on the number of users you can set up or the number of users per serial

port or host. Multiple users can control/monitor the one port or host. There are no limits on the number of groups and each user can be a member of a number of groups. A user does not have to be a member of any groups, but if the user is a member of the default user group, they will not be able to use the Management Consoleto manage ports.

While there are no limits, the time to re-configure increases as the number and complexity increases. Werecommend the aggregate number of users and groups 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 the user access privileges.
- Click **Delete** to remove the user.
- Click **Disable** to temporarily block access privileges.

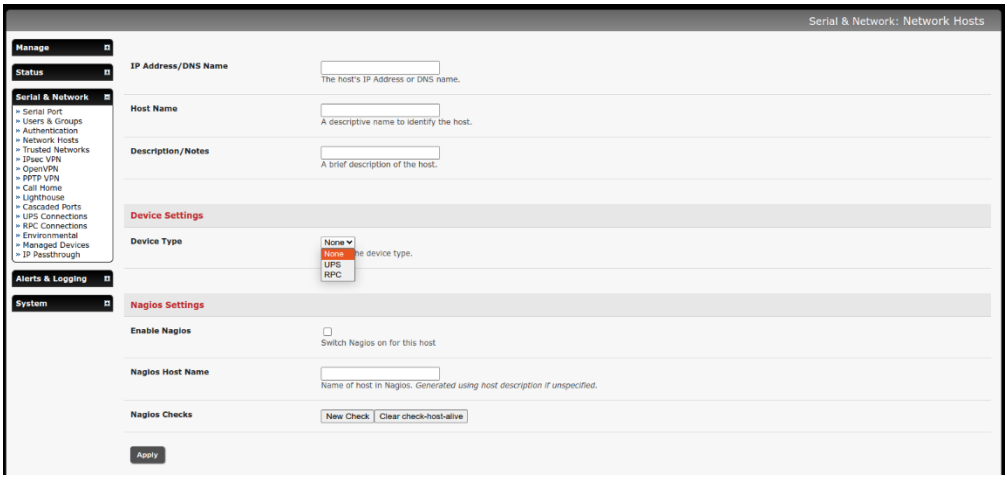
3.3 Authentication

See Chapter 8 for authentication configuration details.

3.4 Network Hosts

To monitor and remotely access a locally networked computer or device (referred to as a Host) you mustidentify the Host:

1. Selecting **Serial & Network > Network Hosts** presents all the network connected Hosts that havebeen enabled for use.
2. Click **Add Host** to enable access to a new Host (or select **Edit** to update the settings for existingHost).
3. 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 andenable which users have permission to remotely cycle power, etc. See Chapter 7. Otherwise leave the Device Type set to None.



4. If the console server has been configured with distributed Nagios monitoring enabled, you willalso see **Nagios Settings** options to enable nominated services on the Host to be monitored.

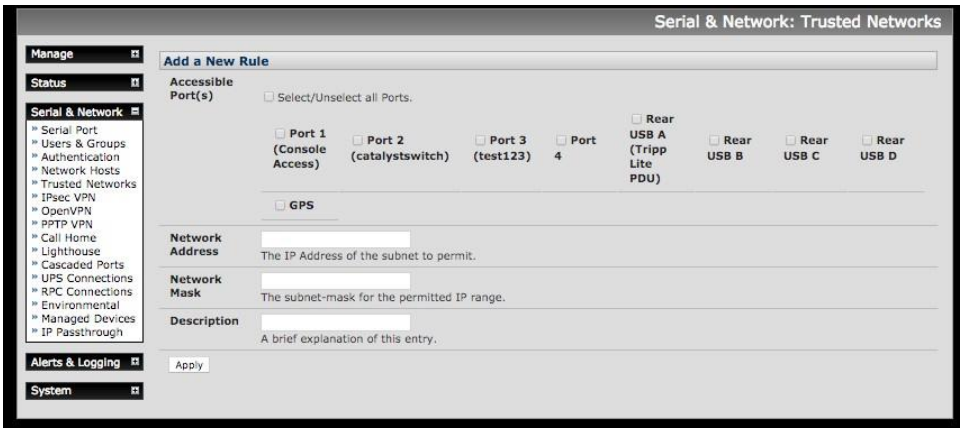
5. Click **Apply.**
   This creates the new Host and also create a new managed device with the samename.

3.5 Trusted Networks

The **Trusted Networks** facility gives you an option to nominate IP addresses that users must be located at,to have access to console server serial ports:

1. Select **Serial & Network > Trusted Networks**.

2. To add a new trusted network, select **Add Rule.**
   In the absence of Rules, there are no accesslimitations as to the IP address at which users can be located.



3. Select the **Accessible Ports** to which the new rule is to be applied.

4. Enter the **Network Address** of the subnet to be permitted access.

5. Specify the range of addresses that are to be permitted by entering a **Network Mask** for thatpermitted IP range e.g:

   - To permit all the users located with a particular Class C network connection to the nominatedport, add the following Trusted Network New Rule:

Network IP Address	204.15.5.0
Subnet Mask	255.255.255.0

   - To permit only one user located at a specific IP address to connect:

Network IP Address	204.15.5.13
Subnet Mask	255.255.255.255

   - To allow all the users operating from within a specific range of IP addresses (say any of the thirtyaddresses from 204.15.5.129 to 204.15.5.158) to be permitted connection to the nominated port:

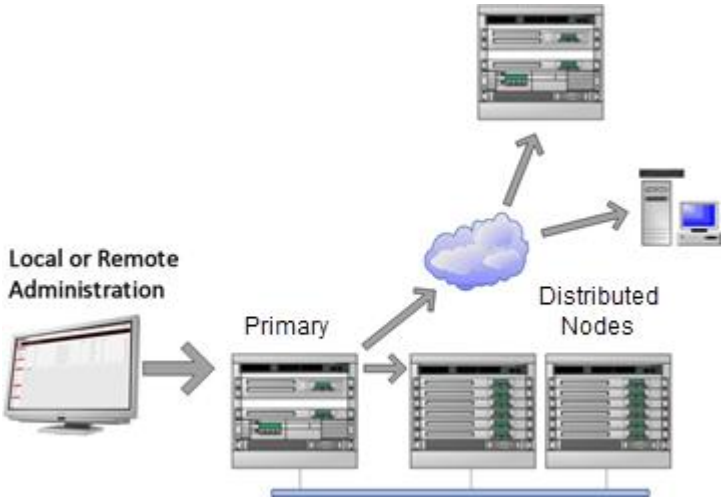
Host/Subnet Address	204.15.5.128
Subnet Mask	255.255.255.224

6. Click **Apply**.

3.6 Serial Port Cascading

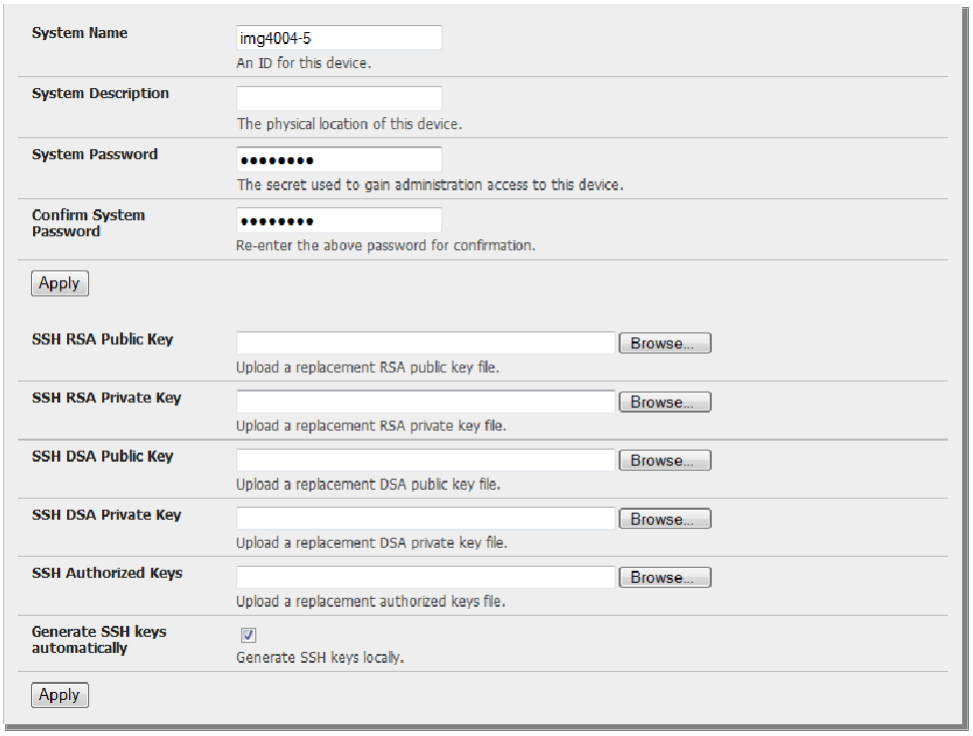
Cascaded Ports enables you to cluster distributed console servers so a large number of serial ports (up to1000) can be configured and accessed through one IP address and managed through the one Management Console. One console server, the Primary, controls other console servers as Node units and all the serial ports on the Node units appear as if they are part of the Primary.

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



3.6.1 Automatically generate and upload SSH keys

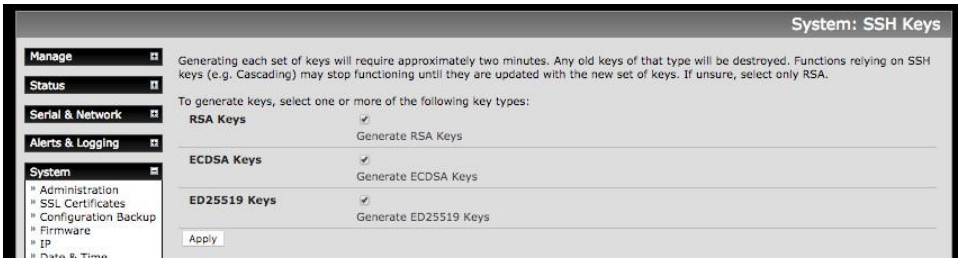
To set up public key authentication you must first generate an RSA or DSA key pair and upload them intothe Primary and Node console servers. This can be done automatically from the Primary:



1. Select **System > Administration** on Primary's Management Console.

2. Check **Generate SSH keys automatically**.

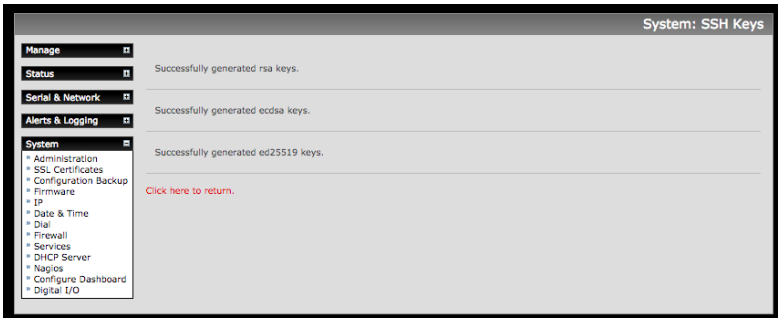
3. Click **Apply**.



Next you must select whether to generate keys using RSA and/or DSA (if unsure, select only RSA). Generating each set of keys require two minutes and the new keys destroy old keys of that type. While thenew generation is underway, functions relying on SSH keys (e.g. cascading) may stop functioning until they are updated with the new set of keys. To generate keys:

4. Check boxes for the keys you want to generate.

5. Click **Apply**.



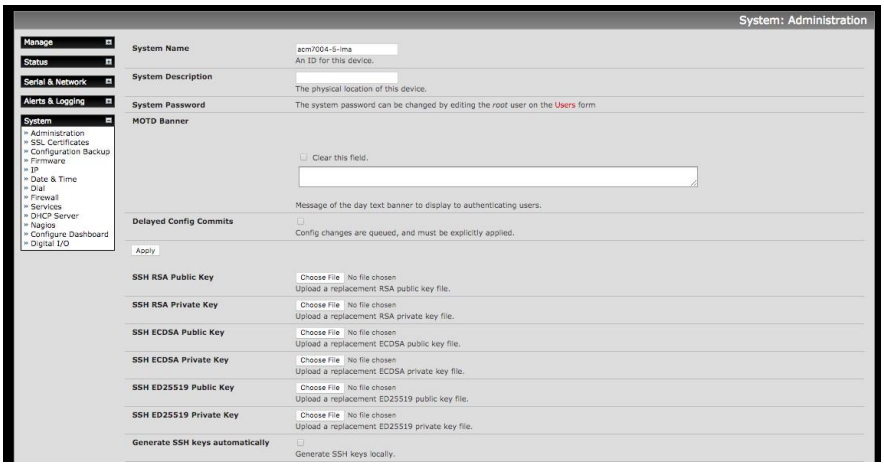
6. When the new keys have been generated, click the link **Click here to return.**
   The keys are uploadedto the Primary and connected Nodes.

3.6.2 Manually generate and upload SSH keys

Alternately if you have an RSA or DSA key pair you can upload them to the Primary and Node consoleservers.

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

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



Next, you must register the Public Key as an Authorized Key on the Node. In the case of one Primary withmultiple Nodes, you upload one RSA or DSA public key for each Node.

1. Select **System > Administration** on the Node's Management Console.
2. Browse to the stored RSA (or DSA) Public Key and upload it to Node's **SSH Authorized Key.**
3. Click **Apply**.

The next step is to Fingerprint each new Node-Primary connection. This step validates that you areestablishing an SSH session to who you think you are. On the first connection the Node receives afingerprint from the Primary used on all future connections:

To establish the fingerprint first log in the Primary server as root and establish an SSH connection to theNode remote host:

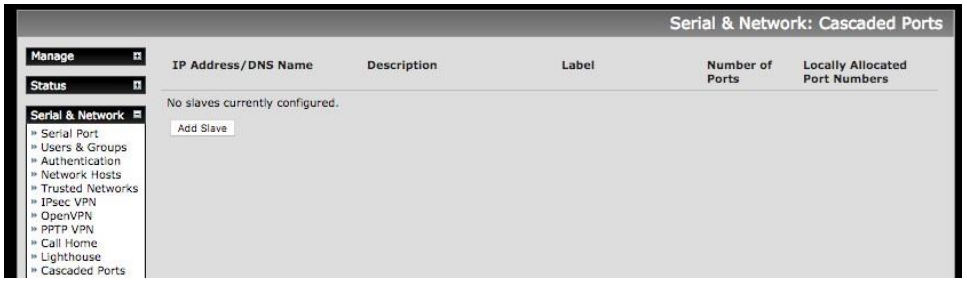
```
# ssh remhost
```

When the SSH connection has been established, you are asked to accept the key. Answer **yes** and thefingerprint is added to the list of known hosts.

If you are asked to supply a password, there was problem uploading keys.

3.6.3 Configure the Nodes and their serial ports

Begin setting up the Nodes and configuring Node serial ports from the Primary console server:



1. Select **Serial & Network > Cascaded Ports** on the Primary's Management Console.

2. To add clustering support, select **Add Node**.

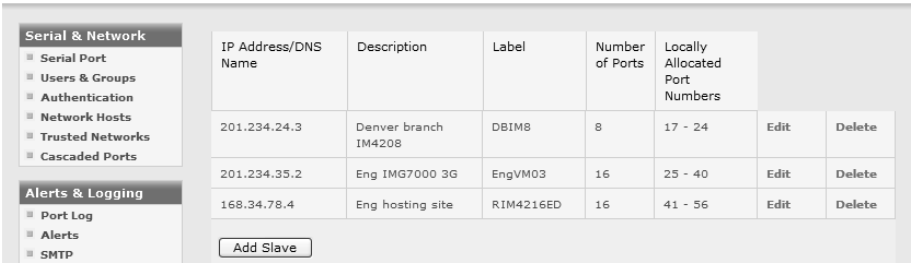
You can't add Nodes until you have generated SSH keys. To define and configure a Node:

1. Enter the remote **IP Address** or DNS Name for the Node console server.

2. Enter a brief **Description** and a short **Label** for the Node.

3. Enter the full number of serial ports on the Node unit in **Number of Ports.**

4. Click **Apply**. This establishes the SSH tunnel between the Primary and the new Node.



The **Serial & Network > Cascaded Ports** menu displays all the nodes and the port numbers that have beenallocated on the Primary. If the Primary console server has 16 ports of its own, ports 1-16 are pre-allocated to the Primary, so the first node added is assigned port number 17 onwards.

When you have added all the Node console servers, the Node serial ports, and the connected devices areconfigurable and accessible from the Primary's Management Console menu and accessible through the Primary's IP address.

1. Select the appropriate **Serial & Network > Serial Port** and **Edit** to configure the serial ports on theNode.

2. Select the appropriate **Serial & Network > Users & Groups** to add new users with access privilegesto the Node serial ports (or to extend existing users access privileges).

3. Select the appropriate **Serial & Network > Trusted Networks** to specify network addresses thatcan access nominated node serial ports.

4. Select the appropriate **Alerts & Logging > Alerts** to configure Node port Connection,

State Changeor Pattern Match alerts. The configuration changes made on the Primary are propagated out to all the nodes when you click **Apply.**

3.6.4 Managing Nodes

The Primary is in control of the Node serial ports. For example, if change a user access privilege or edit any serial port setting on the Primary, the updated configuration files are sent out to each Node in parallel.Each Node makes changes to their local configurations (and only makes changes that relate to its particular serial ports).

You can use the local Node Management Console to change the settings on any node serial port (such asalter the baud rates). These changes are overwritten next time the Primary sends out a configuration file update.

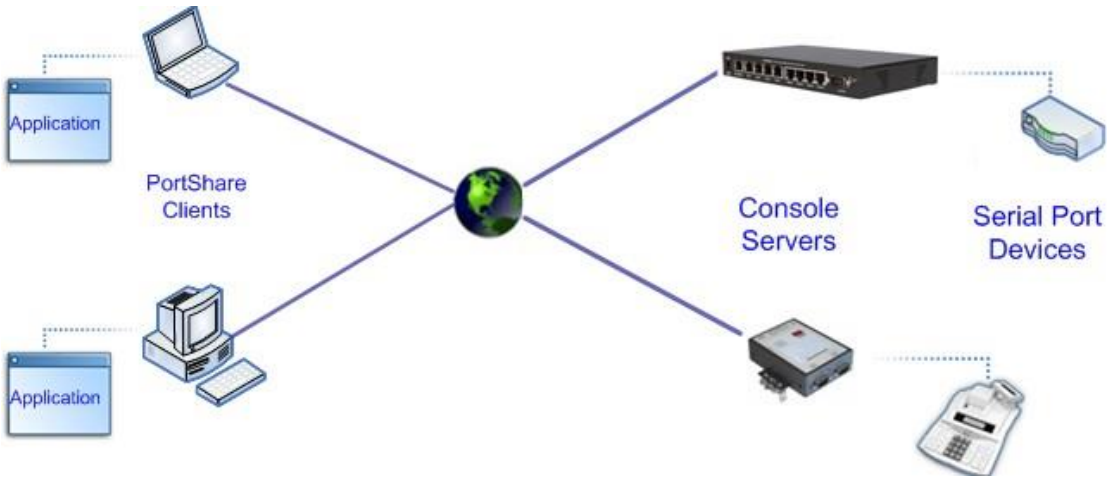
While the Primary is in control of all node serial port related functions, it is not primary over the node network host connections or over the Node Console Server system.

Node functions such as IP, SMTP & SNMP Settings, Date &Time, DHCP server must be managed by accessing each node directly and these functions are not over written when configuration changes are propagated from the Primary. The Node's Network Host and IPMI settings must be configured at each node.

The Primary's Management Console provides a consolidated view of the settings for its own and the entireNode's serial ports. The Primary does not provide a fully consolidated view. For example, if you want to find out who is logged in to cascaded serial ports from the primary, you'll see that **Status > Active Users** only displays those users active on the Primary's ports, so you may need to write custom scripts to providethis view.

3.7 Serial Port Redirection (PortShare)

Opengear's Port Share 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 toyour console server.



PortShare is supplied free with each console server and you are licensed to install *PortShare* on oneor more computers for accessing any serial device connected to a console server port.

***PortShare* for Windows**

The *portshare_setup.exe* can be downloaded from the ftp site. See the PortShare User Manual andQuick Start for details on installation and operation.

***PortShare* for Linux**

The *PortShare* driver for Linux maps the console server serial port to a host *try* port. Opengear hasreleased the *portshare-serial-client* as an open source utility for Linux, AIX, HPUX, SCO, Solaris andUnixWare. This utility can be downloaded from the ftp site.

This 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 apseudo 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 downloaded from the ftp site. See the PortShare User Manual and Quick Start fordetails on installation and operation.

3.8 Managed Devices

The **Managed Devices** page 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 devices with their Description/Notes and lists of all the configuredConnections:

- Serial Port # (if serially connected) or
- USB (if USB connected)
- IP Address (if network connected)
- Power PDU/outlet details (if applicable) and any UPS connections

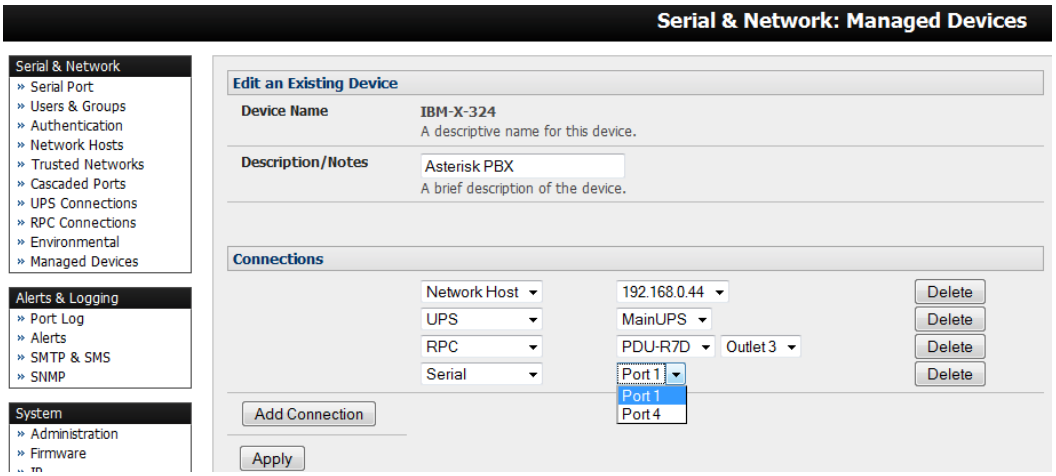
Devices such as servers may have more than one power connection (e.g. dual power supplied) and morethan one network connection (e.g. for BMC/service processor).

All users can view these managed device connections by selecting **Manage > Devices**. Administrators canalso edit and add/delete these managed devices and their connections.

To edit an existing device and add a new connection:

1. Select **Edit** on the **Serial & Network > Managed Devices** and click **Add Connection**.
2. Select the connection type for the new connection (Serial, Network Host, UPS or RPC)

and selectthe connection from the presented list of configured unallocated hosts/ports/outlets.



To add a new network connected managed device:

1. 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.

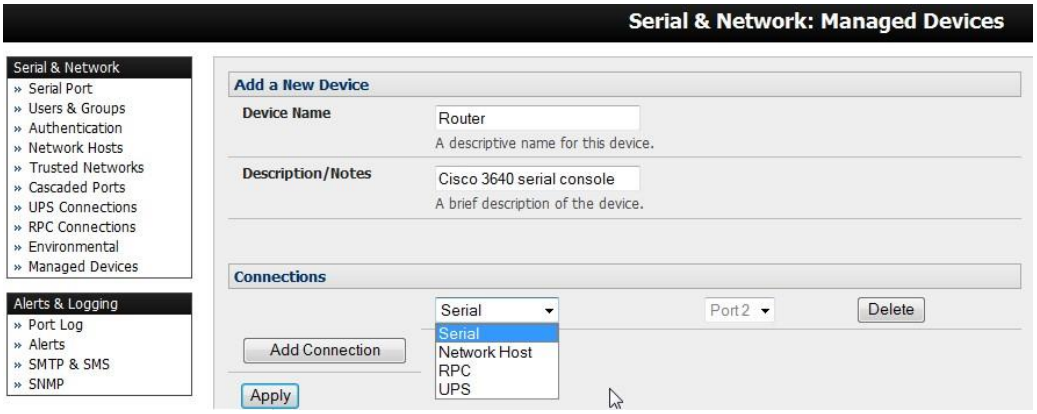
2. When adding a new network connected RPC or UPS power device, you set up a Network Host, designate it as RPC or UPS.
   Go to **RPC Connections** or **UPS Connections** to configure the relevantconnection.
   Corresponding new managed device with the same Name /Description as the RPC/UPS Host is not created until this connection step is completed.

> **NOTE:** The outlet names on the newly created PDU are *Outlet 1* and *Outlet 2*. When you connect a particular managed device that draws power from the outlet, the outlet takes the name of thepowered managed device.

To add a new serially connected managed device:

1. Configure the serial port using the **Serial & Network > Serial Port** menu (See *Section 3.1 -Configure Serial Port).*

2. Select **Serial & Network > Managed Devices** and click **Add Device**.



3. Enter a **Device Name** and **Description** for the managed device.

4. Click **Add Connection** and select **Serial** and the **Port** that connects to the managed

device

5. To add a UPS/RPC power connection or network connection or another serial connection click **Add Connection**.

6. Click **Apply.**

> **NOTE:** To set up a serially connected RPC UPS or EMD device, configure the serial port, designate it as a Device, and enter a Name and Description for that device in the **Serial & Network > RPC Connections** (or **UPS Connections** or **Environmental**). This creates a corresponding new managed device with the same Name /Description as the RPC/UPS Host. The outlet names on this newly created PDU are *Outlet 1* and *Outlet 2*. When you connect a managed device that draws power from the outlet, the outlet takes the name of the powered managed Device.

3.9 IPsec VPN

The ACM7000, CM7100, and IM7200 include Strongswan, 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 console server and managed devices securely over the Internet.

The administrator can establish encrypted authenticated VPN connections between console servers distributed at remote sites and a VPN gateway (such as Cisco router running IOS IPsec) on their central office network:

- Users at the central office can 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

- All these remote console servers can be monitored with a CMS6000 on the central network

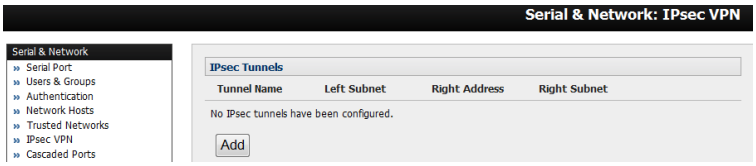
- With serial bridging, serial data from controller at the central office machine can be securely connected to the serially controlled devices at the remote sites

The road warrior administrator can use a VPN IPsec software client to remotely access the console server and every machine on the Management LAN subnet at the remote location

Configuration of IPsec is quite complex so Opengear provides a GUI interface for basic set up as described below.

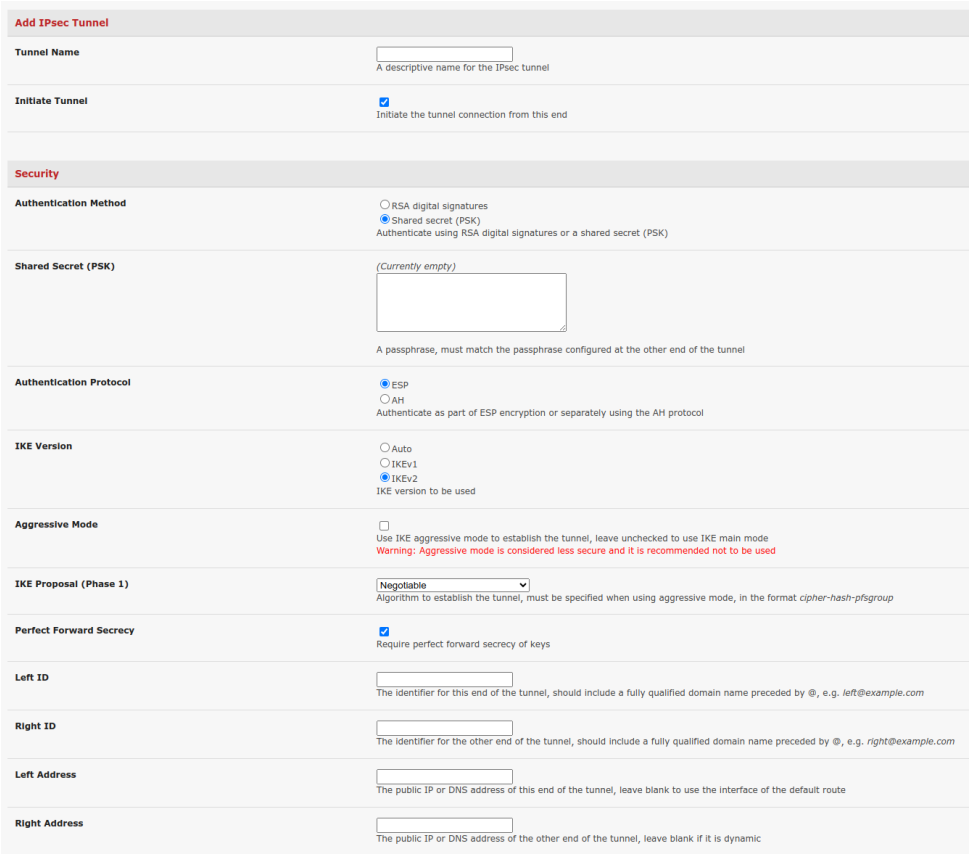
To enable the VPN gateway:

1. Select IPsec VPN on the Serial & Networks menu.



2. Click **Add** and complete the **Add IPsec Tunnel** screen

3. Enter any descriptive name you want to identify the IPsec Tunnel you are adding such asWestStOutlet-VPN.



4. Select the **Authentication Method** to be used, either RSA digital signatures or a Shared secret(PSK):

   - If you select RSA you are asked to **click here to generate keys**. This generates an RSA public key for the console server (the Left Public Key). Locate the key to be used on theremote gateway, cut and paste it into the Right Public Key.

   - If you select Shared secret, enter a Pre-shared secret (PSK). The PSK must match

the PSKconfigured at the other end of the tunnel

5. In **Authentication Protocol,** select the authentication protocol to be used.
   Either authenticate aspart of *ESP* (Encapsulating Security Payload) encryption or separately using the AH (Authentication Header) protocol.

6. In **IKE Version,** select the method of key exchange. IKEv2 is recommended and more secure than IKEv1.
   Auto will initiate a tunnel using IKEv2, but accept any protocol version when responding.

7. In **IKE Proposal** (Phase 1) you can either select Negotiable or choose from the list of algorithm combinations in the format cipher-hash-pfsgroup.

   For individual selection of both phase 1 or phase 2 algorithms, its recommend to use the Custom Tunnel Options and this can override any previous settings in the UI

   For example

   (Option name = Argument):
   `for Phase1:`

   `ike = <encryption_alg>-<integrity_alg>[-<prf>]-<dh_group>`

   `for Phase2:`

   `esp = <encryption_alg>-<integrity_alg>-<dh_group>`

   `OR`

   `ah = <integrity_alg>[-<dh_group>]`

   For example: `'ike = aes256gcm12-sha256-modp4096'`

   To utilize the AEAD (Authenticated Encryption with Associated Data) algorithms that can't be combined with classic encryption ciphers in the same proposal, the Custom Tunnel Option is also recommended.

8. 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 caninclude a fully qualified domain name (e.g. left@example.com).

9. Enter the public IP or DNS address of this Opengear VPN gateway as the **Left Address**. You canleave this blank to use the interface of the default route.

10. In **Right Address** enter the public IP or DNS address of the remote end of the tunnel (only if theremote end has a static or DynDNS address). Otherwise leave this blank.

11. If the Opengear VPN gateway is serving as a VPN gateway to a local subnet (e.g. the console server has a Management LAN configured) enter the private subnet details in **Left Subnet.** Use theCIDR 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 and to its attached serial console devices, leave **Left Subnet** blank
    To use multiple subnets, use a comma-separated list and select IKEv2 for the IKE Version.

12. If there is a VPN gateway at the remote end, enter the private subnet details in **Right Subnet**. Usethe CIDR notation and leave blank if there is only a remote host

13. 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 is configured with a static(or DynDNS) IP address

14. Click **Apply** to save changes.

> **NOTE:** Configuration details set up on the console server (referred to as the Left or Local host) must match the set up entered when configuring the Remote (Right) host/gateway or software client.See https://portal.opengear.com/s/article/IPsecConfiguringanIPsecVPNconnection661d28915010e for details on configuring these remote ends.

3.10 OpenVPN

The ACM7000, CM7100, and IM7200 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.

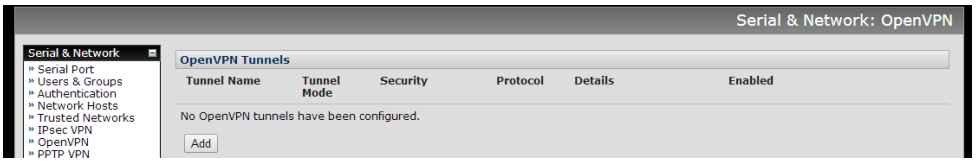
OpenVPN allows secure tunneling of data through a single TCP/UDP port over an unsecured network, thusproviding secure access to multiple sites and secure remote administration to a console server over the Internet.

OpenVPN also allows the use of Dynamic IP addresses by both the server and client thus providing clientmobility. For example, an OpenVPN tunnel may be established between a roaming windows client and anOpengear console server within a data center.

Configuration of OpenVPN can be complex so Opengear provides a GUI interface for basic set up asdescribed below. More detailed information is available at **http://www.openvpn.net**

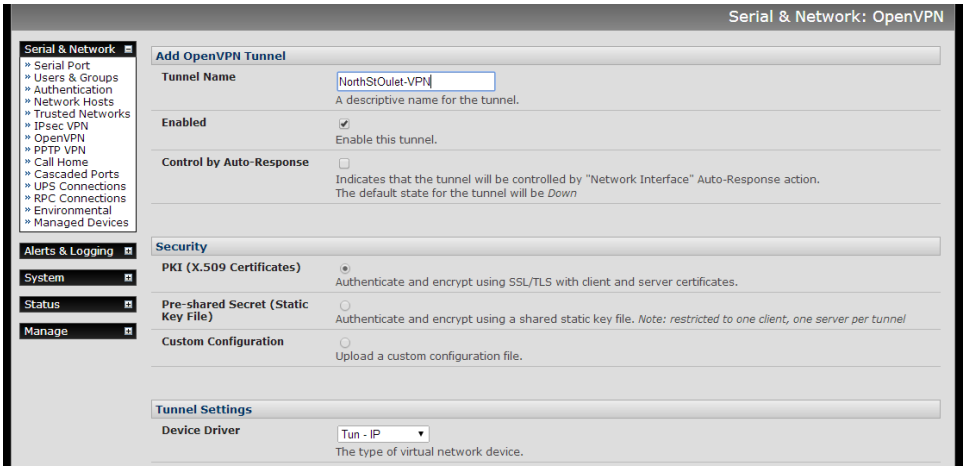
3.10.1 Enable the OpenVPN

1. Select OpenVPN on the Serial & Networks menu.



2. Click **Add** and complete the **Add OpenVPN Tunnel** screen.

3. Enter any descriptive name you wish to identify the OpenVPN Tunnel you are adding, for exampleNorthStOutlet-VPN.



4. Select the authentication method to be used. To authenticate using certificates select **PKI (X.509Certificates)** or select **Custom Configuration** to upload custom configuration files. Custom configurations must be stored in /etc/config.

> **NOTE:** If you select PKI, establish:
> - Separate certificate (also known as a public key). This Certificate File is a *.crt file type
> - Private Key for the server and each client. This Private Key File is a *.key file type
> - Primary Certificate Authority (CA) certificate and key which is used to sign each of the server andclient certificates. This Root CA Certificate is 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 authenticationmethods see http://openvpn.net/index.php/documentation/howto.html#auth.

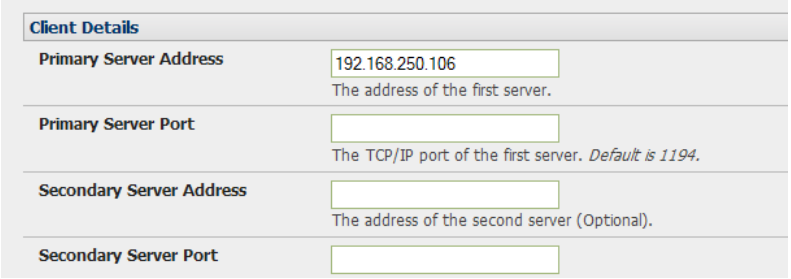
5. Select the **Device Driver** to be used, either **Tun-IP** or **Tap-Ethernet**. The TUN (network tunnel) andTAP (network tap) drivers are virtual network drivers that support IP tunneling and Ethernet tunneling, respectively. TUN and TAP are part of the Linux kernel.

6. Select either **UDP** or **TCP** as the **Protocol.** UDP is the default and preferred protocol for OpenVPN.

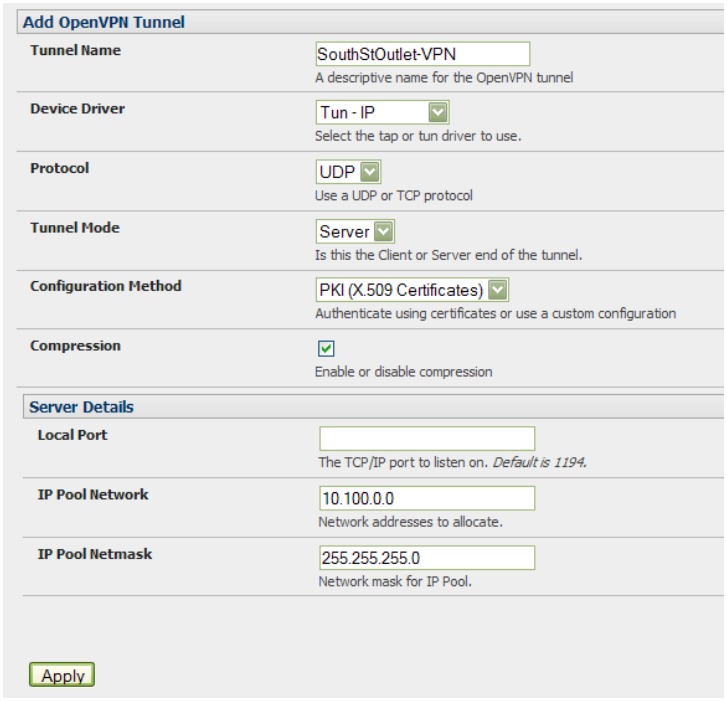
7. Check or uncheck the **Compression** button to enable or disable compression.

8. In **Tunnel Mode,** nominate whether this is the **Client** or **Server** end of the tunnel. When running asa server, the console server supports multiple clients connecting to the VPN server over the sameport.

3.10.2 Configure as Server or Client

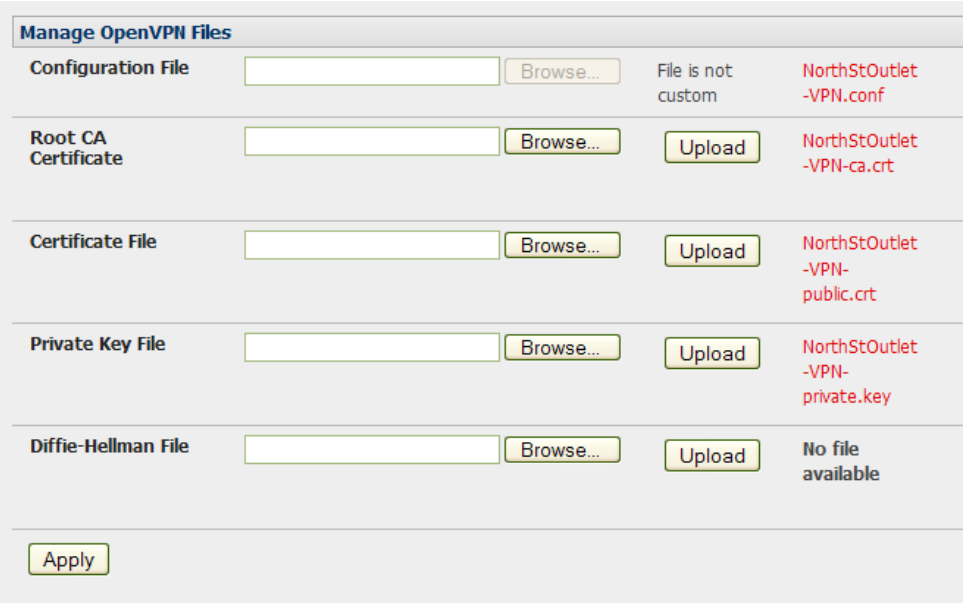


1. Complete the **Client Details** or **Server Details** depending on the Tunnel Mode selected.
    - If Client has been selected, the Primary Server Address is the address of the OpenVPNServer.
    - If Server has been selected, enter the IP Pool Network address and the IP Pool Network mask for the IP Pool. The network defined by the IP Pool Network address/mask is usedto provide the addresses for connecting clients.
2. Click **Apply** to save changes.

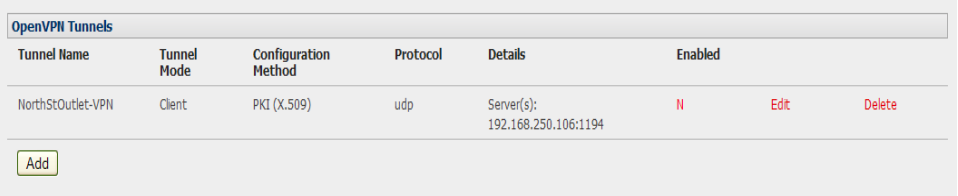


3. To enter authentication certificates and files, select the **Manage OpenVPN Files** tab.
4. Upload or browse to relevant authentication certificates and files.

5. **Apply** to save changes.
   Saved files are displayed in red on the right-hand side of the Uploadbutton.



6. To enable OpenVPN**, Edit** the OpenVPN tunnel.

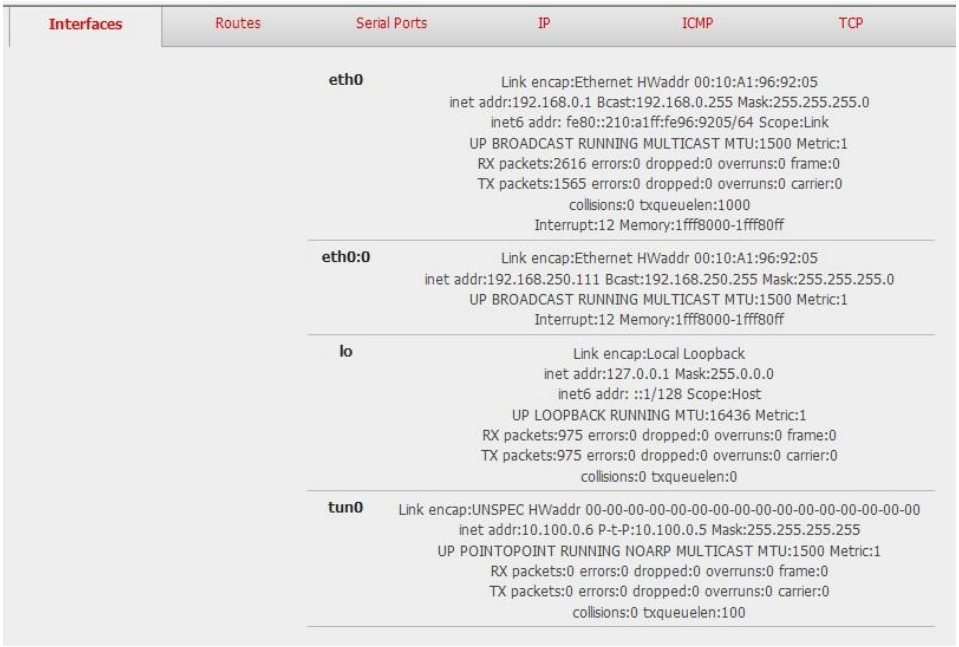


7. Check the **Enabled** button.

8. **Apply** to save changes.

> **NOTE:** Make sure that the console server system time is correct when working with OpenVPN to avoidauthentication issues.

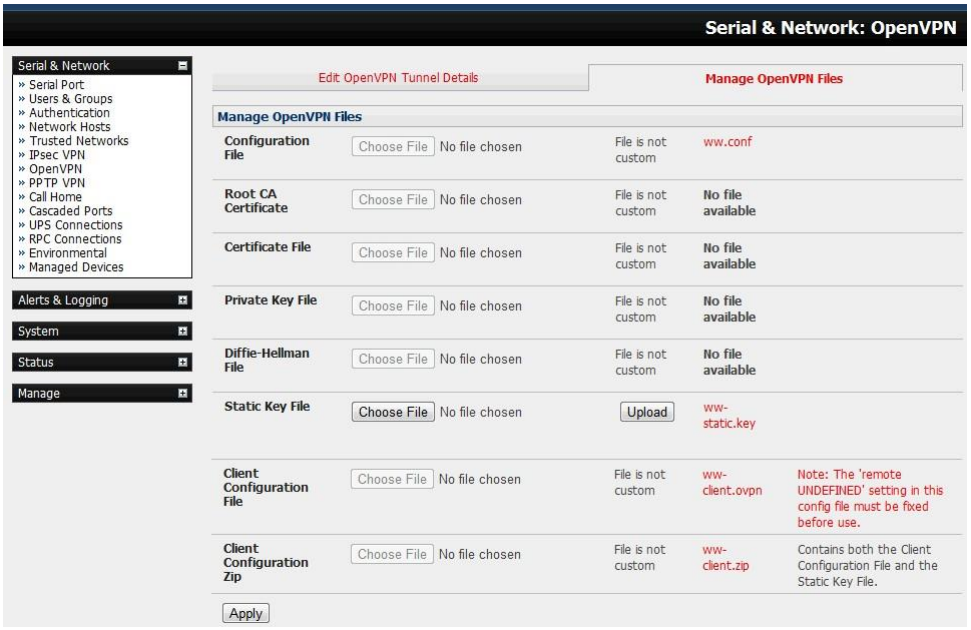
9. Select **Statistics** on the **Status** menu to verify that the tunnel is operational.



3.10.3 Windows OpenVPN Client and Server set up

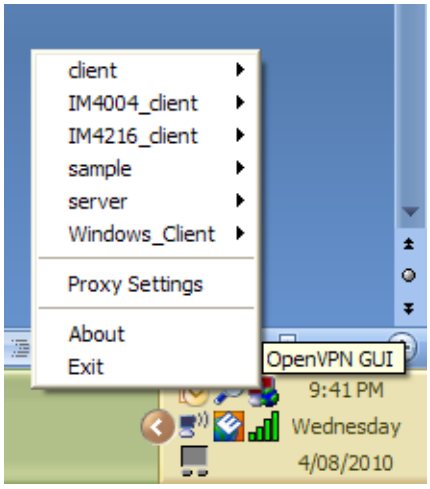
This section outlines the installation and configuration of a Windows OpenVPN client or a WindowsOpenVPN server and setting up a VPN connection to a console server.

Console servers 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 aWindows GUI) can be downloaded from http://openvpn.net.

When installed on the Windows machine, an OpenVPN icon is added to the Notification Area located in theright side of the taskbar. Right click on this icon to start and stop VPN connections, edit configurations, and view logs.



When the OpenVPN software begins running, the C:\Program Files\OpenVPN\config folder is scanned for **.opvn** files. This folder is rechecked for new configuration files whenever the OpenVPN GUI icon is right-clicked. Once OpenVPN is installed, create a configuration file:

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 of an OpenVPN Windows client configuration file is shown below:# description: IM4216_client

```
client
proto udpverb 3 dev tun
remote 192.168.250.152
port 1194
ca c:\\openvpnkeys\\ca.crt
cert c:\\openvpnkeys\\client.crt
key c:\\openvpnkeys\\client.keynobind
persist-keypersist-tuncomp-lzo
```

An example of an OpenVPN Windows Server configuration file is shown below:

```
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:

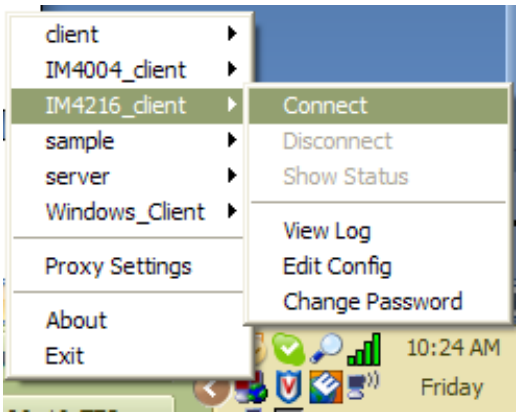
Options	Description
#description:	This is a comment describing the configuration. Comment lines start with'#' and are ignored by OpenVPN.
Client server	Specify whether this will be a client or server configuration file. In the server configuration file, define the IP address pool and netmask. For

Options	Description
	example, server 10.100.10.0 255.255.255.0
proto udp proto tcp	Set the protocol to UDP or TCP. The client and server must use the same settings.
mssfix <max. size>	Mssfix sets the maximum size of the packet. This is only useful for UDP if problems occur.
verb <level>	Set log file verbosity level. Log verbosity level can be set from 0 (minimum) to 15 (maximum). For example, 0 = silent except for fatal errors 3 = medium output, good for general usage 5 = helps with debugging connection problems 9 = verbose, excellent for troubleshooting
dev tun dev tap	Select ‘dev tun’ to create a routed IP tunnel or ‘dev tap’ to create an Ethernet tunnel. The client and server must use the same settings.
remote <host>	The hostname/IP of OpenVPN server when operating as a client. Enter either the DNS hostname or the static IP address of the server.
Port	The UDP/TCP port of the server.
Keepalive	Keepalive uses ping to keep the OpenVPN session alive. 'Keepalive 10 120' pings every 10 seconds and assumes the remote peer is down if noping has been received over a 120 second time period.
http-proxy <proxy server> <proxy port #>	If a proxy is required to access the server, enter the proxy server DNS name or IP and port number.
ca <file name>	Enter the CA certificate file name and location. The same CA certificate file can be used by the server and all clients. Note: Ensure each ‘\’ in the directory path is replaced with ‘ \\’. For example, c:\openvpnkeys\ca.crt will become 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. Note: Ensure each ‘\’ in the directory path is replaced with ‘ \\’.
key <file name>	Enter the file name and location of the client’s or server’s key. Each client should have its own certificate and key files. Note: Ensure each ‘\’ in the directory path is replaced with ‘ \\’.
dh <file name>	This is used by the server only. Enter the path to the key with the Diffie-Hellman parameters.
Nobind	‘Nobind’ is 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	This option prevents the reloading of keys across restarts.
persist-tun	This option prevents the close and reopen of TUN/TAP devices across restarts.

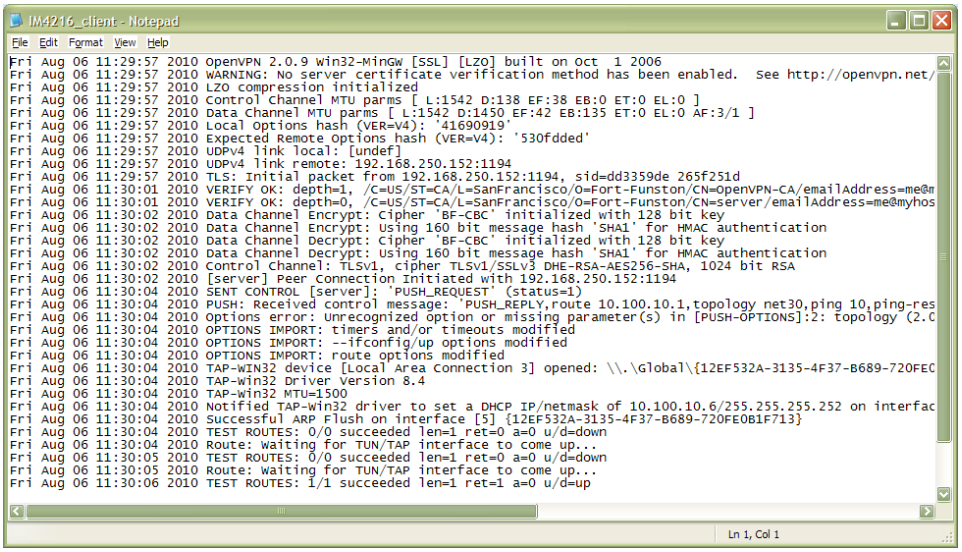
Options	Description
cipher BF-CBC Blowfish (default) cipher AES-128-CBC AES cipher DES-EDE3-CBC Triple-DES	Select a cryptographic cipher. The client and server must use the same settings.
comp-lzo	Enable compression on the OpenVPN link. This must be enabled on both the client and the server.
syslog	By default, logs are located in syslog or, if running as a service on Window, in \Program Files\OpenVPN\log directory.

To initiate the OpenVPN tunnel following the creation of the client/server configuration files:

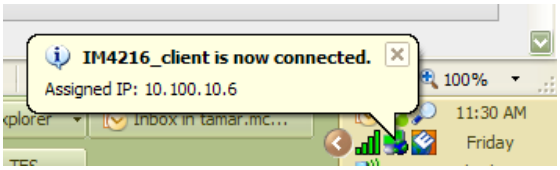
1. Right-click on the OpenVPN icon in the **Notification Area**.
2. Select the newly created client or server configuration.
3. Click **Connect.**



The log file is displayed as the connection is established.



When established, the OpenVPN icon displays a message indicating a successful connection andassigned IP. This information, as well as the time the connection was established, is available byscrolling over the OpenVPN icon.



3.11 PPTP VPN

Console servers include a PPTP (Point-to-Point Tunneling Protocol) server. PPTP is used for communications over a physical or virtual serial link. The PPP endpoints define a virtual IP address to themselves. Routes to networks can be defined with these IP addresses as the gateway, which results intraffic 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 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. Telecommuters canalso 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 localnetwork:

1. Enable and configure the PPTP VPN server on your Opengear appliance.

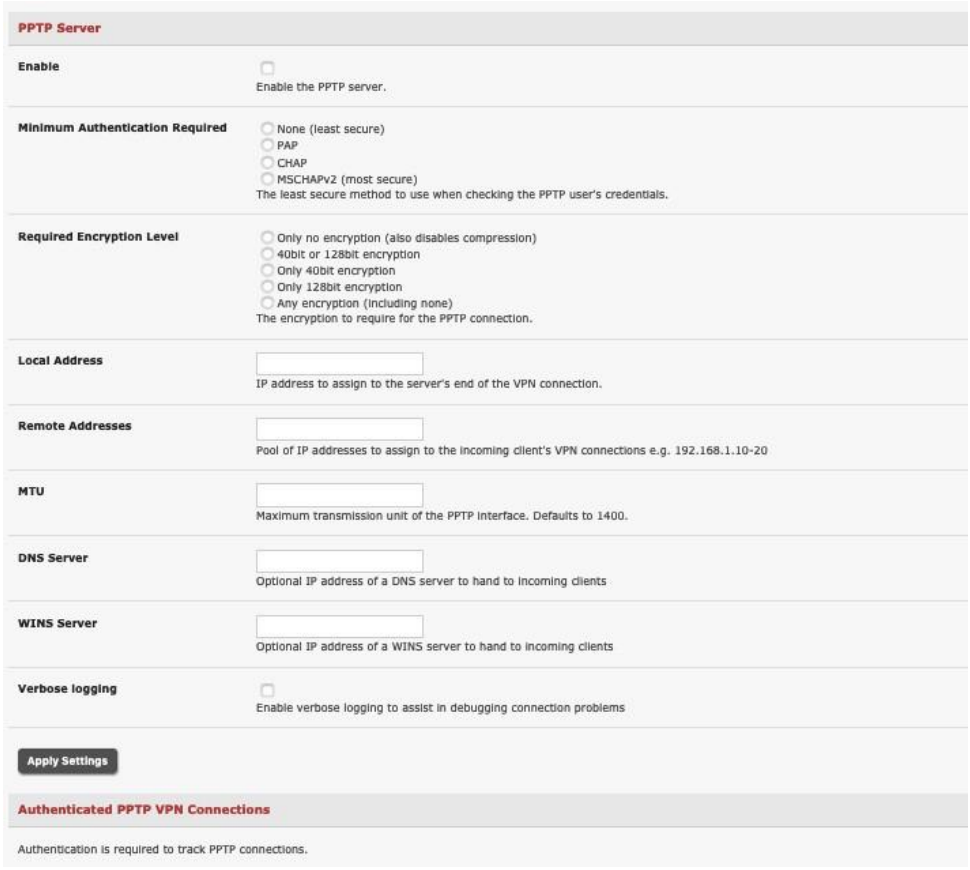
2. Set up VPN user accounts on the Opengear appliance and enable the appropriate authentication.

3. Configure the VPN clients at the remote sites. The client does not require special software asthe PPTP Server supports the standard PPTP client software included with Windows NT and later.

4. Connect to the remote VPN.

3.11.1 Enable the PPTP VPN server

1. Select **PPTP VPN** on the **Serial & Networks** menu.



2. Select the **Enable** check box to enable the PPTP Server.

3. Select the **Minimum Authentication Required**.
   Access is denied to remote users attempting toconnect using an authentication scheme weaker than the selected scheme. The schemes are described below, from strongest to weakest.

   - **Encrypted Authentication (MS-CHAP v2):** The strongest type of authentication to use; this isthe recommended option
   - **Weakly Encrypted Authentication (CHAP):** This is the weakest type of encrypted passwordauthentication 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 toencrypt traffic
   - **Unencrypted Authentication (PAP):** This is plain text password authentication. When usingthis type of authentication, the client password is transmitted unencrypted.
   - **None**

4. Select the **Required Encryption Level**.
   Access is denied to remote users attempting to connectthat are not using this encryption level.

5. In **Local Address** enter IP address to assign to the server's end of the VPN connection.

6. In **Remote Addresses** enter the pool of IP addresses to assign to the incoming client's VPN connections (e.g. 192.168.1.10-20). This must be a free IP address or range of addresses fromthe network that remote users are assigned while connected to the Opengear appliance.

7. Enter the desired value of the Maximum Transmission Unit (MTU) for the PPTP interfaces into the **MTU** field (defaults to 1400).

8. In the **DNS Server** field, enter the IP address of the DNS server that assigns IP addresses toconnecting PPTP clients.

9. In the **WINS Server** field, enter the IP address of the WINS server that assigns IP addresses toconnecting PPTP client.

10. Enable **Verbose Logging** to assist in debugging connection problems.

11. Click **Apply Settings**.

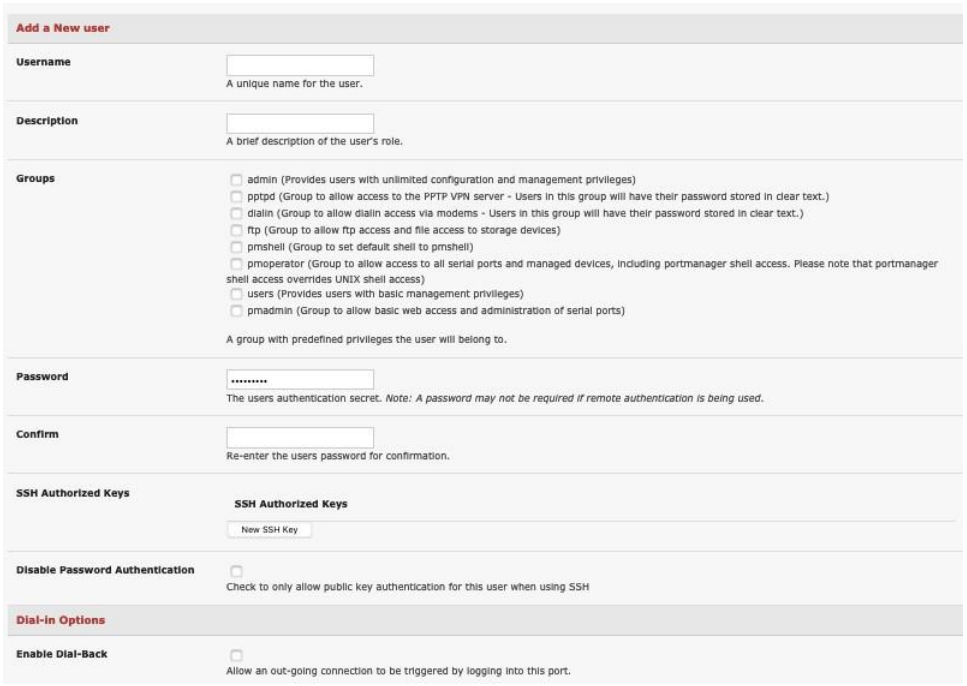
3.11.2 Add a PPTP user

1. Select **Users & Groups** on the **Serial & Networks** menu and complete the fields as covered insection 3.2.

2. Ensure the **pptpd** group has been checked, to allow access to the PPTP VPN server. Note - usersin this group have their passwords stored in clear text.

3. Keep note of the username and password for when you need to connect to the VPN connection

4. Click **Apply**.



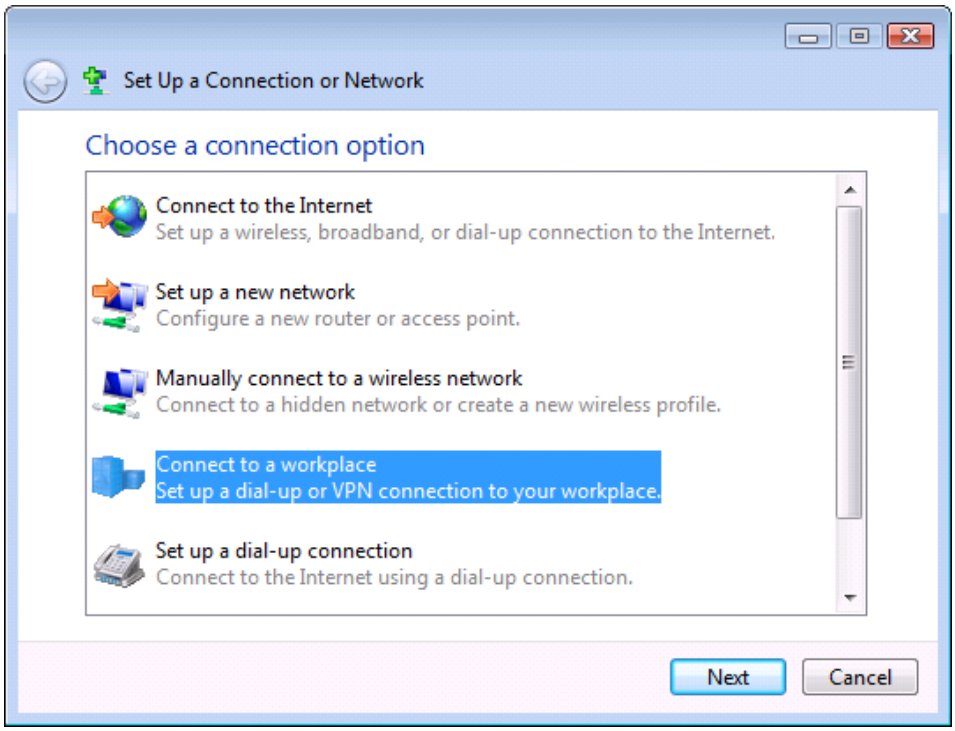
3.11.3 Set up a remote PPTP client

Ensure the remote VPN client PC has Internet connectivity. To create a VPN connection across theInternet, you must set up two networking connections. One connection is for the ISP, and the otherconnection is for the VPN tunnel to the Opengear appliance.

NOTE: This procedure sets up a PPTP client in the Windows Professional operating system. The stepsmay vary slightly depending on your network access or if you are using an alternate version of Windows. More detailed instructions are available from the Microsoft web site.

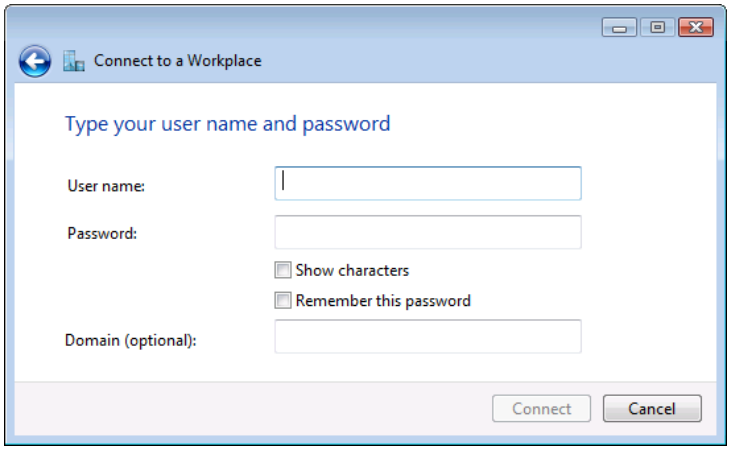
1. Login to your Windows client with administrator privileges.

2. From the **Network & Sharing Center** on the **Control Panel** select **Network Connections** and createa new connection.



3. Select **Use My Internet Connection (VPN)** and enter the IP Address of the Opengear appliance.

To connect remote VPN clients to the local network, you need to know the username and password for the PPTP account you added, as well as the Internet IP address of the Opengear appliance. If your ISP hasnot 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

All console servers include the Call Home feature which initiates the setup of a secure SSH tunnel from the console server to a centralized Opengear Lighthouse. The console server registers as a **candidate** on the Lighthouse. Once accepted there it becomes a **Managed Console Server**.

Lighthouse monitors the Managed Console Server and administrators can access the remote Managed Console Server through the Lighthouse. This access is available even when the remote console server is behinda third-party firewall or has a private non-routable IP address.

NOTE: Lighthouse maintains public key authenticated SSH connections to each of its Managed Console Servers. These connections are used for monitoring, directing 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 Lighthouse, the SSH connections are initiated by Lighthouse.

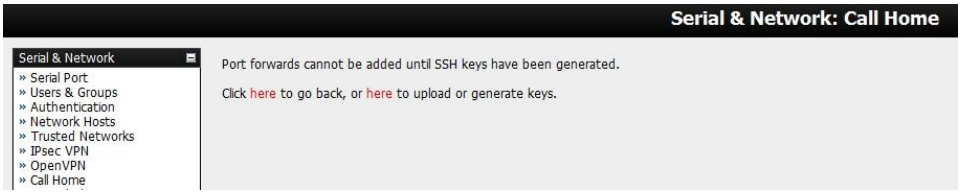
To manage Remote Console Servers, or console servers that are firewalled, not routable, or otherwise unreachable from the Lighthouse, the SSH connections are initiated by the Managed Console Server via an initial Call Home connection.

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 Set up Call Home candidate

To set up the console server as a Call Home management candidate on the Lighthouse:

1. Select **Call Home** on the **Serial & Network** menu.



2. If you have not already generated or uploaded an SSH key pair for this console server, doso before you proceed.

3. Click **Add.**

4. Enter the IP address or DNS name (e.g. the dynamic DNS address) of the Lighthouse.

5. Enter the Password that you configured on the CMS as the **Call Home Password.**

6. Click **Apply**.

These steps initiate the Call Home connection from the console server to the Lighthouse. This creates an SSHlistening port on the Lighthouse and sets the console server up as a candidate.

When the candidate has been accepted on the Lighthouse an SSH tunnel to the console server is redirected backacross the Call Home connection. The console server has become a Managed Console Server and the Lighthouse can connect to and monitor it through this tunnel.

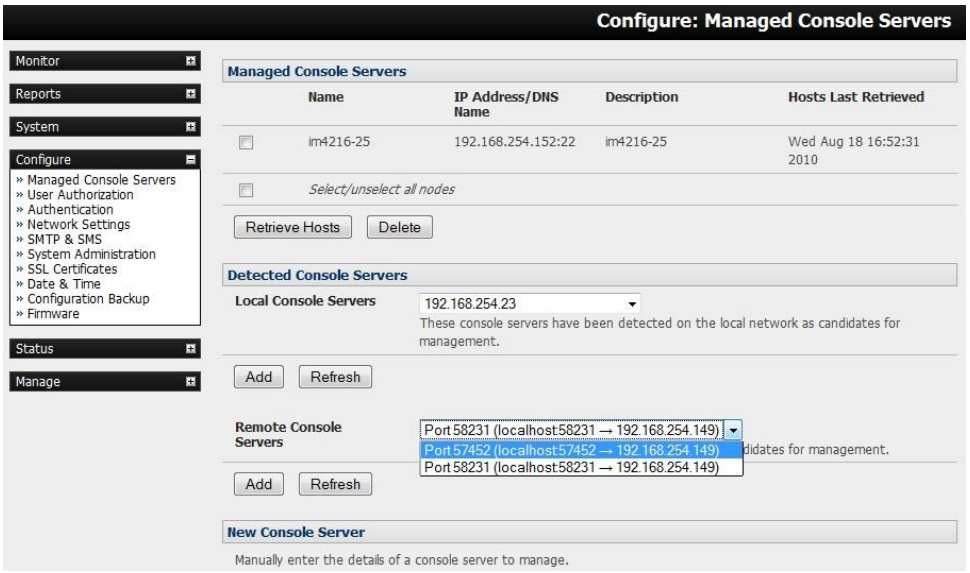
3.12.2 Accept Call Home candidate as Managed Console Server on Lighthouse

This section gives an overview on configuring the Lighthouse to monitor console Lighthouse servers that are connected via Call Home. For more details see the Lighthouse User Guide:

1. Enter a new **Call Home Password** on the Lighthouse.
   This password is used for accepting Call Homeconnections from candidate console servers

2. The Lighthouse can be contacted by the console server it must either have a static IP address or, ifusing DHCP, be configured to use a dynamic DNS service

   The **Configure > Managed Console Servers** screen on the Lighthouse shows the status of local andremote Managed Console Servers and candidates.

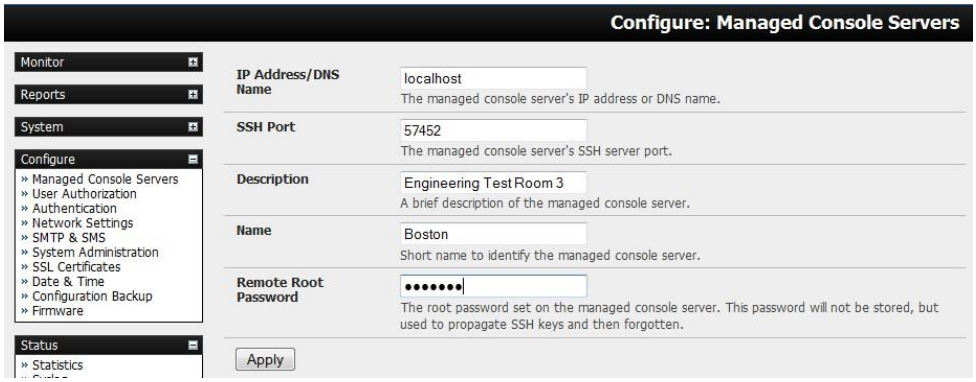


   The **Managed Console Servers** section shows the console servers being monitored by the Lighthouse.The **Detected Console Servers** section contains:

- The **Local Console Servers** drop-down which lists all the console servers which are on thesame subnet as the Lighthouse, and are not being monitored

- The **Remote Console Servers** drop-down which lists all the console servers that have established a Call Home connection and are not being monitored (i.e. candidates). Youcan click **Refresh** to update

To add a console server candidate to the **Managed Console Server** list, select it from the **Remote Console Servers** drop-down list and click **Add.** Enter IP Address and SSH Port (if these fields have notbeen auto-completed) and enter a **Description** and unique **Name** for the Managed Console server youare adding

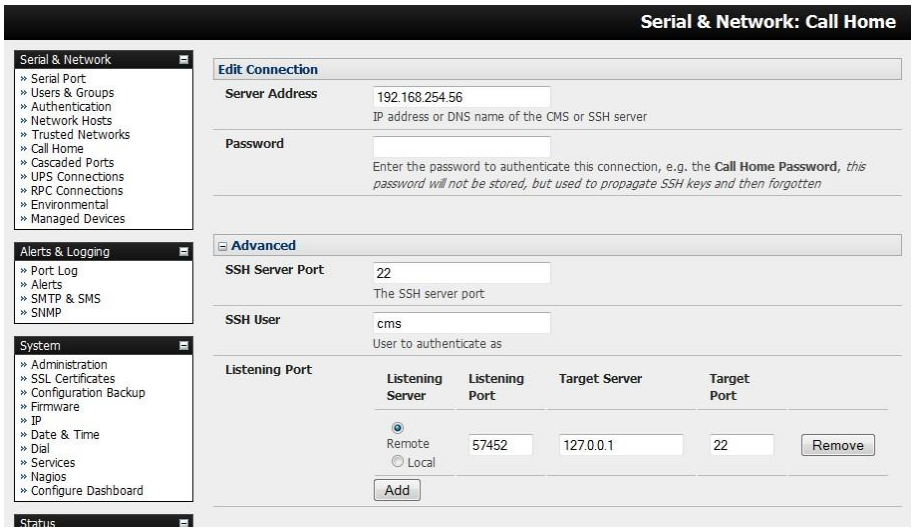


Enter the **Remote Root Password** (i.e. System Password that has been set on this Managed Console server). This password is used by the Lighthouse to propagate auto generated SSH keys and isnot stored. Click **Apply**. The Lighthouse sets up secure SSH connections to and from the Managed Console Server and retrieves 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 Lighthouse) you may configure Advancedsettings:

- Enter the SSH Server Port and SSH User.
- 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

3.13 IP Passthrough

IP Passthrough is used to make a modem connection (e.g. the internal cellular modem) appear like a regular Ethernet connection to a third-party downstream router, allowing the downstream router to use themodem connection as a primary or backup WAN interface.

The Opengear device provides the modem IP address and DNS details to the downstream device overDHCP and passes network traffic to and from the modem and router.

While IP Passthrough turns an Opengear into a modem-to-Ethernet half bridge, some layer 4 services (HTTP/HTTPS/SSH) may be terminated at the Opengear (Service Intercepts). Also, services running onthe 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 bemanaged 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 ormore WAN interfaces.

> **NOTE:** Failover in IP Passthrough context is performed by the downstream router, and the built-in out-of-band failover logic on the Opengear is not available while in IP Passthrough mode.

Connect an Ethernet WAN interface on the downstream router to the Opengear's Network Interface orManagement 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 portconnected to the Opengear.

3.13.2 IP Passthrough Pre-Configuration

Prerequisite steps to enable IP Passthrough are:

1. Configure the Network Interface and where applicable Management LAN interfaces with staticnetwork 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 section entitled NetworkConfiguration for detailed instructions).
    - For the interface connected to the downstream router, you may choose any dedicated privatenetwork – this network only exists between the Opengear and downstream router and is not normally accessible.

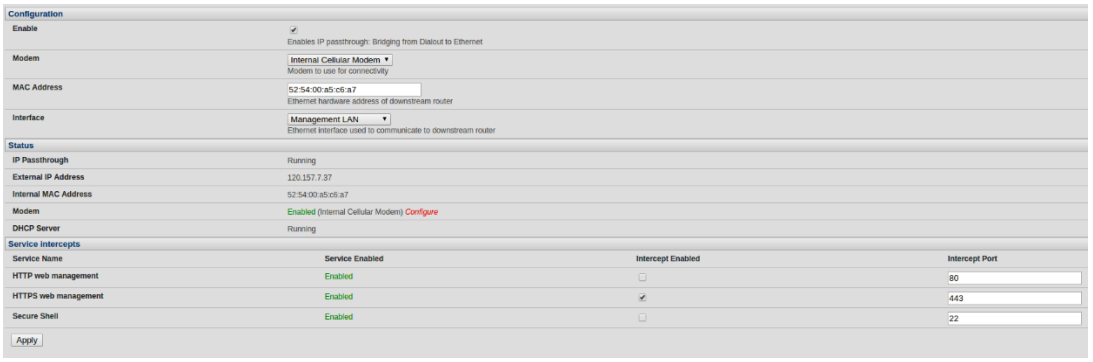
- For the other interface, configure it as you would per normal on the local network.
- For both interfaces, leave **Gateway** blank.

2. Configure the 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 section Cellular ModemConnection for detailed instructions).

3.13.3 IP Passthrough Configuration

To configure IP Passthrough:

1. Click **Serial & Network > IP Passthrough** and check **Enable**.
2. Select the Opengear **Modem** to use for upstream connectivity.
3. Optionally, enter the **MAC Address** of downstream router's connected interface. If MAC address isnot specified, the Opengear will passthrough to the first downstream device requesting a DHCP address.
4. Select the Opengear Ethernet **Interface** to use for connectivity to the downstream router.



5. Click **Apply**.

3.13.4 Service Intercepts

These allow the Opengear to continue to provide services, for example, for out-of-band management whenin IP Passthrough mode. Connections to the modem address on the specified intercept port(s) are handled by the Opengear rather than 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 (e.g. 8443 for HTTPS), this is useful if youwant to continue to allow 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 passedthrough, 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.

You may be alerted to the failover status of the downstream router by configuring a **Routed Data UsageCheck** under **Alerts & Logging > Auto-Response**.

3.13.6 Caveats

Some downstream routers may be incompatible with the gateway route. This can happen when IP Passthrough is bridging a 3G cellular network where the gateway address is a point-to-point destinationaddress and no subnet information is available. The Opengear sends a DHCP netmask of 255.255.255.255. Devices normally construe this as a single host route on the interface, but some olderdownstream devices may have issues.

Intercepts for local services will not work if the Opengear is using a default route other than the modem.Also, they will not work unless the service is enabled and access to the service is enabled (see **System >Services**, under the **Service Access** tab find **Dialout/Cellular**).

Outbound connections originating from Opengear to remote services are supported (e.g. sending SMTPemail alerts, SNMP traps, getting NTP time, IPSec tunnels). There is a small risk of connection failure should both the Opengear and the downstream device try to access the same UDP or TCP port on the same remote host at the same time when they have randomly chosen the same originating local port number.

3.14 Configuration over DHCP (ZTP)

Opengear devices can be provisioned during their initial boot from a DHCPv4 or DHCPv6 server using config-over-DHCP. Provisioning on untrusted networks can be facilitated by providing keys on a USB flashdrive.

The ZTP functionality can also be used to perform a firmware upgrade on initial connection to thenetwork, or to enroll into a Lighthouse 5 instance.

Preparation

The typical steps for configuration over a trusted network are:

1. Configure a same-model Opengear device.
2. Save its configuration as an Opengear backup (.opg) file.
3. Select **System > Configuration Backup > Remote Backup**.
4. Click **Save Backup**.

A backup configuration file — *model-name_iso-format-date*_config.opg — is downloaded from theOpengear device to the local system.

You can save the configuration as an xml file:

1. Select **System > Configuration Backup > XML Configuration**.
   An editable field containing theconfiguration file in XML format appears.
2. Click into the field to make it active.
3. If you are running any browser on Windows or Linux, right-click and choose **Select All** from thecontextual menu or press Control-A. Right-click and choose **Copy** from the contextual menu or press Control-C.

4. If you are using any browser on macOS, choose **Edit > Select All** or press Command-A. Choose **Edit > Copy** or press Command-C.

5. In your preferred text-editor, create a new empty document, paste the copied data into the empty document and save the file.
   Whatever filename you choose, it must include the .xmlfilename suffix.

6. Copy the saved .opg or .xml file to a public-facing directory on a file server serving at least oneof the following protocols: HTTPS, HTTP, FTP or TFTP. (Only HTTPS can be used if the connection between the file server and a to-be-configured Opengear device travels over an untrusted network.).

7. 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 stringmust not exceed 250 characters and it must end in either .opg or .xml.

8. Connect a new Opengear device, either factory-reset or Config-Erased, to the network andapply power. It may take up to 5 minutes for the device to reboot itself.

Example ISC DHCP (dhcpd) server configuration

The following is an example DHCP server configuration fragment for serving an .opg configuration imagevia 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";
}
```

This setup can be modified to upgrade the configuration image using the opengear.image-url option, andproviding a URI to the firmware image.

Setup when the LAN is untrusted

If the connection between the file server and a to-be-configured Opengear device includes an untrustednetwork, 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 itsdeployment. 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 canprovide 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 USBflash 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 fileserver' above using the HTTPS protocol between the client and server.

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 besigned.
  # 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

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

- Generate the server certificate.
  # openssl genrsa -out server.key 4096
  # openssl req -new -key server.key -out server.csr -subj /CN=demo.example.com # openssl ca -days 365 -in server.csr -out server.crt \
  -keyfile ca.key -policy policy_anything -batch -notext

  > **NOTE:** The hostname or IP address must be the same string used in the serving URL. In the exampleabove, the hostname is demo.example.com.

- 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.

Debugging ZTP issues

Use the ZTP log feature to debug ZTP issues. While the device is attempting to perform ZTP operations,log information is written to /tmp/ztp.log on the device.

The following is an example of the log file from a successful ZTP run.

```
# cat /tmp/ztp.log
Wed Dec 13 22:22:17 UTC 2017 [5127 notice] odhcp6c.eth0:
restoring config viaDHCP
Wed Dec 13 22:22:17 UTC 2017 [5127 notice] odhcp6c.eth0:
waiting 10s for networkto settle
Wed Dec 13 22:22:27 UTC 2017 [5127 notice] odhcp6c.eth0: NTP
skipped: no server
Wed Dec 13 22:22:27 UTC 2017 [5127 info] odhcp6c.eth0:
vendorspec.1 =
'http://[fd07:2218:1350:44::1]/tftpboot/config.sh'
Wed Dec 13 22:22:27 UTC 2017 [5127 info] odhcp6c.eth0:
vendorspec.2 (n/a)
Wed Dec 13 22:22:27 UTC 2017 [5127 info] odhcp6c.eth0:
vendorspec.3 (n/a)
Wed Dec 13 22:22:27 UTC 2017 [5127 info] odhcp6c.eth0:
vendorspec.4 (n/a)
Wed Dec 13 22:22:27 UTC 2017 [5127 info] odhcp6c.eth0:
vendorspec.5 (n/a)
Wed Dec 13 22:22:28 UTC 2017 [5127 info] odhcp6c.eth0:
vendorspec.6 (n/a)
```

```
Wed Dec 13 22:22:28 UTC 2017 [5127 info] odhcp6c.eth0: no
firmware to download(vendorspec.2)
backup-url: trying
http://[fd07:2218:1350:44::1]/tftpboot/config.sh ...backup-
url: forcing wan config mode to DHCP
backup-url: setting hostname to acm7004-0013c601ce97backup-
url: load succeeded
Wed Dec 13 22:22:36 UTC 2017 [5127 notice] odhcp6c.eth0:
successful config load
Wed Dec 13 22:22:36 UTC 2017 [5127 info] odhcp6c.eth0: no
lighthouseconfiguration (vendorspec.3/4/5/6)
Wed Dec 13 22:22:36 UTC 2017 [5127 notice] odhcp6c.eth0:
provisioning completed,not rebooting
```

Errors are recorded in this log.

3.15 Enrollment into Lighthouse

Use Enrollment into Lighthouse to enroll Opengear devices into a Lighthouse instance, providingcentralized access to console ports, and allowing central configuration of the Opengear devices.

See the **Lighthouse User Guide** for instructions for enrolling Opengear devices into Lighthouse.

3.16 Enable DHCPv4 Relay

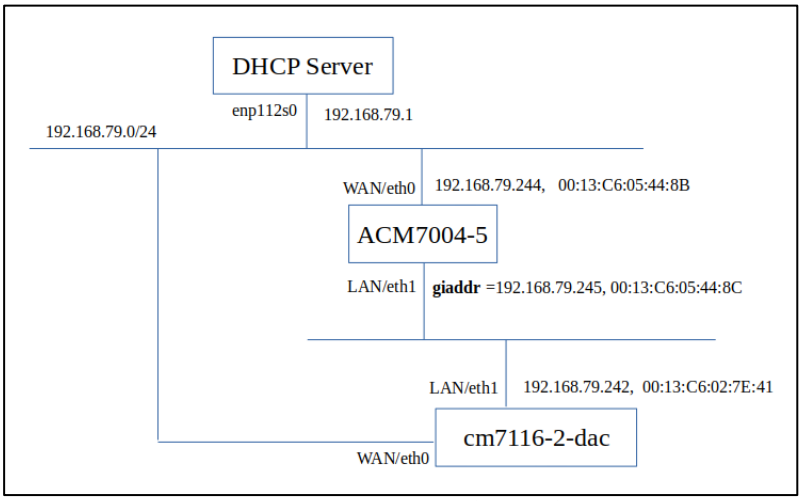
A **DHCP relay service** forwards the DHCP packets between clients and remote DHCP servers. DHCP relay service can be enabled on an Opengear console server, so that its listens for DHCP clients on designated **lower interfaces**, wraps and forwards their messages up to DHCP servers using either normal routing, or broadcast directly onto designated **upper interfaces**. The DHCP relay agent thus receives DHCP messages and generates a new DHCP message to send out on another interface.

In the steps below, the console servers can connect to circuit-ids, Ethernet or cell modems using DHCPv4 Relay service.

DHCPv4 Relay + DHCP Option 82 (circuit-id)

Infrastructure - Local DHCP server, ACM7004-5 for relay, any other devices for clients. Any device with LAN role can be used as a relay.

In this example, the 192.168.79.242 is the address for the client's relayed interface (as defined in the DHCP server configuration file above) and the 192.168.79.244 is the relay box's upper interface address, and enp112s0 is the downstream interface of the DHCP server.



1 Infrastructure - DHCPv4 Relay + DHCP Option 82 (circuit-id)

Steps on the DHCP Server

1. Setup local DHCP v4 server, in particular, it should contain a "host" entry as below for the DHCP client:

```
host cm7116-2-dac {
      # hardware ethernet 00:13:C6:02:7E:41;
      host-identifier option agent.circuit-id "relay1";
      fixed-address 192.168.79.242;
      }
```

> **NOTE:** The "hardware ethernet" line is commented off, so that the DHCP server will make use of the "circuit-id" setting to assign an address for relevant client.

2. **Re**-start DHCP Server to reload its changed configuration file.

```
pkill -HUP dhcpd
```

3. Manually add a host route to the client "relayed" interface (the interface behind the DHCP relay, not other interfaces the client may also have:

```
sudo ip route add 192.168.79.242/32 via 192.168.79.244 dev
enp112s0
```

This will help avoid the asymmetric routing issue when the client and DHCP server would like to access each other via the client's relayed interface, when the client has other interfaces in the same subnet of the DHCP address pool.

> **NOTE:** This step is a must-have to support the dhcp server and client able to access each other.

Steps on the Relay box - ACM7004-5

1. Setup WAN/eth0 in either static or dhcp mode (not unconfigured mode). If in static mode, it must have an IP address within the address pool of the DHCP server.

2. Apply this config through CLI (where 192.168.79.1 is DHCP server address).

```
config -s config.services.dhcprelay.enabled=on
config -s
config.services.dhcprelay.lowers.lower1.circuit_id=relay1
```

```
config -s config.services.dhcprelay.lowers.lower1.role=lan
config -s config.services.dhcprelay.lowers.total=1
config -s
config.services.dhcprelay.servers.server1=192.168.79.1
config -s config.services.dhcprelay.servers.total=1
config -s config.services.dhcprelay.uppers.upper1.role=wan
config -s config.services.dhcprelay.uppers.total=1
```

3. The lower interface of the DHCP relay must have a static IP address within the address pool of the DHCP server. In this example, giaddr = 192.168.79.245.

```
config -s config.interfaces.lan.address=192.168.79.245
config -s config.interfaces.lan.mode=static
config -s config.interfaces.lan.netmask=255.255.255.0
config -d config.interfaces.lan.disabled -r ipconfig
```

4. Wait a short while for the client to acquire a DHCP lease via the relay.

Steps on the Client (CM7116-2-dac in this example or any other OG CS)

1. Plug in the client's LAN/eth1 to the relay's LAN/eth1.

2. Configure the client's LAN to get IP address via DHCP as per usual.

3. When the client gets DHCP address on its LAN, ping the relay's giaddr via client's LAN interface:

```
ping -I eth1 192.168.79.245
```

> **NOTE:** Without the 3rd step setup on the DHCP server, this won't be possible.

Steps on the Relay box - ACM7004-5

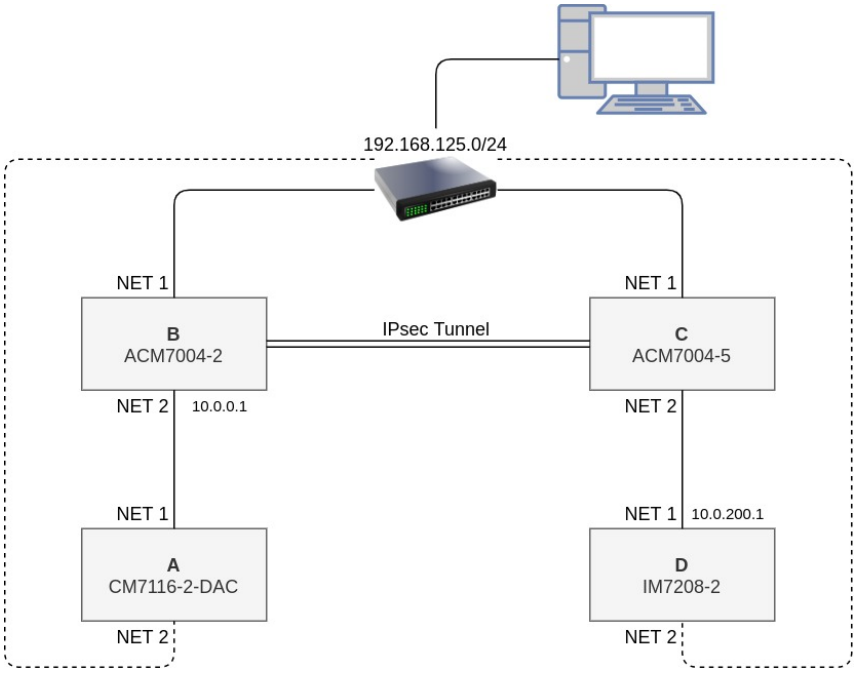
1. Ping the client (CM7116-2-dac).

```
ping -I eth1 192.168.79.242
```

DHCPv4 Relay + IPsec (Ethernet)

Infrastructure - Local DHCP server, ACM7004-5 for relay, any other for clients. We need 4 console servers in total.

Any device with LAN role can be used as relay.



NOTE: The connections representing the dashed lines are not essential but allow the console server to be configured via the web UI, but they may introduce asymmetric routing on D and thus a subnet route to A is needed for reply DHCP traffic back to A.

Additionally, local serial connections exist between each CS and the PC.

The 192.168.125.0/24 is a sample subnet. Substitute your subnet in here for any reference to this in the steps below.

Steps to Enable DHCP Server on D

Note: To enable NET2 in DHCP mode via the CLI, after a config erase run:

```
config -d config.interfaces.lan.disabled

config -s config.interfaces.lan.mode=dhcp

config -r ipconfig
```

1. On D's NET1 interface go to IP → Network Interface and fill in:
   Configuration method: static
   IP Address: 10.0.200.1
   Subnet Mask: 255.255.255.0

2. Click **Apply.**

3. On the DHCP Server page:
   DHCP Server: Select
   Use interface address as gateway: Select

4. Click **Apply.**

5. Fill in the pool
   DHCP Pool start address: 10.0.200.100
   DHCP Pool end address: 10.0.200.200

6. Edit the /etc/config/dhcpd.conf file to look like this:

```
subnet 10.0.200.0 netmask 255.255.255.0 {       # This is the subnet between C
Net2 and D Net1

    range 10.0.200.100 10.0.200.200;

    option subnet-mask 255.255.255.0;

    option broadcast-address 10.0.200.255;

}

subnet 10.0.0.0 netmask 255.255.255.0 {         # This is the subnet between B
net2 and A Net1

    range 10.0.0.100 10.0.0.200;

    option subnet-mask 255.255.255.0;

    option broadcast-address 10.0.0.255;

    option routers 10.0.0.1;

}

host relay2-upper {

    hardware ethernet  00:13:C6:04:68:84;       # Replace with the MAC address
of C NET2 (eth1)

    fixed-address 10.0.200.100;

}

host cm7116 {

    hardware ethernet  00:13:C6:05:BB:A1;       # Replace with the MAC address
of A NET1 (eth0)

    #host-identifier option agent.circuit-id "relay1";

    fixed-address 10.0.0.3;

}
```

NOTE: The DHCP server on D Net1 caters for two address pools / subnets: 10.0.200.0/24 for the subnet behind the right side of the IPsec tunnel, whereas 10.0.0.0/24 for the subnet behind the left side of the IPsec tunnel.

7. Restart the DHCP server with 'pkill -HUP dhcpd'. This causes it to reload /etc/config/dhcpd.conf

Steps to Create IPsec tunnel between B and C

Select **Serial & Networks > IPsec VPN** menu to add a new tunnel and enter the following pair of settings:

On B (left side of IPsec tunnel):
Tunnel Name = acm_to_acm5
Initiate Tunnel = true
Authentication Method = RSA digital signatures (or use shared password, which is simpler)
Left and right pub keys = generate this then copy the lefts to the rights between devices
Authentication Protocol = ESP
Aggressive mode = false
IKE Proposal (Phase 1) = aes128-sha-modp768
Perfect forward secrecy = false
Left ID = 192.168.125.102 (could be the same as Left Address)
Right ID = 192.168.125.104 (could be the same as Right Address)
Left Address = 192.168.125.102 (the upstream / NET1 address of the left side)
Right Address = 192.168.125.104 (the upstream / NET1 address of the right side)
Left Subnet = 10.0.0.0/24 (the subnet behind this side)
Right Subnet = 10.0.200.100/24 (the subnet behind the peer side)
Add a custom tunnel option with:
Option Name = leftsourceip
Argument = 10.0.0.1 (the static address on B Net2, see below)

On C (right side of IPsec tunnel):
Tunnel Name = acm5_to_acm
Initiate Tunnel = false
Authentication Method = RSA digital signatures (or use shared password, which is simpler)
Left and right pub keys = generate this then copy the lefts to the rights between devices
Authentication Protocol = ESP
Aggressive mode = false
IKE Proposal (Phase 1) = aes128-sha-modp768
Perfect forward secrecy = false
Left ID = 192.168.125.104
Right ID = 192.168.125.102
Left Address = 192.168.125.104
Right Address = 192.168.125.102
Left Subnet = 10.0.200.100/24
Right Subnet = 10.0.0.0/24,10.0.0.1/32 (note that there are 2 subnets here)
Add a custom tunnel option with:
Option Name = leftsourceip
Argument = 10.0.200.100

Steps to start DHCP Relay on B and C

1. On B, go to **System > IP > Management LAN Interface** and set the following:

   Disable = false

   Configuration Method = Static

   IP Address = 10.0.0.1

Subnet Mask = 255.255.255.0

2. Then on B's command line configure the DHCP relay by running:

```
config -s config.services.dhcprelay.enabled=on
config -s config.services.dhcprelay.lowers.lower1.circuit_id=relay1
config -s config.services.dhcprelay.lowers.lower1.role=lan
config -s config.services.dhcprelay.lowers.total=1
config -s config.services.dhcprelay.servers.server1=10.0.200.1
config -s config.services.dhcprelay.servers.total=1
config -s config.services.dhcprelay.uppers.total=1
config -s
config.services.dhcprelay.uppers.upper1.interface=ipsec0            <<< B is
using IPsec as upper interface
config -s config.services.dhcprelay.uppers.upper1.role=vpn
config -r ipconfig
```

3. If it started successfully, the logs will appear like this:

```
<30>Apr 24 00:49:23 dhcrelay: Internet Systems Consortium DHCP Relay
Agent 4.1-ESV-R15-P1
<30>Apr 24 00:49:23 dhcrelay: Copyright 2004-2018 Internet Systems Consortium.
<30>Apr 24 00:49:23 dhcrelay: All rights reserved.
<30>Apr 24 00:49:23 dhcrelay: For info, please visit
https://www.isc.org/software/dhcp/
<30>Apr 24 00:49:23 dhcrelay: Listening on LPF/eth1/00:13:c6:01:d0:06
<30>Apr 24 00:49:23 dhcrelay: Sending on   LPF/eth1/00:13:c6:01:d0:06
<30>Apr 24 00:49:23 dhcrelay: Listening on LPF/ipsec0/00:13:c6:01:d0:05
<30>Apr 24 00:49:23 dhcrelay: Sending on   LPF/ipsec0/00:13:c6:01:d0:05
<30>Apr 24 00:49:23 dhcrelay: Sending on   Socket/fallback
<14>Apr 24 00:49:52 conman[6023]: INFO     conman - dhcp-relay test run
succeeded
<14>Apr 24 00:49:52 conman[6023]: INFO     conman - dhcp-relay is now running
successfully
```

4. On C's command line run the following to first enable NET2 (Lan) then the dhcprelay:

```
config -d config.interfaces.lan.disabled
config -s config.interfaces.lan.mode=dhcp
config -s config.services.dhcprelay.enabled=on
config -s config.services.dhcprelay.lowers.lower1.circuit_id=relay2
config -s
config.services.dhcprelay.lowers.lower1.interface=ipsec0            <<< C is
using IPsec as lower interface
config -s config.services.dhcprelay.lowers.lower1.role=vpn
config -s config.services.dhcprelay.lowers.total=1
config -s config.services.dhcprelay.option82.policy=append
config -s config.services.dhcprelay.servers.server1=10.0.200.1
config -s config.services.dhcprelay.servers.total=1
config -s config.services.dhcprelay.uppers.total=1
config -s config.services.dhcprelay.uppers.upper1.role=lan
config -r ipconfig
```

You should see similar logs for dhcrelay as occurred for B's setup.

Steps for Routing between B, C and D

Before attempting to acquire a DHCP lease on A from the DHCP server running on D, make sure that devices B, C and D can ping each others NET1 (eth0) and NET2 (eth1) interfaces.

For example, when B would ping D (eth0 10.0.200.1 address), the ICMP echo request would reach this device but the corresponding reply traffic would be routed out D's NET2 / eth1 instead of NET1 / eth0 (so it didn't reply to B's ping). This is because the DHCP lease obtained on D NET2 / eth1 contains a default route with default gateway to a downstream interface.

To fix this the following command can be run on D to add a subnet route back to B via NET1/eth0:

Note, the 10.0.200.100 is C NET2 address, or the "next hop" from D's perspective to reach back to B (via the IPsec tunnel)

```
# ip r add 10.0.0.0/24 via 10.0.200.100 dev eth0
```

Steps to Acquire a DHCP lease on A

First start tcpdump on D to watch for DHCP packets run:

Note: using "host 10.0.0.1" to filter out just traffic sent from/to the giaddr, or DHCP relay gateway address, that is, D NET2/eth1

```
tcpdump -i eth0 host 10.0.0.1
```

Now on A, either reboot the device or simply run

```
conman_command network-connection-wan-dhcp restart
```

to acquire the DHCP lease. You should see the following lines in D's tcpdump

```
# tcpdump -v -i eth0 host 10.0.0.1
tcpdump: listening on eth0, link-type EN10MB (Ethernet), capture size 96 bytes
19:10:02.313713 IP (tos 0x0, ttl  63, id 0, offset 0, flags [DF], proto: UDP
(17), length: 350) 10.0.0.1.bootps > 10.0.200.1.bootps: UDP, length 322
19:10:02.315524 IP (tos 0x0, ttl  64, id 0, offset 0, flags [DF], proto: UDP
(17), length: 328) 10.0.200.1.bootps > 10.0.0.1.bootps: UDP, length 300
19:10:02.316252 IP (tos 0x0, ttl  64, id 0, offset 0, flags [DF], proto: UDP
(17), length: 328) 10.0.200.1.bootps > 10.0.0.1.bootps: UDP, length 300
19:10:02.319529 IP (tos 0x0, ttl  63, id 0, offset 0, flags [DF], proto: UDP
(17), length: 362) 10.0.0.1.bootps > 10.0.200.1.bootps: UDP, length 334
19:10:02.323216 IP (tos 0x0, ttl  64, id 0, offset 0, flags [DF], proto: UDP
(17), length: 328) 10.0.200.1.bootps > 10.0.0.1.bootps: UDP, length 300
19:10:02.325003 IP (tos 0x0, ttl  64, id 0, offset 0, flags [DF], proto: UDP
(17), length: 328) 10.0.200.1.bootps > 10.0.0.1.bootps: UDP, length 300
```

Then A should have an IPv4 address.

DHCPv4 Relay + IPSec (Cellular Modem)

Infrastructure: Two devices with cell modems to setup IPSec tunnels, one of them is also used as DHCP relay. One more device used as DHCP client and another device or local PC used as DHCP server.

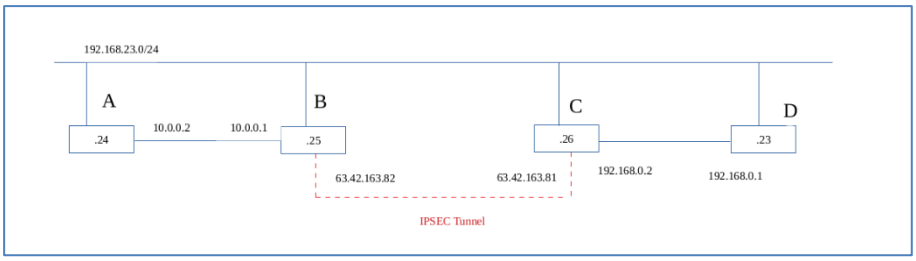
In this example, 4 devices are used to demonstrate the setup:

A. 192.168.23.24, DHCP client

B. 192.168.23.25, DHCP relay, IPsec terminal

C. 192.168.23.26, IPsec terminal, acting as a normal router

D. 192.168.23.23, DHCP server



NOTE: the LANs among A/B, and LANs among C/D are wired up together in this setup.

Steps to set up D.DHCP Server (192.168.23.23)

The LAN port is connected to the LAN port on 192.168.23.26

1. Enable LAN in static mode.
   - address = 192.168.0.1
   - subnet = 255.255.255.0
2. Enable DHCP server on LAN, manually edit /etc/config/dhcpd.conf to cater for **two** subnets of 192.168.0.0/24 (for DHCP server side) and 10.0.0.0/24 (for DHCP client side) respectively, and adding a host entry for the DHCP client to specify particular IP address based on the Circuit ID option in the DHCP Request packets:

```
# cat /etc/config/dhcpd.conf
#
# This file is auto-generated. Do Not Edit.
#
subnet 192.168.0.0 netmask 255.255.255.0 {
    range 192.168.0.3 192.168.0.10;
    option subnet-mask 255.255.255.0;
    option broadcast-address 192.168.0.255;
    option routers 192.168.0.1;
}

subnet 10.0.0.0 netmask 255.255.255.0 {
    range 10.0.0.2 10.0.0.10;
    option subnet-mask 255.255.255.0;
    option broadcast-address 10.0.0.255;
    option routers 10.0.0.1;
}

host acm7004-2-1 {
    hardware ethernet 00:13:C6:05:C0:2C;
    # host-identifier option agent.circuit-id "relay1";         <<< NOT
supported by dhcpd in OPENGEAR DEVICE
    fixed-address 10.0.0.10;
```

```
}
```

3. When the dhcpd.conf is edited, send -HUP signal to it to reload it:

   ```
   # pkill -HUP dhcpd
   ```

4. Add a route to the 10.0.0.0/24 subnet (which is behind the remote end of the IPsec tunnel) via the router that acts as this side of the IPsec tunnel:

   ```
   # ip route add 10.0.0.0/24 via 192.168.0.2 dev eth1
   ```

   from the DHCP server's perspective, the LAN on Device C, or 192.168.0.2, is the gateway to the 10.0.0.0/24 subnet.

Steps to set up C.Normal Router (192.168.23.23)

1. Plug LAN into LAN of 192.168.23.23.
2. Enable LAN in static mode:
   - address = 192.168.0.2
   - subnet = 255.255.255.0
3. Enable cell modem:
   - Select **Internal Cellular Modem** panel on the **System > Dial menu**.
   - Check **Enable Dial-Out Settings**.
   - Record the wwan0 address, for example, 63.42.163.81 (NOTE: the VzW SIM card used seems to get static/fixed IP address).
4. Setup IPsec over cell modem.

   The left ID and address could be the cell modem address of this side and the right ID and address could be the cell modem address of the remote side. For example:

   ```
   # config -g config.ipsec
   config.ipsec.tunnels.total 1
   config.ipsec.tunnels.tunnel1.auth esp
   config.ipsec.tunnels.tunnel1.authby secret
   config.ipsec.tunnels.tunnel1.ike aes128-sha-modp768
   config.ipsec.tunnels.tunnel1.left 63.42.163.81
   config.ipsec.tunnels.tunnel1.leftid 63.42.163.81
   config.ipsec.tunnels.tunnel1.leftsubnet 192.168.0.0/24
   config.ipsec.tunnels.tunnel1.name sand_26_to_25
   config.ipsec.tunnels.tunnel1.options.option1.arg %wwan0
   config.ipsec.tunnels.tunnel1.options.option1.opt left
   config.ipsec.tunnels.tunnel1.options.option2.arg 192.168.0.2
   config.ipsec.tunnels.tunnel1.options.option2.opt leftsourceip
   config.ipsec.tunnels.tunnel1.options.total 2
   config.ipsec.tunnels.tunnel1.right 63.42.163.82
   config.ipsec.tunnels.tunnel1.rightid 63.42.163.82
   config.ipsec.tunnels.tunnel1.rightsubnet 10.0.0.0/24
   config.ipsec.tunnels.tunnel1.secret dhcprelay
   ```

In particular, add two more options, to setup the ipsec tunnel successfully:

```
left=%wwan0
leftsourceip=192.168.0.2
```

5. Manually edit /etc/config/ipsec.conf in the following way:

```
# cat /etc/config/ipsec.conf
version 2.0

config setup
- interfaces=%defaultroute
+ interfaces="ipsec0=wwan0"
nat_traversal=yes

include /etc/config/ipsec.config.conf
       #
```

By default, interfaces=%defaultroute, that is, the IPSec tunnel will be established upon the default gateway interface (such as eth0). By changing it to "ipsec0=wwan0", the ipsec0 interface is enforced to be established upon the wwan0 interface

NOTE: This effectively implies that the IPSec tunnel should only be configured once the cell modem is UP (so that the bearer interface is determined).

6. Enable forwarding among eth1 and ipsec0

   - On the **Firewall** page > **Forwarding** tab, enable Forwarding between LAN and VPN and vice versa
   - On CLI, run the following commands to enable forwarding on eth1 and ipsec0:

```
# echo 1 > /proc/sys/net/ipv4/conf/eth1/forwarding
# echo 1 > /proc/sys/net/ipv4/conf/ipsec0/forwarding
```

Steps to set up B. DHCP relay (192.168.23.25)

The LAN port is connecting to the LAN port on 192.168.23.24

1. Enable LAN in static mode:
   - address = 10.0.0.1
   - subnet = 255.255.255.0
2. Enable Cellular Modem:
   - Don't need to specify anything on Web UI other than enable it
   - Record the wwan0 address, e.g., 63.42.163.82 (NOTE: the VzW SIM card used seems to get static/fixed IP address)
3. Setup IPsec:

   The left ID and address could be the cell modem address of this side and the right ID and address could be the Cellular Modem address of the remote side. e.g.

```
# config -g config.ipsec
config.ipsec.tunnels.total 1
config.ipsec.tunnels.tunnel1.auth esp
config.ipsec.tunnels.tunnel1.authby secret
config.ipsec.tunnels.tunnel1.ike aes128-sha-modp768
config.ipsec.tunnels.tunnel1.initiate on
```

```
config.ipsec.tunnels.tunnel1.left 63.42.163.82
config.ipsec.tunnels.tunnel1.leftid 63.42.163.82
config.ipsec.tunnels.tunnel1.leftsubnet 10.0.0.0/24
config.ipsec.tunnels.tunnel1.name sandy_25_to_26
config.ipsec.tunnels.tunnel1.options.option1.arg %wwan0
config.ipsec.tunnels.tunnel1.options.option1.opt left
config.ipsec.tunnels.tunnel1.options.option2.arg 10.0.0.1
config.ipsec.tunnels.tunnel1.options.option2.opt leftsourceip
config.ipsec.tunnels.tunnel1.options.total 2
config.ipsec.tunnels.tunnel1.right 63.42.163.81
config.ipsec.tunnels.tunnel1.rightid 63.42.163.81
config.ipsec.tunnels.tunnel1.rightsubnet 192.168.0.0/24
config.ipsec.tunnels.tunnel1.secret dhcprelay
#
```

4. In particular, add two more options, which are must-haves to setup the ipsec tunnel successfully:

```
left=%wwan0
leftsourceip=10.0.0.1
```

5. Setup IPsec over Cellular Modem
   Manually edit /etc/config/ipsec.conf in the following way:

```
# cat /etc/config/ipsec.conf
version 2.0

config setup
- interfaces=%defaultroute
+ interfaces="ipsec0=wwan0"
nat_traversal=yes

include /etc/config/ipsec.config.conf
#
```

   By default, interfaces=%defaultroute, that is, the IPSec tunnel will be established upon the default gateway interface (such as eth0). By changing it to "ipsec0=wwan0", the ipsec0 interface is enforced to be established upon the wwan0 interface.

   NOTE: This effectively implies that the IPSec tunnel should only be configured once the Cellular Modem is UP (so that the bearer interface is determined)

6. Enable DHCP relay on the CLI manually (NOTE: there is no Web UI for DHCP relay since 4.7.0):

```
# config -g config.services.dhcprelay
config.services.dhcprelay.enabled on
config.services.dhcprelay.lowers.lower1.circuit_id relay1
config.services.dhcprelay.lowers.lower1.role lan
config.services.dhcprelay.lowers.total 1
config.services.dhcprelay.servers.server1 192.168.0.1
config.services.dhcprelay.servers.total 1
config.services.dhcprelay.uppers.total 1
config.services.dhcprelay.uppers.upper1.interface ipsec0
config.services.dhcprelay.uppers.upper1.role vpn
#
```

   In particular, the 192.168.0.1 is the IP address of the DHCP server.

Steps to set up A. DHCP client (192.168.23.24)

1. Plug LAN into LAN of 192.168.23.25.

2. Enable LAN in dhcp mode.

3. When all above devices are setup correctly, remove any existing / previously obtained IP address from LAN/eth1 interface and enforce conman to restart its DHCP daemon:

```
# ip addr del 10.0.0.10 dev eth1
# conman_command network-connection-lan-dhcp restart
```

Expected results

DHCP relay and DHCP client

The subnet route to the right subnet should be added once the IPSec tunnel is established successfully

The host route to the client via a lower interface should be added automatically on the client gets a DHCP offer.

The default route is added automatically.

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. 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 administrators can 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 canalso be configured for dial-in OOB access.
- All console server models with an internal or externally attached modem can be configuredfor out-dial to be permanently connected.
- The console server models can also be configured for transparent out-dial failover. In the event of a disruption in the principal management network, an external dial-up ppp connectionis automatically established.
- These console server models can also be accessed out-of-band using an alternate broadbandlink and also offer transparent broadband failover.
- Models with an internal cellular modem can be configured for OOB cellular access or forcellular transparent failover or can be configured as a cellular router.

4.1 Dialup Modem Connection

To enable dial-in or dial-out you must first ensure there is a modem attached to the console server.

- Models with an internal modem allow OOB dial-in access. These models display an **Internal ModemPort** tab under **System > Dial** (as well as the **Serial DB9 Port** tab).
- Other models also support external USB modems. The USB modem is autodetected and an **ExternalUSB Modem Port** tab will show under **System > Dial** as well as the **Serial Console** 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 are by default all configured as RJ serial console server ports. Port 1can be configured to be the **Local Console/Modem** port.

4.2 OOB Dial-In Access

When a modem has been attached to the console server you can configure the console server for dial-in PPP access. The console server waits for an incoming connection from a dial-in at remote site. Next theremote client dial-in software needs to be configured to establish the connection between an administrator's client modem to the dial in modem on the console server.

4.2.1 Configure Dial-In PPP

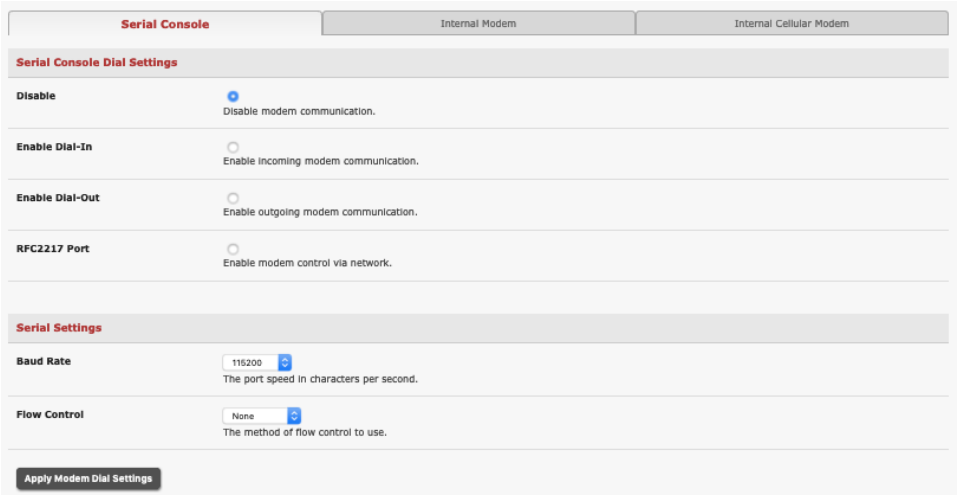
Enable PPP access on the internal or externally attached modem:

1. Select the **System > Dial** menu option and the **Internal Modem** or **Serial Port** tab.
2. Select the **Baud Rate** and **Flow Control** that will communicate with the modem.

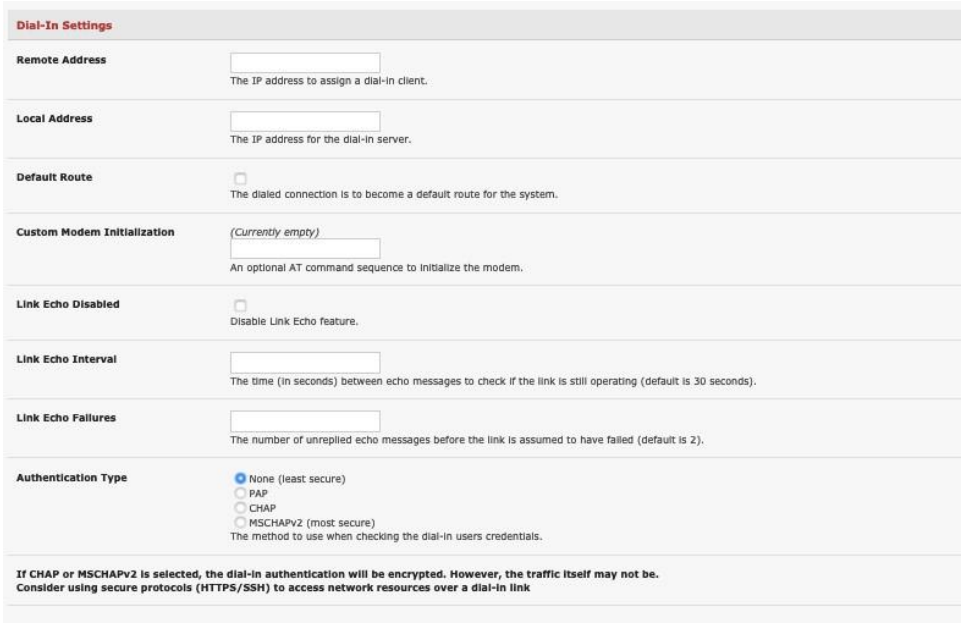
By default, the modem port is set with software flow control and the baud rate is set at:

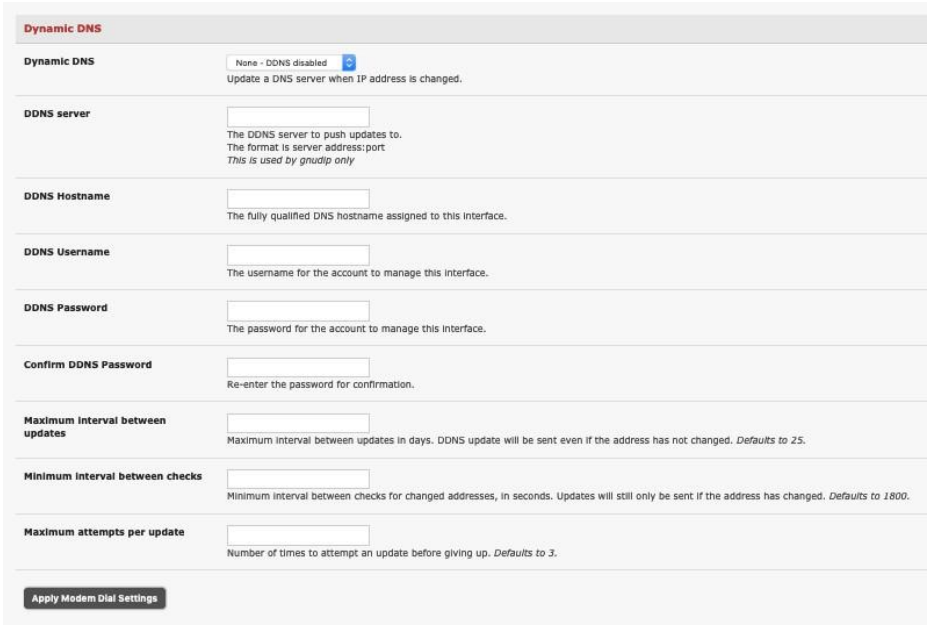
- 115200 baud for external modems connected to the local console port on CM7100 andIM7200 console servers.
- 9600 baud for the internal modem or external USB modem and for external modems connected to the Console serial ports which have been reassigned for dial-in access (onACM7000).

We recommend Serial Settings of 38400 baud with Hardware Flow Control for OOB dial-in.



3. Check the **Enable Dial-In** radio button.
4. 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. It must be in the same network range as the LocalIP Address (e.g. 200.100.1.12 and 200.100.1.67).
5. In the **Local Address** field enter the IP address for the Dial-In PPP Server. This is the IP address used by the remote client to access console server once the modem connection is established. You can select any address for the Local IP Address but it must be in the same network range asthe Remote IP Address.
6. The **Default Route** option enables the dialed PPP connection to become the default route for theconsole server.
7. The **Custom Modem Initialization** option allows a custom AT string modem initialization string tobe entered (e.g. AT&C1&D3&K3).





8. Select the **Authentication Type** required. Access is denied to remote users attempting to connectusing an authentication scheme weaker than the selected scheme. The schemes are described below, from strongest to weakest.

    - **Encrypted Authentication (MS-CHAP v2):** The strongest type of authentication to use; this isthe recommended option.

    - **Weakly Encrypted Authentication (CHAP):** This is the weakest type of encrypted passwordauthentication 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 toencrypt traffic.

    - **Unencrypted Authentication (PAP):** This is plain text password authentication. When usingthis type of authentication, the client password is transmitted unencrypted.

    - **None**.

9. Select the **Required Encryption Level**. Access is denied to remote users attempting to connect notusing this encryption level.

> **NOTE:** The firmware supports multiple dial-in users, who are setup with dialin group membership. The **username** and **password** to be used for the dial-in PPP link and any dial-back phone numbers areconfigured when the user is set up.

4.2.2 Set up Windows XP or later client

1. Open **Network Connections** in Control Panel and click the **New Connection Wizard**.
2. Select **Connect to the Internet** and click **Next**.
3. On the **Getting Ready** screen select **Set up my connection manually** and click **Next**.
4. On the **Internet Connection** screen select **Connect using a dial-up modem** and click **Next**.
5. Enter a **Connection Name** (any name you choose) and the dial-up **Phone number** that willconnect thru to the console server modem.
6. Enter the PPP **Username** and **Password** for have set up for the console server.

4.2.3 Set up 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 the **Start** button and selecting **Settings.** Click **Network and Dial-upConnections** and click **Make New Connection.**

For Windows 98, double click **My Computer** on the Desktop, open **Dial-Up Networking** and doubleclick **Make New Connection** and proceed as above.

4.2.4 Set up Linux clients

The online tutorial http://www.yolinux.com/TUTORIALS/LinuxTutorialPPP.html presents a selection ofmethods for establishing a dial up PPP connection.

For all PPP clients:

- Set the PPP link up with TCP/IP as the only protocol enabled.
- Specify that the Server will assign IP address and do DNS.
- Do not set up the console server PPP link as the default for Internet connection.

4.3 Dial-Out Access

The internal or externally attached modem on the console server can be set up in Failover mode where a dial-out connection is only established in event of a ping failure, or with the dial-out connection always on,or network control via RFC2217 Port.

The console server attempts to re-establish the connection in the event of a disruption in the dial-outconnection.

4.3.1 Always-on dial-out

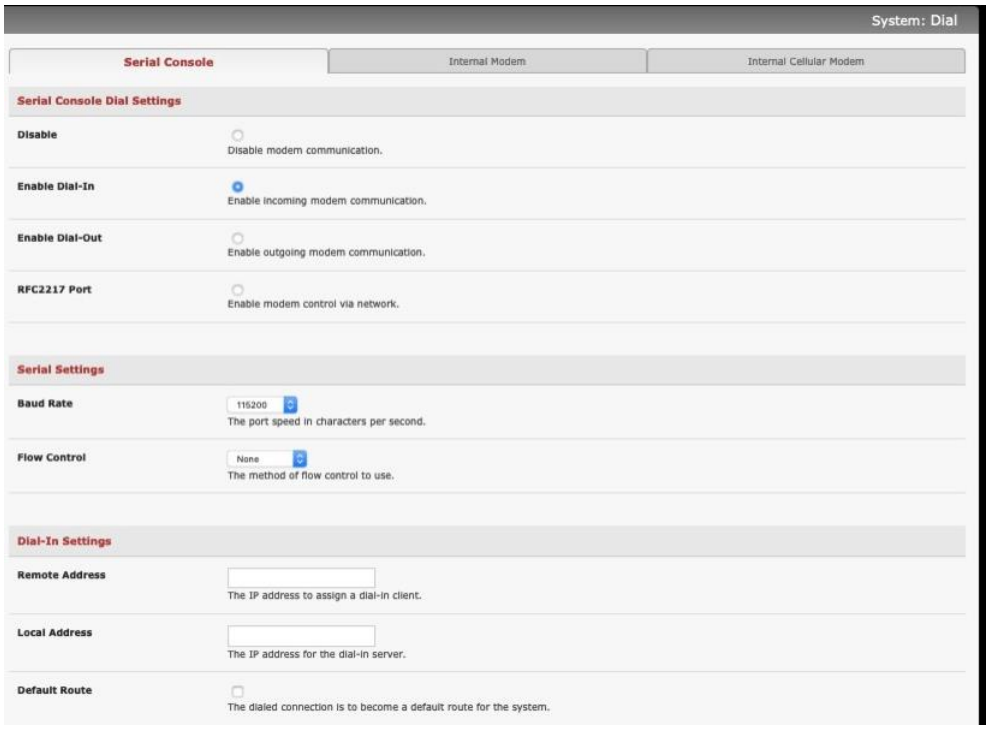
The console server modem can be configured for out-dial to be always on, with a

permanent external dial-up ppp connection.

- Select the **System > Dial** menu option and check **Enable Dial-Out** to allow outgoing modemcommunications.
- Select the **Baud Rate** and **Flow Control** that will communicate with the modem.
- In the **Dial-Out Settings - Always On Out-of-Band** field enter the access details for the remote PPPserver to be called.

Override DNS is available for PPP Devices such as modems. Override DNS allows the use of alternateDNS 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 box. Enter the IP of the DNS serversinto the spaces provided.

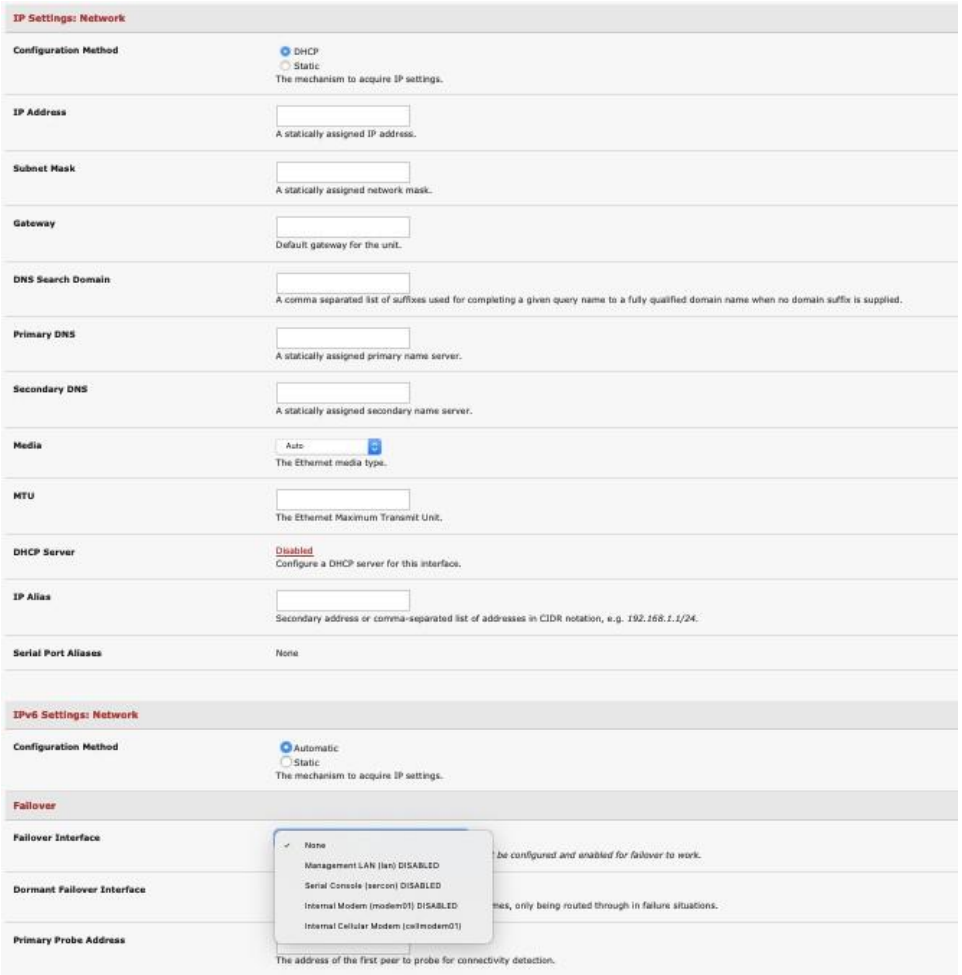


4.3.2 Failover dial-out

The ACM7000, CM7100, and IM7200 can be configured so a dial-out PPP connection is automatically setup in the event of a disruption in the principal management network.

> **NOTE:** SSH and HTTPS access is enabled on the failover connection so an administrator can SSH orHTTPS connect to the console server and fix the problem..

1. When configuring the principal network connection in **System > IP** specify the **Failover Interface** used when a fault is detected with Network / Network1 (eth0).
   This can be either **Internal Modem** or the **Serial Console** if you are using an external modem on the Console port or **USB Modem** ifyou are using a USB modem on an ACM7000.



2. Specify the **Probe Addresses** of two sites (the **Primary** and **Secondary**) that the console server isto ping to determine if Network / Network1 is operational.

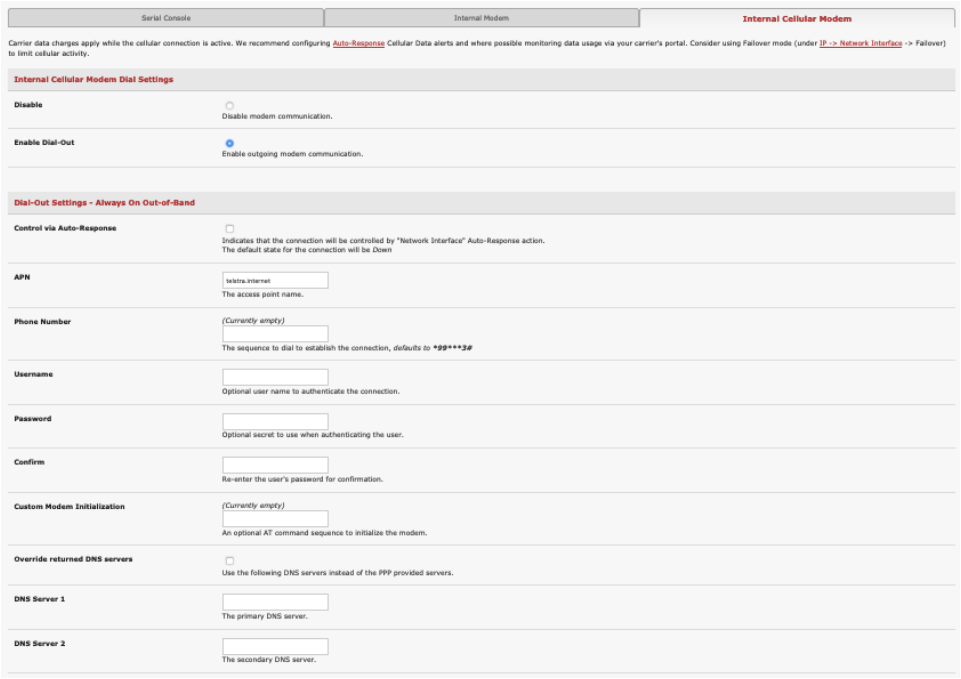
3. Select the **System > Dial** menu option and the port to be configured (**Serial Console** or **InternalModem Port**).

4. Select the **Baud Rate** and **Flow Control** that will communicate with the modem.

5. Check the **Enable Dial-Out Access** box and enter the access details for the remote PPP server tobe called.

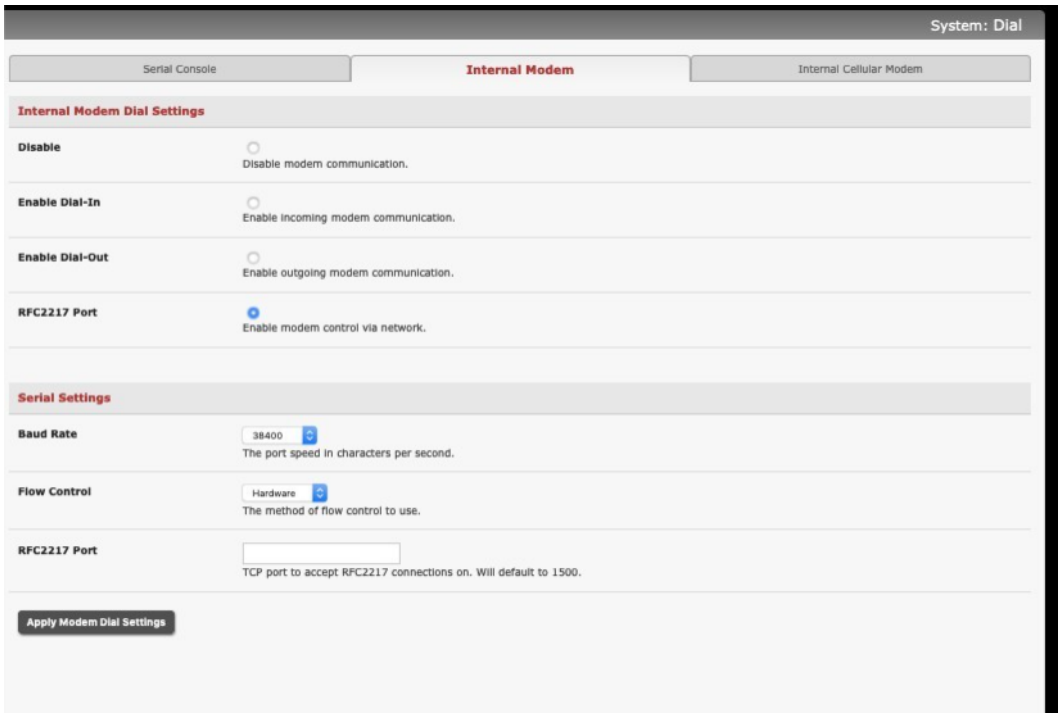
Override DNS is available for PPP Devices such as modems. Override DNS allows the use of alternateDNS servers from those provided by your ISP. For example, an alternative DNS may be required for OpenDNS used for content filtering.

To enable **Override DNS**, check the Override returned DNS Servers box. Enter the IP of the DNS serversinto the spaces provided.



NOTE: By default, the console server supports automatic failure-recovery back to the original state priorto failover. The console server continually pings probe addresses while in original and failover states. The original state is automatically set as a priority and reestablished following three successful pings of the probe addresses during failover. The failover state is removed once the original state has been re-established.

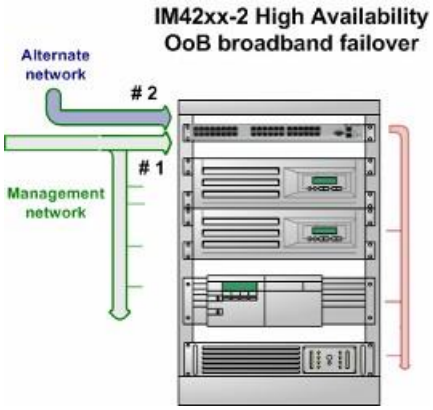
4.3.3 Enable modem control via network



Choose this option to control the internal modem via RFC2217. This option allows control fromLighthouse.

4.4 OOB Broadband Ethernet Access

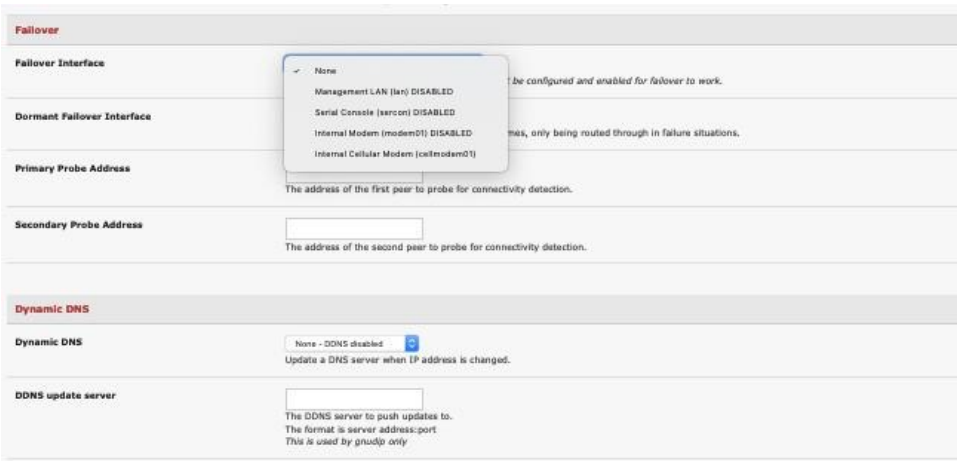
The ACM7000, CM7100, and IM7200 have a second Ethernet port (NET2 on the CM7100 and ACM7000,) that can be configured for alternate and OOB (out-of-band) broadband access. With two active broadbandaccess paths to these console servers, in the event you are unable to access through the primary management network (LAN1, Network or Network1) you can access it through the alternate broadband path.



On the **System > IP** menu select **Management LAN Interface** (CM7100, IM7200) and configure the **IPAddress, Subnet Mask**, **Gateway** and **DNS** with the access settings that relate to the alternate link.

Ensure when configuring the principal **Network Interface** connection, the **Failover Interface** is set to **None**.

4.5 Broadband Ethernet Failover



The second Ethernet port can also be configured for failover to ensure transparent high availability.

1. When configuring the principal network connection, specify **Management LAN Interface** asthe **Failover Interface** to be used when a fault has been detected with **Network Interface.**

2. Specify the **Probe Addresses** of two sites (the **Primary** and **Secondary**) that the consoleserver is to ping to determine if **Network Interface** is operational.

Then on the **Management LAN Interface** (CM7100 or IM7200) configure the **IP Address**, **Subnet Mask**, and **Gateway**. The Management LAN Interface address must be unique,

although it is permissible for itto be in the same subnet as the **Network Interface.**

In this mode, **Management LAN Interface** is available as the transparent back-up port to **Network Interface** for accessing the management network. **Management LAN Interface** takes over the work of**Network Interface** in the event **Network Interface** becomes unavailable.

> **NOTE:** SSH and HTTPS access is enabled on the failover connection so an administrator can connect tothe console server and fix the problem.

By default, the console server supports automatic failure-recovery back to the original state prior to failover (V3.1.0 firmware and later). The console server continually pings probe addresses whilst in original and failover states. The original state is set as a priority and reestablished following three successful pings of the probe addresses during failover. The failover state is removed once the originalstate has been re-established.

4.6 Cellular Modem Connection

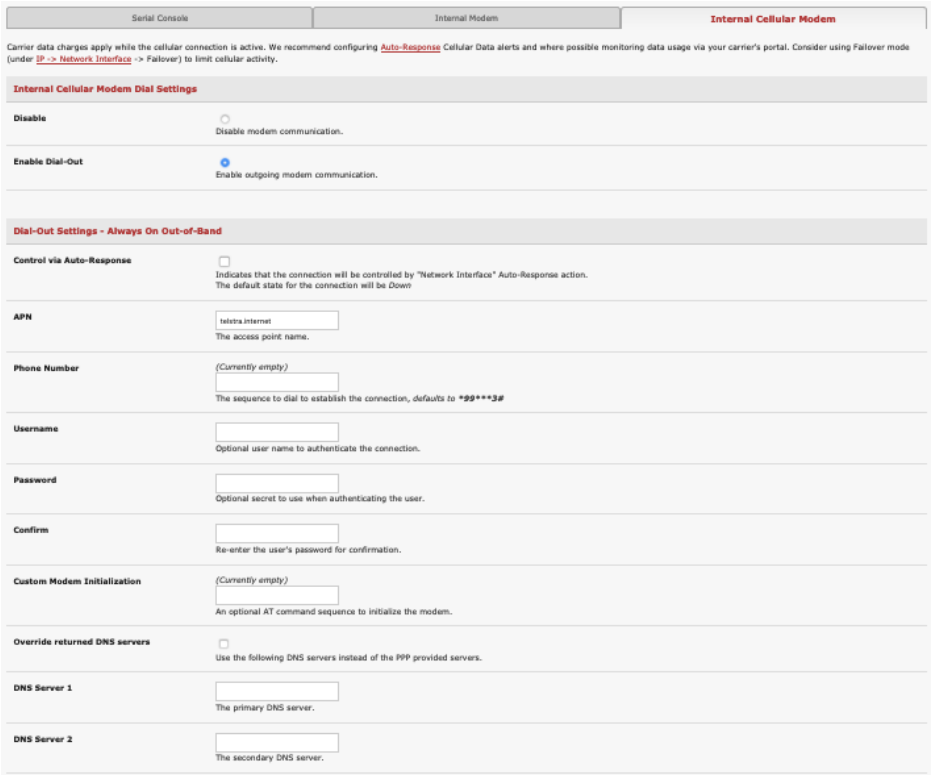
Some models support internal cellular modems. These modems first need to be installed and set up tovalidate they can connect to the carrier network They can be configured for operation in Always- on cellular router or OOB mode or in Failover mode.

4.6.1 Connecting to a GSM HSUPA/UMTS carrier network

Some models have an internal GSM modem that connects to any major GSM carrier globally.

1. Select **Internal Cellular Modem** panel on the **System > Dial** menu.

2. Check **Enable Dial-Out Settings**.



> **NOTE:** Your 3G carrier may have provided you with details for configuring the connection including APN (Access Point Name), Pin Code (optional PIN code which may be required to unlock the SIM card), Phone Number (the sequence to dial to establish the connection, defaults to *99***1#), Username /Password (optional) and Dial string (optional AT commands). In general, you only need to enter your provider's APN and leave the other fields blank.

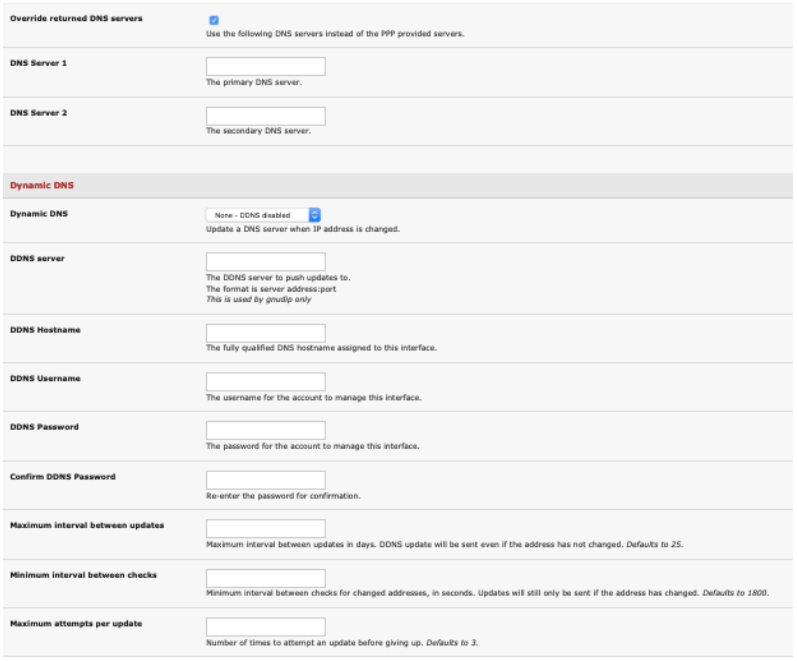
3. Enter the carrier's **APN** e.g. for AT&T (USA) enter i2gold, for T-Mobile (USA) enter epc.tmobile.com, for InterNode (Aust) enter internode and for Telstra (Aust) enter telstra.internet

4. If the SIM Card is configured with a PIN Code, unlock the card by entering the PIN Code. If the PINCode is entered incorrectly three times, the PUK Code is required to unlock the Card.

You may also need to set Override DNS to use alternate DNS servers from those provided by your carrier.

5. To enable **Override DNS**, check the **Override returned DNS Servers** box.

6. Enter the IP of the DNSservers into the spaces provided.

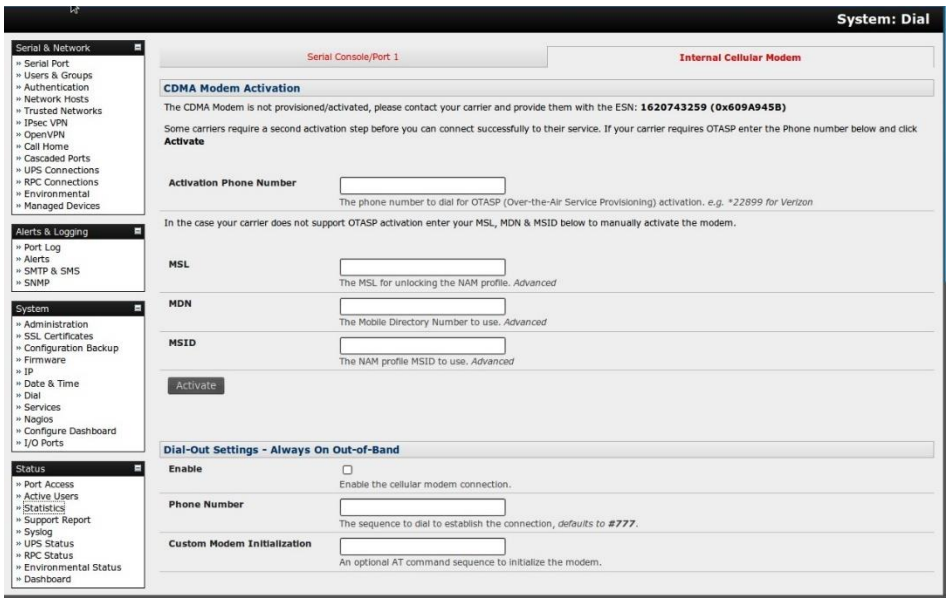


7. Check **Apply** to establish a radio connection with your cellular carrier.

4.6.2 Connecting to a CDMA EV-DO carrier network

Some models have an internal CDMA modem. Both connect to the Verizon network in NorthAmerica.

After creating an account with the CDMA carrier some carriers require an additional step to provision the **Internal Cellular Modem**, referred to as Provisioning.



OTASP Activation:

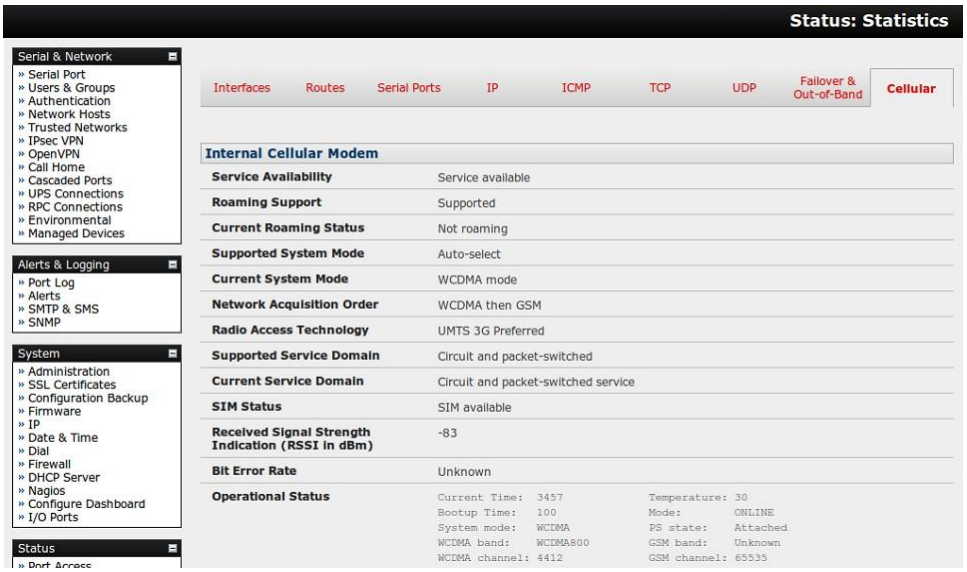
Before this can be achieved you need both a working account and an activated device in that the Opengear's ESN (Electronic Serial Number) needs to be registered with an appropriate plan on yourCarriers account.

1. Select **Internal Cellular Modem** panel on the **System > Dial** menu.

2. A particular phone number needs to be dialed to complete OTASP e.g. Verizon uses *22899, Telususes *22886.

3. Click **Activate** to initiate the OTASP call. The process is successful if no errors are displayed and youno longer see the CDMA Modem Activation form. If OTASP is unsuccessful you can consult the System Logs for clues to what went wrong at **Status > Syslog.**

4. When **OTASP** has completed, enable the **Internal Cellular Modem** by entering the carriers phonenumber (which defaults to **#777**) and clicking **Apply.**



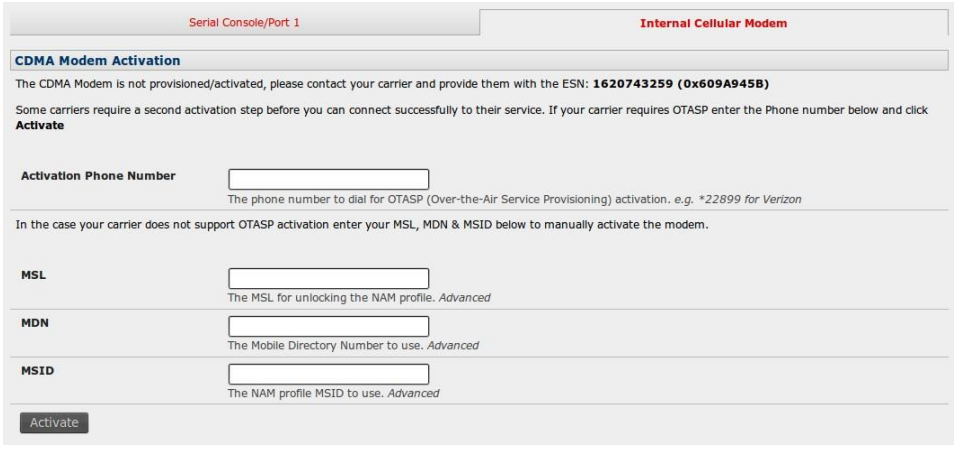
5. The **Cellular** statistics page on **Status > Statistics** displays the current state of the modem.

6. **OTASP** success results in a valid phone number placed in the **NAM Profile Account MDN** field.

Manual Activation:

Some carriers may not support **OTASP** in which case it may be necessary to manually provision themodem.

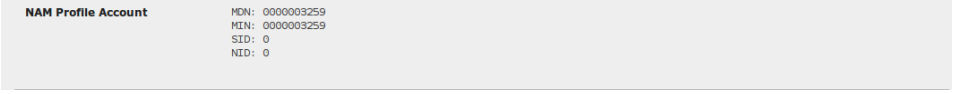
1. Select **Internal Cellular Modem** panel on the **System > Dial menu**.



2. Enter the **MSL**, **MDN** and **MSID** values. These are specific to your carrier and for manual activation, find out which values your carrier uses in each field. For example,

Verizon has usedan **MSL** of **000000** and the phone number assigned to the Opengear device as both the **MDN** and **MSID** with no spaces or hyphens, e.g. *5551231234* for *555-123-1234*.

3. Click **Activate**. If no errors occur, the new values appear in the **NAM Profile** at the **Cellular** page on **Status > Statistics**.



4. Navigate to the **Internal Cellular Modem** tab on **System > Dial**. To connect to your carrier's 3G network, enter the appropriate phone number (usually **#777**) and a **Username** and **Password** ifdirected to by your account/plan documentation.

5. Select **Enable**.

6. Click **Apply** to initiate the **Always On Out-of-Band** connection.

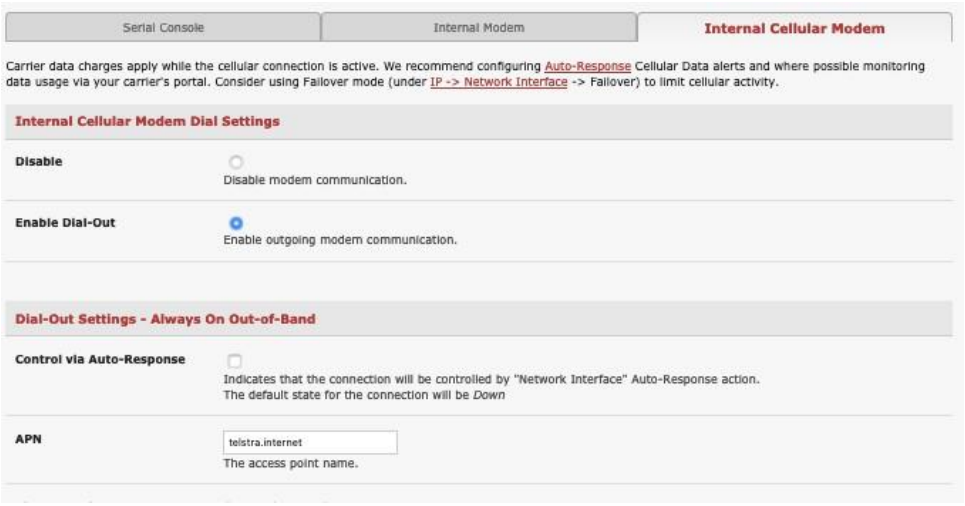
4.6.3 Connecting to a 4G LTE carrier network

-LMV, -LMA, -LMP, -L and -LR models have an internal modem that connect to any major 4G LTE carrier globally.

1. Before powering on, you must install the SIM card provided by your cellular carrier and attach theexternal antenna.

2. Select **Internal Cellular Modem** panel on the **System > Dial** menu.

3. Check **Enable Dial-Out Settings**.



4. Enter the carrier's **APN.**

5. You may also need to provide a username, password and authentication if required by your carrier. Enter your connection credentials if required:

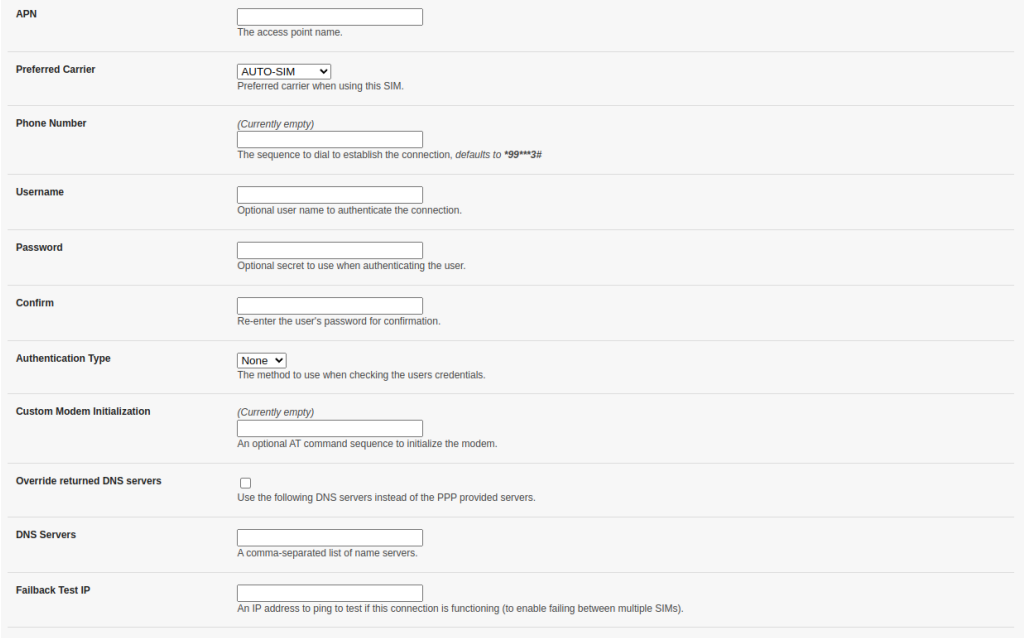
   - Enter your username and password.

   - Select the **Authentication Type** if required.
     During setup you may need to choose the Authentication type. Access is denied to remote users attempting to connect using an authentication scheme weaker than the selected scheme. The schemes are described below, from strongest to weakest.

- Challenge Handshake Authentication Protocol (CHAP): CHAP is a challenge and response authentication method that Point-to-Point Protocol (PPP) servers use to verify the identity of a remote user. CHAP uses a three-way handshake to verify and authenticate the identity of the user.

- Unencrypted Authentication (PAP): This is plain text password authentication. When using this type of authentication, the client password is transmitted unencrypted.

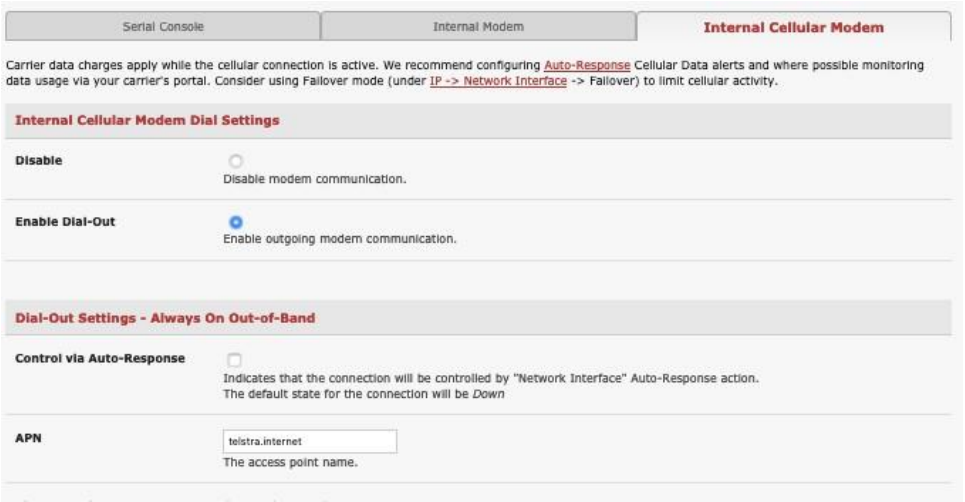
- None.



6. If the SIM Card is configured with a PIN Code, unlock the Card by entering the PIN Code.

You may also need to set Override DNS to use alternate DNS servers from those provided by your carrier.

7. To enable **Override DNS**, check the Override returned DNS Servers box. Enter the IP of the DNSservers into the spaces provided.



8. Check **Apply.** A radio connection is established with your cellular carrier.

9. In the command line shell, apply additional IPV6 configuration for an IPV6 keepalive option:

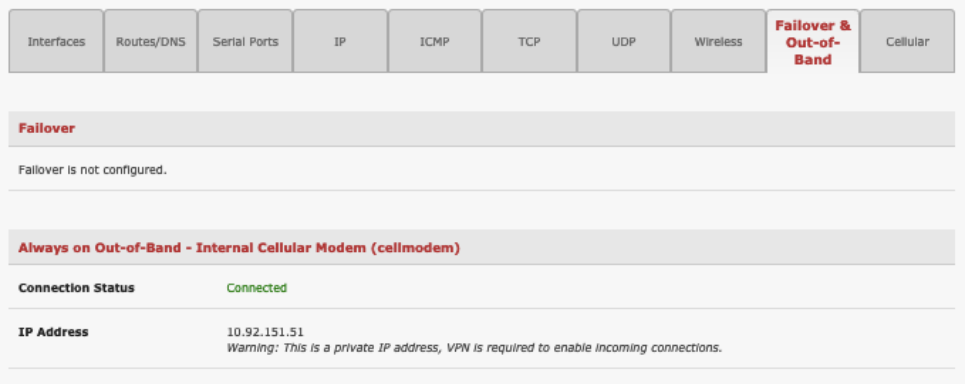
   - config -s config.cellmodem.ipv6.keepalive.enabled=on
   - config -s config.cellmodem.ipv6.keepalive.threshold=900

> **NOTE:** Some carriers may have adopted the bearer's inactive timeout threshold for IPV6 connections. If the ipv6 connection stays idle (no application-driven traffic) the bearer connection may be dropped; In such cases the setting in step 9 may be required. However, for the Verizon carrier this is turned on by default.
> The threshold value is configurable, if unset, defaults to 3600 seconds, or 1 hour.

4.6.4 Verifying the cellular connection

Out-of-band access is enabled by default so the cellular modem connection should be on.

- Verify the connection status from the **Status > Statistics:**
  - Select the **Cellular** tab and under **Service Availability** verify **Mode** is set to **Online**.
  - Select **Failover& Out-of-Band** and verify the **Connection Status** reads **Connected.**
  - You can check your allocated IP address



- Measure the received signal strength from the **Cellular Statistics** page on the **Status > Statistics** screen.
  This displays the current state of the cellular modem including the Received Signal Strength Indicator (**RSSI**). The best throughput comes from placing the device in an area with the highest RSSI.

  -100 dbm or less = Unacceptable coverage

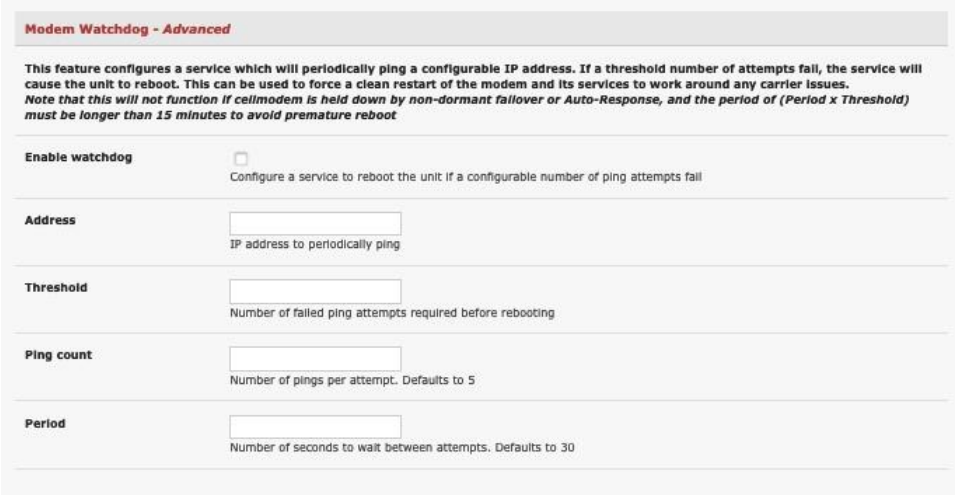
  -99 dbm to –90 dbm = Weak Coverage

  -89 dbm to – 70 dbm = Medium to High Coverage

  -69 dbm or greater = Strong Coverage

  You can also see the connection status from the LEDs on top of the device.

4.6.5 Cellular modem watchdog



Select **Enable Dial-Out** on the **System > Dial** menu under **Internal Cellular Modem** to configure a cellular modem watchdog service. This service periodically pings a configurable IP address. If a threshold numberof consecutive attempts fail, the service reboots the unit to force a clean restart of the modem and its services to work around any carrier issues.

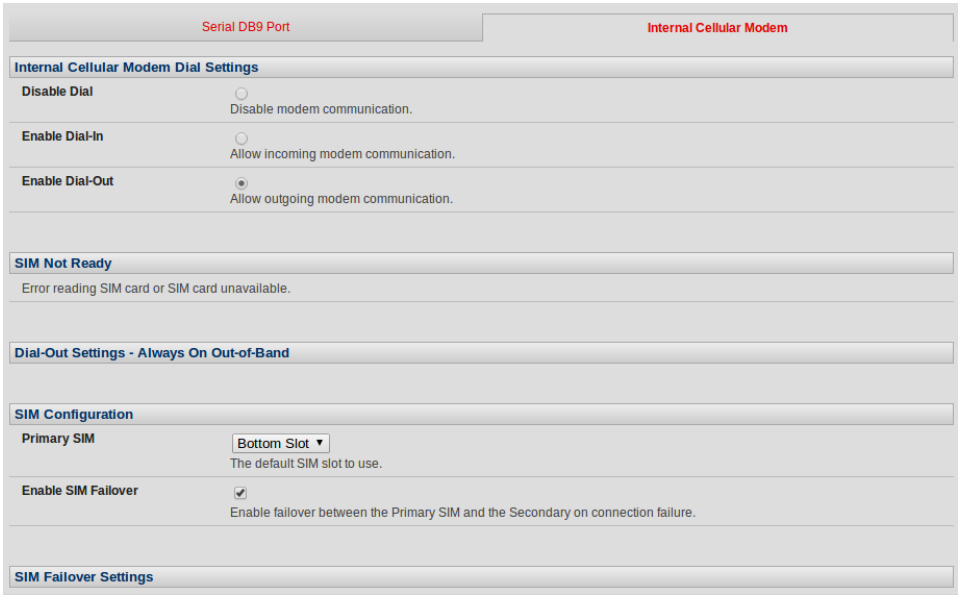
4.6.6 Dual SIM failover

Some console server models allow you to insert two SIM cards so you can connect to two carrier networks. The dual SIM failover feature allows the cell modem to selectively failover to the secondary SIMwhen communications over the primary SIM fails.

To configure dual SIM failover, you need to:

1. Choose which of the SIMs is to be the Primary.
   The other SIM will be the secondary/failover. It is recommended that an explicit slot is chosen, rather than leaving it on **Automatic**. Select **Internal Cellular Modem** panel on the **System > Dial** menu nominate which slot (**Top** or **Bottom**) contains thePrimary.

2. Check **Enable SIM Failover**.



3. Specify how the device will Failback from the failover SIM to the Primary SIM. There are two options:

   - **On Disconnect** failbacks to the Primary SIM only after the connection on the failover SIM hasfailed its ping test.

   - **On Timeout** failbacks to the Primary SIM after the connection on the failover SIM has been upfor the timeout period. The timeout period is either the default value of 600 seconds or the number of seconds you have specified in the **Failback Timeout** field.

4. Configure each SIM connection with as much information to make a successful connection givensufficient signal strength from the cell service provider.

5. Enter a **Failback Test IP** address for each SIM.
   This IP address is used to ping test the status of thecell modem connection and to determine if SIM failover or failback is to take place.

   Configuring DDNS and the Modem Watchdog are optional. DDNS, when configured, is applied to thecell modem dial out connection regardless of which SIM is in use. Dual SIM failover is for dial out connections only.

4.6.7 Automatic SIM Slot Detection

If a single SIM card is used in a Dual SIM slot product, the console server selects that slot. If both slots arepopulated, the bottom SIM slot is used.

4.6.8 Multi-carrier cellular support

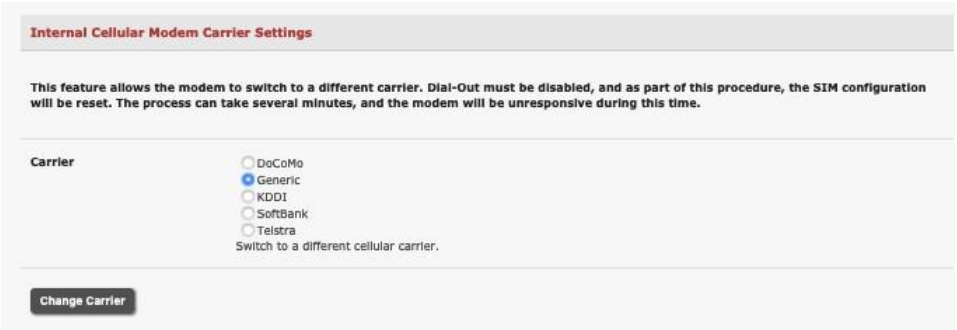
Some cellular carriers require the console server's cellular modem to be programmed with carrier-specificfirmware to operate on their network. Some console server models are equipped with a reprogrammable cellular modem, allowing them to operate on more than one cellular network.

Changes to the cellular modem firmware are unaffected by Opengear firmware upgrades or factoryerase/configuration reset operations.

To switch carriers using the UI:

1. For devices with multi-carrier capability, the **System > Dial > Internal Cellular Modem** tabprovides control over which carrier's firmware is installed on the modem.

2. Select the desired carrier and click the **Change Carrier** button to program the modem's flash withthe carrier-specific firmware image(s).



3. The flashing process takes several minutes during which the cellular modem is unavailable. During this time, the page refreshes with status information. Upon

successful completion, thepage 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 availableand is published on the Opengear download site.

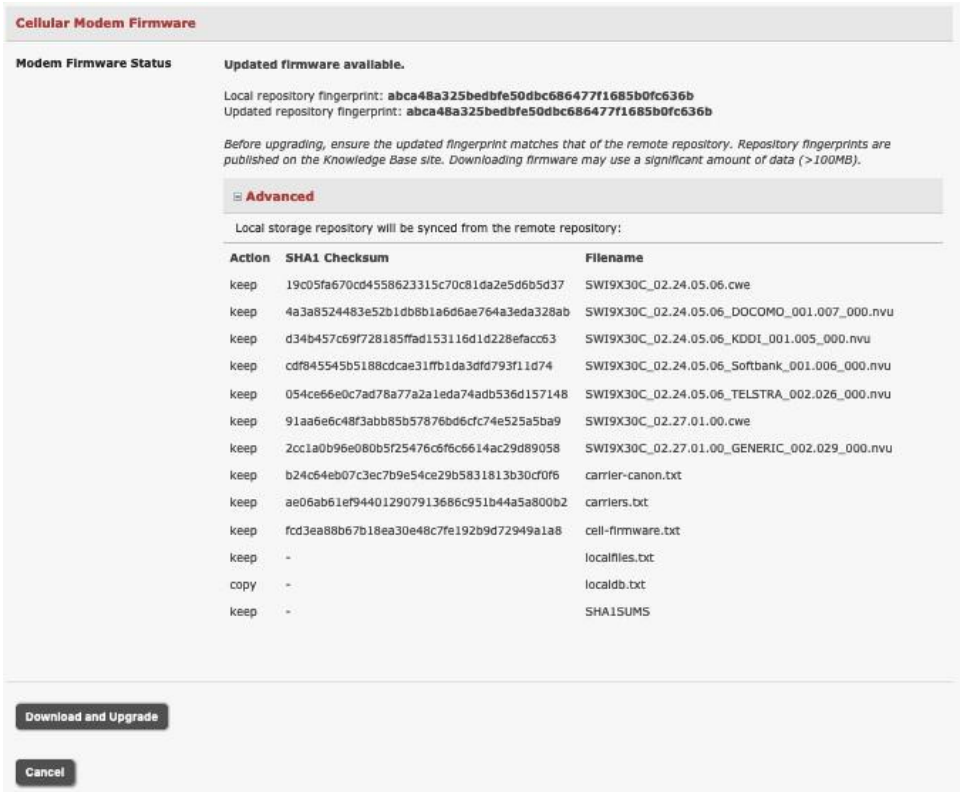
To download and apply new cellular firmware using the UI:

1. For devices with multi-carrier capability, the **System > Firmware** page shows a second sectionwith local cellular firmware image status and a button to start the firmware update process.

2. The **Cellular Firmware Status** indicates the date of the last firmware download, and a cryptographic fingerprint that can be used to verify the local files' integrity against the fingerprintpublished in the Opengear Knowledge Base site.

3. Click the **Check for Update** button to step through the upgrade process. This process contactsthe remote server (ftp.opengear.com) and displays an update summary.

4. The update summary indicates the local and remote fingerprints for comparison, without alteringany of the local files. The **Advanced** section, when expanded, shows a full list of files to be downloaded or deleted, along with their SHA1 hashes. Temporary files downloaded during the initial **Check for Updates** check may be listed as files to copy into place, as they do not have to be re-downloaded.

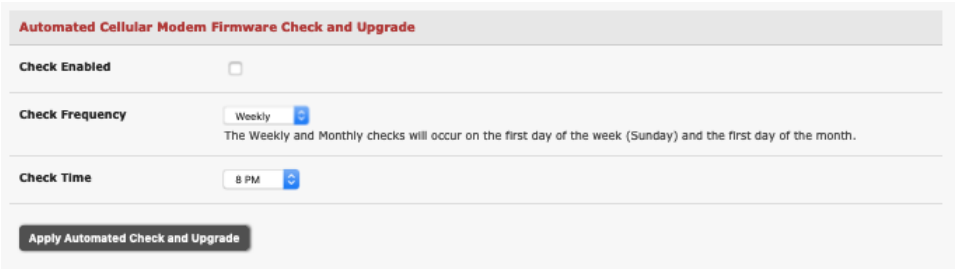


5. Click **Download and Apply** to start the update. The modem is only flashed if new firmware isavailable for the selected carrier. You can click **Cancel** to reject the update.

6. During the download/apply, an interstitial screen is displayed, showing upgrading cellular modemfirmware. When completed, the **System > Firmware** page displays the status of the firmware update.

7. To automate this operation, enable the **Automatic Cellular Modem Firmware Check**

and Upgradeoption. This allows the user to schedule these checks on a daily, weekly, or monthly schedule, and specify the time of day the check runs. If new firmware is found, the device downloads and applies it.



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 either:

- Cellular router mode. In this case the dial-out connection to the carrier cellular network is alwayson, and IP traffic is routed between the cellular connected network and the console server's localnetwork ports.
- OOB mode. As above in this mode the dial-out connection to the carrier cellular network is alwayson - awaiting any incoming access (from a remote site wanting to access to the console server orattached serial consoles/network hosts).
- Failover mode. In this case a dial-out cellular connection is only established in event of a pingfailure.
- Circuit Switched Data (CSD) mode. In this dial-in mode the cellular modem can receive incomingcalls from remote modems who dial a special Data Terminating number. This is a 3G mode only.

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 are 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, the status reports and alerts from the sitecan be carried over the main network.

This mode is used for out of band access to remote sites. This OOB mode is the default for IM7200appliances with internal cellular modems. Out-of-Band access is enabled by default and the cellularmodem connection is always on.

To be accessed, the console server needs to have a Public IP address and it must not have SSH accessfirewalled.

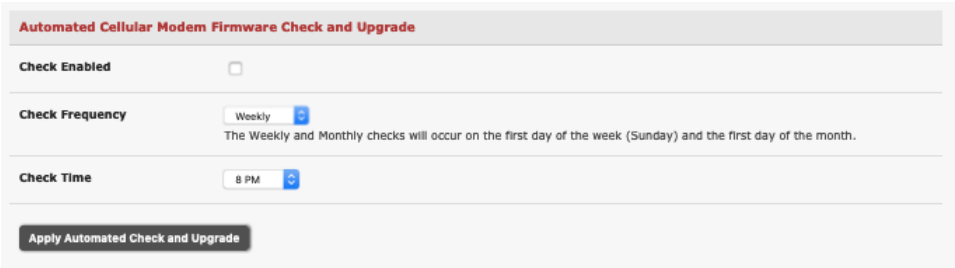
Almost all carriers offer corporate mobile data service/plans with a Public IP address. These plans oftenhave a service fee attached.

- If you have a static Public IP address plan you can also try accessing the console server using the Public IP Address provided by the carrier. By default, only HTTPS and SSH access is enabled on the OOB connection. You can browse to the console server, but you cannot ping it
- If you have a dynamic Public IP address plan, a DDNS service needs to be configured to enable the remote administrator to initiate incoming access. When this is done you

can try accessing the console server using the allocated domain name.

Most providers offer a consumer grade service which provides dynamic Private IP address assignmentsto 3G devices. This IP address is not visible across the Internet, but it is adequate for home and general business use.

- With this service, the **Failover & Out-of-Band** tab on the **Status > Statistics** shows that your carrierhas allocated you a Private IP Address (i.e. in the range 10.0.0.0 – 10.255.255.255, 172.16.0.0 – 172.31.255.255 or 192.168.0.0 – 192.168.255.255).



- For inbound OOB connection with this service, use Call Home with a Lighthouse/VCMS/CMS6110or set up a VPN.

In out of band access mode the internal cellular modem stays connected. The alternative is to set upFailover mode on the console server as detailed in the next section.

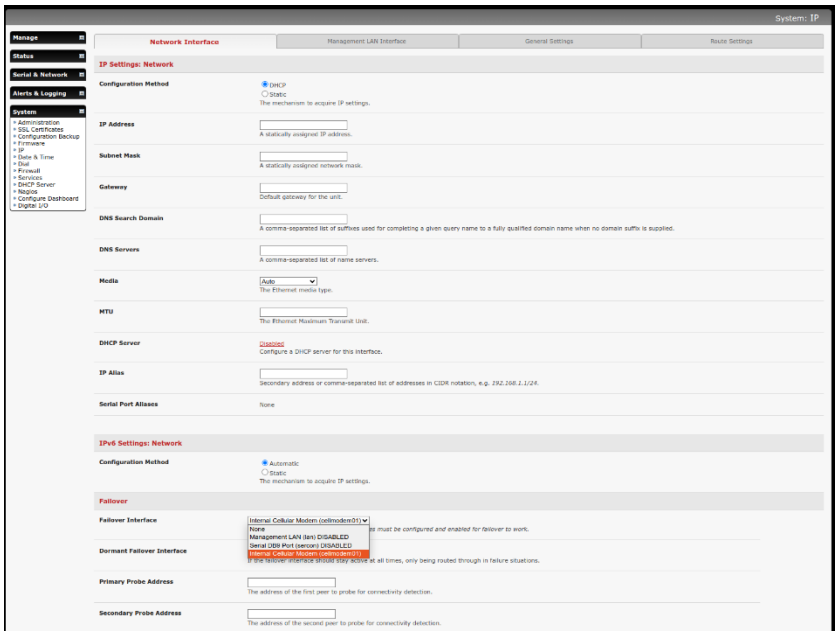
4.7.2 Cellular failover setup

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 over the cellular modemand access is switched to this network connection. When the main network connection is restored, access is switched back.

This dial-out cellular connection is established in event of disruption to the main network. The cellular connection remains idle and is only activated in event of a ping failure. This standby mode can suit remotesites with expensive power or cellular traffic costs.

When you have set up a carrier connection, the cellular modem can be configured for failover.

This tells the cellular connection to remain idle in a low power state. If the primary and secondary probe addresses are not available, it brings up the cellular connection and connects back to the cellular carrier.



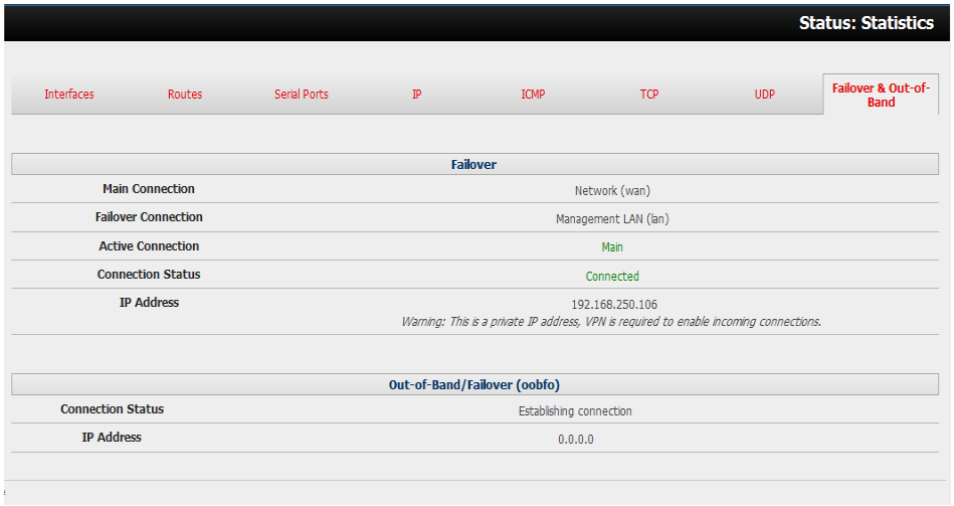
1. Navigate back to the **Network Interface** on the **System >IP** menu specify **Internal Cellular modem (cell modem 01**) as the **Failover Interface** to be used when a fault has been detected.

2. Specify the **Probe Addresses** of two sites (the **Primary** and **Secondary**) that the console server isto ping to determine if the principal network is operational.

3. In event of a failure of the principal network the 3G network connection is activated as the access path to the console server and managed devices. Only HTTPS and SSH access is enabledon the failover connection (which should enable an administrator to connect and fix the problem).

> **NOTE:** By default, the console server supports automatic failure-recovery back to the original state priorto failover. The console server continually pings probe addresses while in original and failover states. The original state is reestablished after three successful pings of the probe addresses during failover. The failover state is removed once the original state has been re-established.

You can check the connection status by selecting the Cellular panel on the **Status > Statistics** menu.



The Operational Status changes as the cellular modem finds a channel and connects to the network.

The **Failover & Out-of-Band** screen displays information relating to a configured Failover/OOB interface and the status of that connection. The IP Address of the Failover / OOB interface is bepresented in the **Failover & Out-of-Band** screen when the Failover/OOB interface is triggered.

4.7.3 Cellular routing

When you have 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 Chapter4.8.

4.7.4 Cellular CSD dial-in setup

When you have configured carrier connection, the cellular modem can be configured to receive CircuitSwitched Data (CSD) calls, a legacy form of data transmission developed for the TDMA based mobilephone systems like GSM.

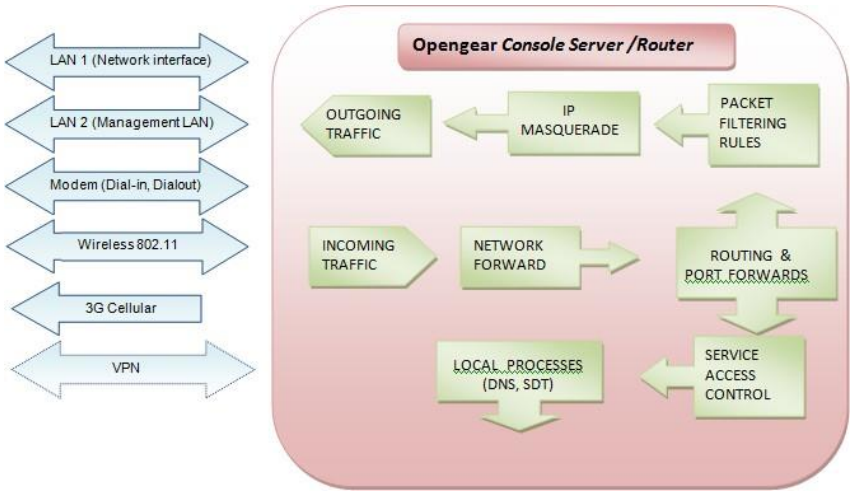
> **NOTE:** CSD is provided selectively by carriers, and it is important you receive a Data Terminating number as part of the mobile service your carrier provides. This is the number which external modems callto access the console server.

1. Select the **Cellular Modem** panel on the **System > Dial** menu.

2. Check **Enable Dial-In** and configure the **Dial-In Settings**.

4.8 Firewall & Forwarding

Opengear console servers have basic routing, NAT (Network Address Translation), packet filtering andport forwarding support on all network interfaces



This enables the console server to function as an Internet or external network gateway, via cellular connectionsor via other Ethernet networks on two Ethernet port models:

- **Network Forwarding** allows the network packets on one network interface (i.e. NET2 / eth0) to beforwarded to another network interface (i.e. NET2/eth1 or dial-out/cellular). Locally networked devices can IP connect through the console server to devices on remote networks

- **IP Masquerading** is used to allow all the devices on your local private network to hide behind andshare 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 porton 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 andaccepts or rejects it based on user-defined rules

- Then **Service Access Rules** can be set for connecting to the console server/router

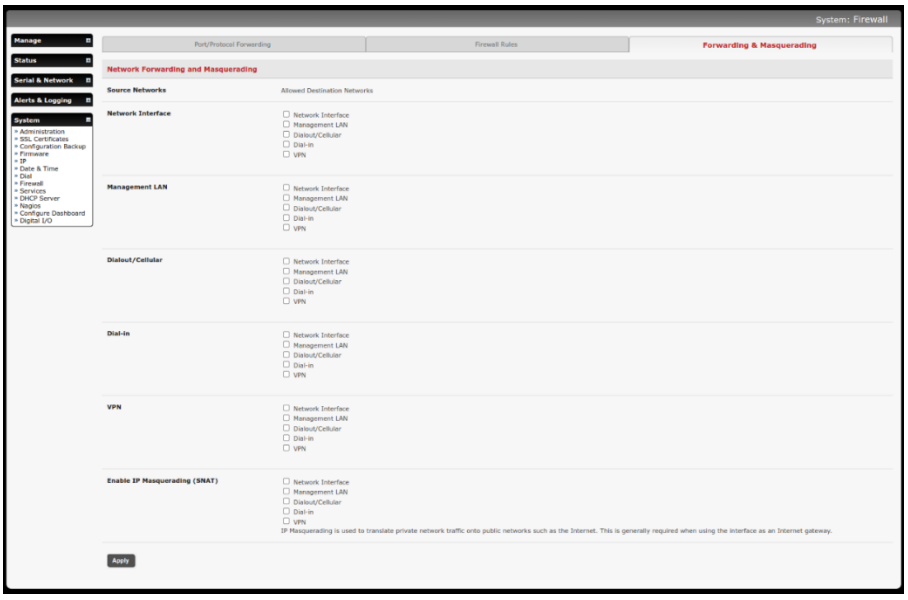
4.8.1 Configuring network forwarding and IP masquerading

To use a console server as an Internet or external network gateway requires establishing an externalnetwork connection and setting up forwarding and masquerading.

> **NOTE:** Network forwarding allows the network packets on one network interface (i.e. NET2 / eth0) to be forwarded to another network interface (i.e. NET2/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.

Console servers are configured so that they will not route traffic between networks. To use the consoleserver as an Internet or external network gateway, forwarding must be enabled so that traffic can be routed from the internal network to the Internet/external network:

1. Navigate to the **System > Firewall** page, and click on the **Forwarding & Masquerading** tab.



2. Find the **Source Network** to be routed, and tick the relevant **Destination Network** to enableForwarding

IP Masquerading is required if the console server is routing to the Internet or if the external network beingrouted to does not have routing information about the internal network behind the console server.

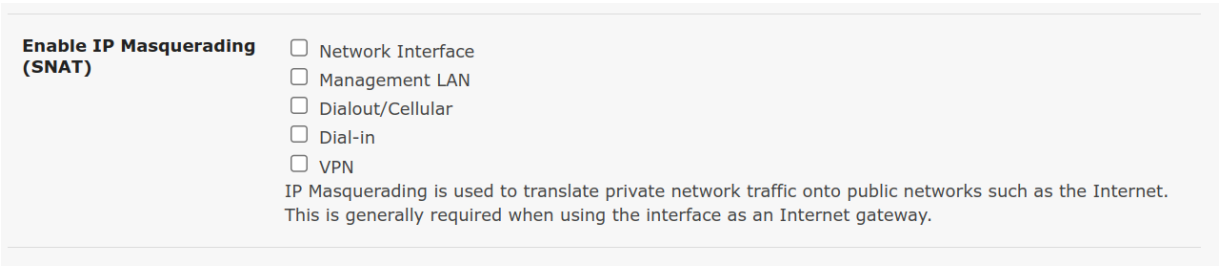
IP Masquerading performs Source Network Address Translation (SNAT) on outgoing packets, to make them appear like they've come from the console server (rather than devices on the internal network). When response packets come back devices on the external network, the console server translates the packet 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:

1. Select **Forwarding & Masquerading** panel on the **System > Firewall** menu.

2. Check **Enable IP Masquerading (SNAT)** on the network interfaces where masquerading isenabled.

This masquerading would be applied to any interface that is connecting with a public network such as theInternet.



4.8.2 Configuring client devices

Client devices on the local network must be configured with Gateway and DNS settings. This can be donestatically on each device or using DHCP (on IM and ACM models).

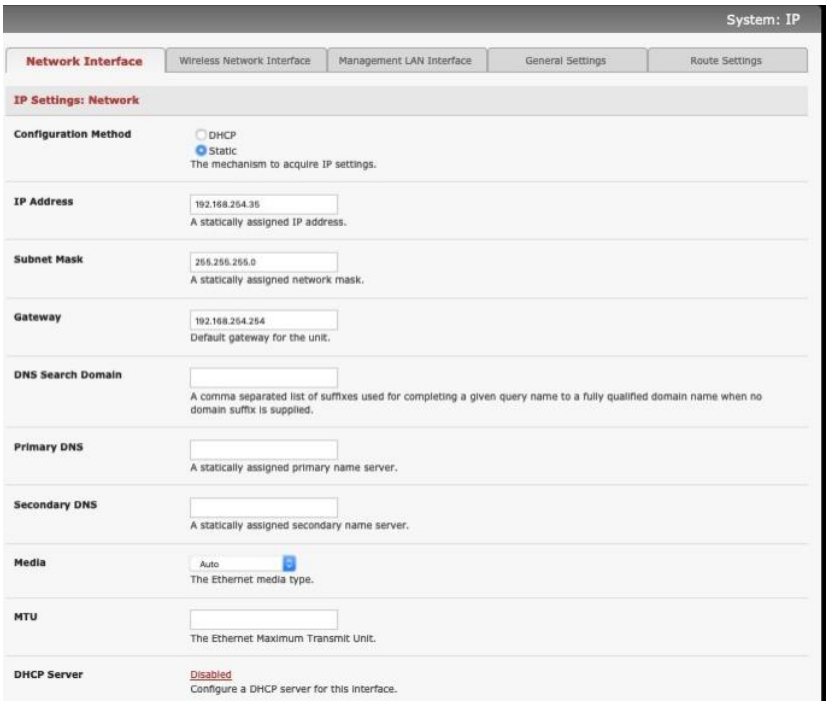
Manual Configuration:

Manually set a static gateway address (being the address of the console server) and set the DNS serveraddress to be the same as used on the external network i.e. if the console server is acting as an internetgateway or a cellular router. Use the ISP provided DNS server address.

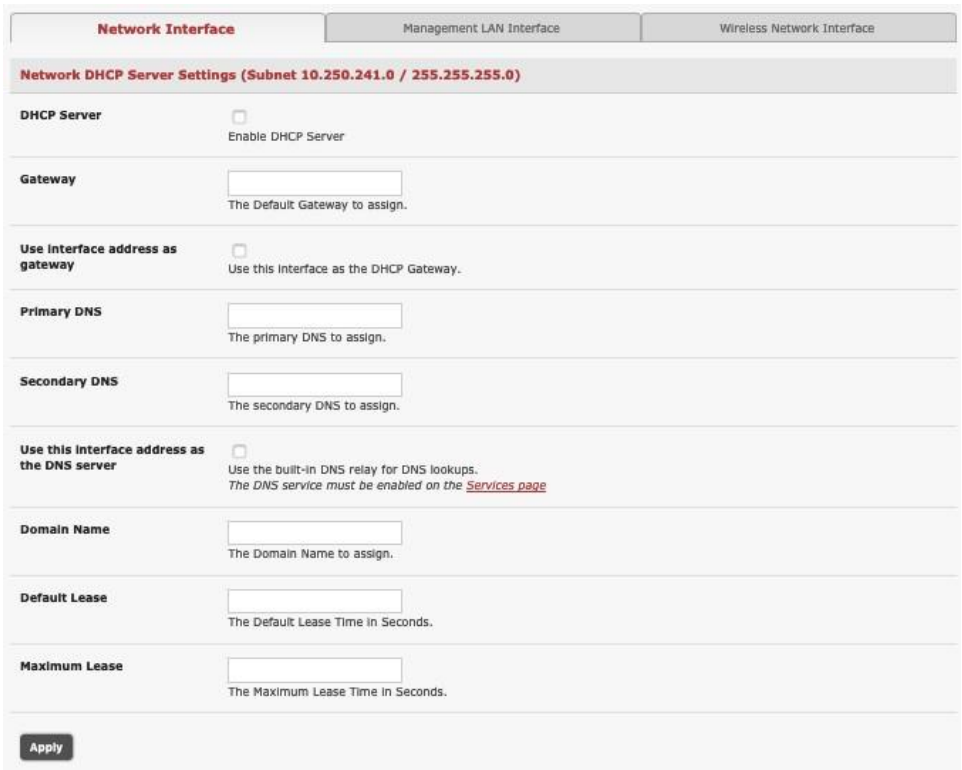
DHCP Configuration (IM/ACM families only):

1. Navigate to the **System > IP** page.

2. Click the tab of the interface connected to the internal network. To use DHCP, a static addressmust be set. Check that the static IP and subnet mask fields are set.



3. Click on the **Disabled** link next to **DHCP Server** which brings up **the System > DHCP Server** page.



4. Check **Enable DHCP Server**.

5. To configure the DHCP server, tick the **Use interface address as gateway** check box.

6. Set the DNS server address to be the same as used on the external network, i.e. if the consoleserver is acting as an internet gateway or a cellular router. Use the ISP provided DNS server address.

7. Enter the **Default Lease** time and **Maximum Lease** time in seconds. The lease time is the time thata dynamically assigned IP address is valid before the client must request it again.

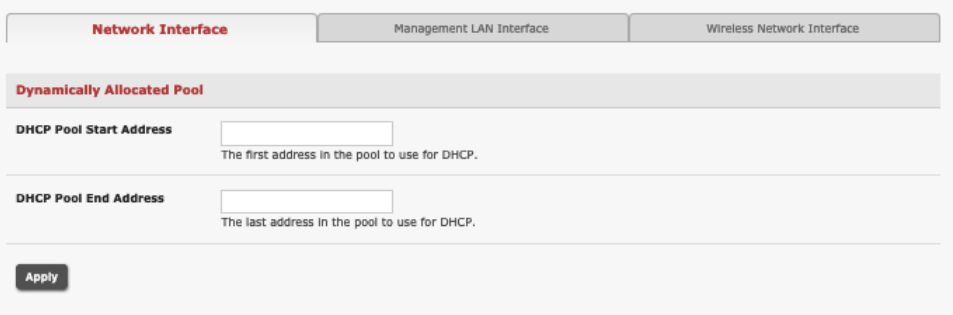
8. Click **Apply**.

The DHCP server sequentially issues IP addresses from a specified address pool(s):

1. Click **Add** in the **Dynamic Address Allocation Pools** field.

2. Enter the **DHCP Pool Start Address** and **End Address**.

3. Click **Apply**.



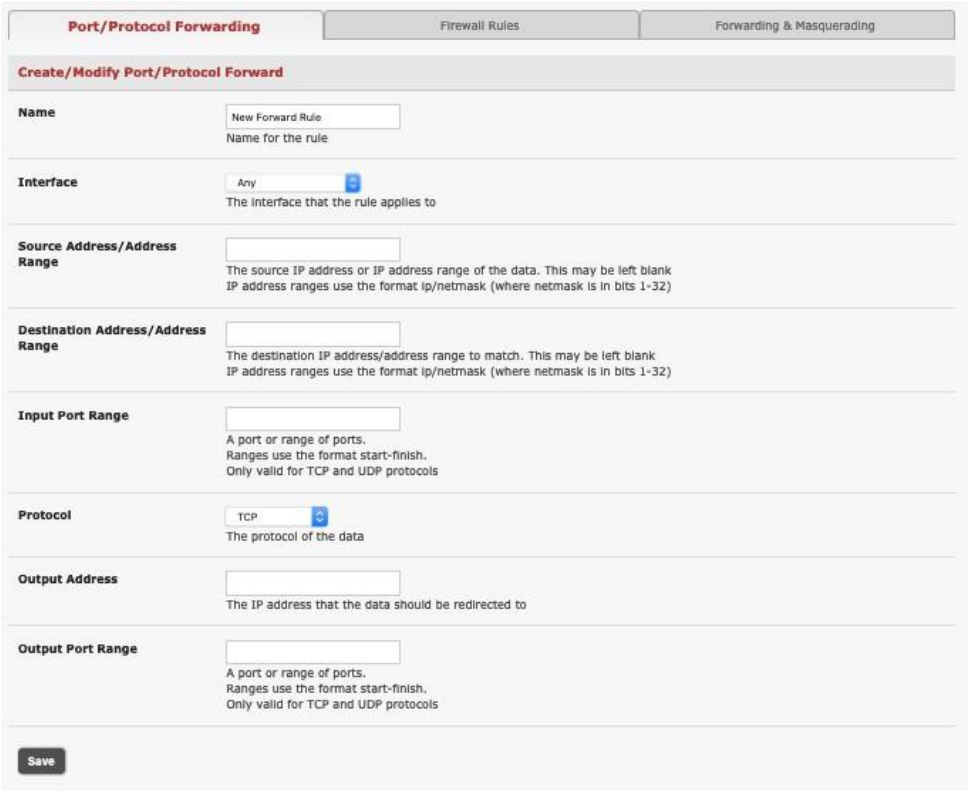
The DHCP server also supports pre-assigning IP addresses to be allocated only to specific MAC addresses and reserving IP addresses to be used by connected hosts with fixed IP addresses. To reservean IP addresses for a particular host.

When applied, devices on the internal network can access resources on the external network.

4.8.3 Port / Protocol forwarding

When using IP Masquerading, devices on the external network cannot initiate connections to devices onthe internal network.

To work around this, Port Forwards can be set up to allow external users to connect to a specific port, orrange of ports on the external interface of the console server/cellular router and have the console server/cellular router redirect the data to a specified internal address and port range.



To setup a port/protocol forward:

1. Navigate to the **System > Firewall** page, and click on the **Port Forwarding** tab.
2. Click **Add New Port Forward**.
3. Fill in the following fields:

   Name: Name for the port forward. This should describe the target and the service thatthe port forward is used to access.

   Input Interface: This allows the user to only forward the port from a specific interface. In mostcases, this should be left as **Any.**

   Source Address/Address: Range Restrict access to a port forward to a specific source IP addressor IP address range of the data. This may be left blank. IP address ranges use theformat 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 netmaskis 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 asthe output port range.

   Protocol: The protocol of the data being forwarded. The options are **TCP**, **UDP**, **TCP andUDP**, **ICMP**, **ESP**, **GRE,** or **Any.**

   Output Address: The target of the port forward. This is an address on the internal network wherepackets 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 OutputAddress. 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, the following settingswould be used:

Input Interface: Any

Input Port Range: 8443

Protocol: TCP

Output Address: 192.168.10.2

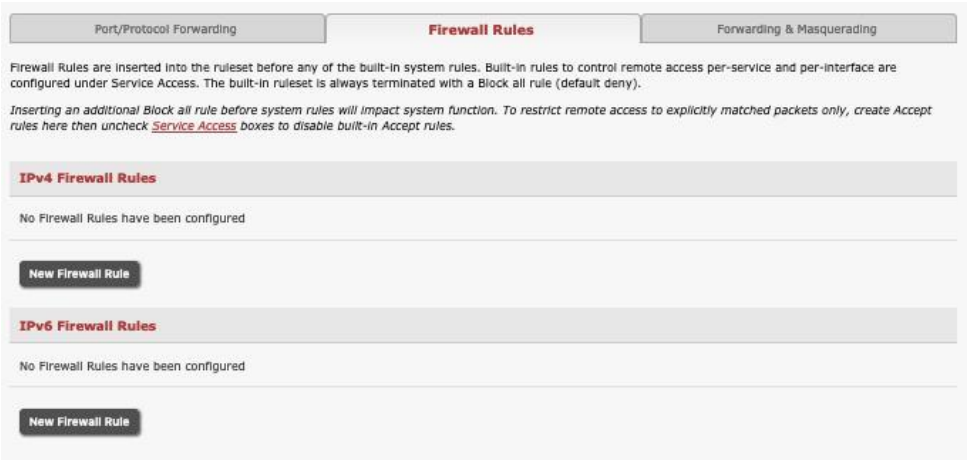
Output Port Range: 443

4.8.4 Firewall rules

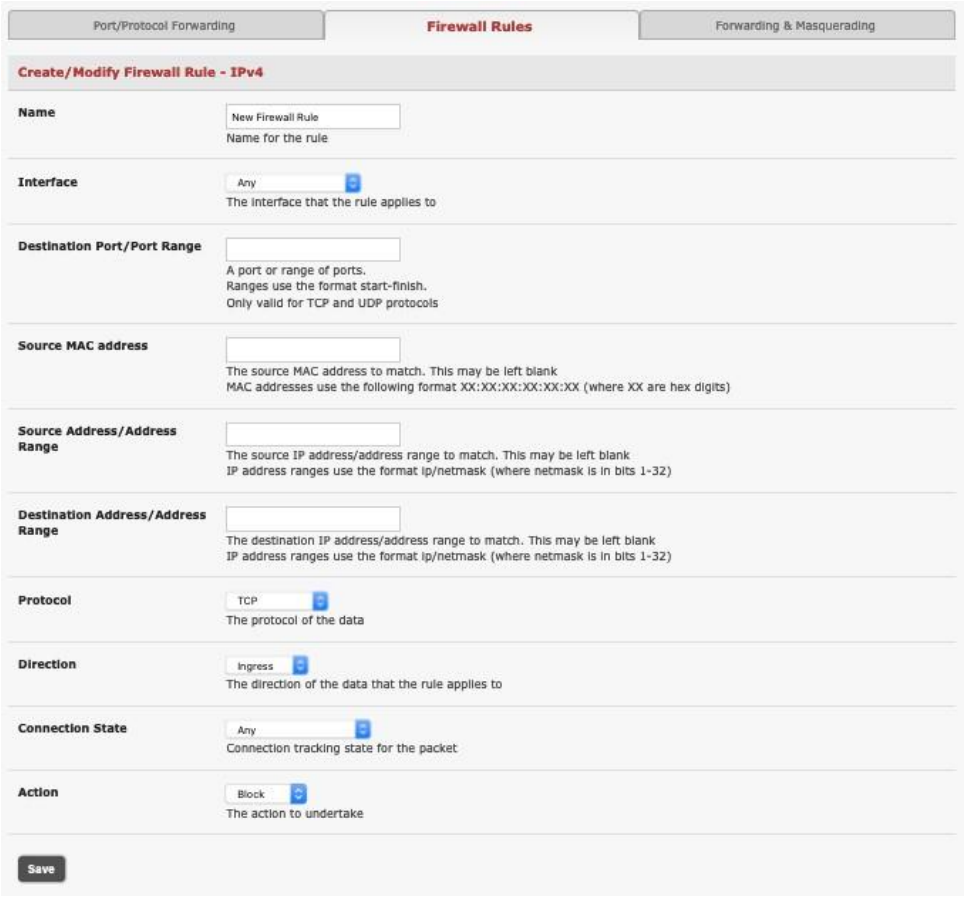
Firewall rules can be used to block or allow traffic through an interface based on port number, the source and/or destination IP address (range), the direction (ingress or egress) and the protocol. This can be usedto allow custom on-box services, or block traffic based on policy.

To setup a firewall rule:

1. Navigate to the **System > Firewall** page, and click on the **Firewall Rules** tab.



2. Click **New Firewall Rule**.



3. Fill in the following fields:

Name: Name the rule. This name should describe the policy the firewall rule isbeing used to implement (e.g. block ftp, Allow Tony).

Interface: The interface that the firewall rule applies to (i.e. Any, Dialout/Cellular,VPN, Network Interface, Dial-in etc).

Port Range: Specifies the Port or range of Ports (e.g. 1000 – 1500) that the ruleapplies to. This may be left blank for Any.

Source MAC address: Specifies the source MAC address to be matched. This may be left blankfor any. MAC addresses use the format XX:XX:XX:XX:XX:XX, where XX are hex digits.

Source Address Range: Specifies the source IP address (or address range) to match. IP addressranges use the format ip/netmask (where netmask is in bits 1-32). This may be left blank for Any.

Destination Range: Specifies the destination IP address/address range to match. IP addressranges use the format ip/netmask (where netmask is in bits 1-32). This may be left blank.

Protocol: Select if the firewall rule applies to **TCP**, **UDP**, **TCP and UDP**, **ICMP**, **ESP**,**GRE**, or **Any.**

Direction: The traffic direction that the firewall rule applies to (Ingress = incoming or Egress).

Connection State: The state of connections that the firewall rule applies to (Any, Related/Established, or New). This can be used to only allow established connections out an interface.

Action: The action (**Accept** or **Block**) that applies to the packets detected that match the Interface+ Port Range+ Source/destination Address Range+Protocol+ Direction.

For example, to block all SSH traffic from leaving Dialout Interface, the following settings can be used:

Interface: Dialout/Cellular

Port Range: 22

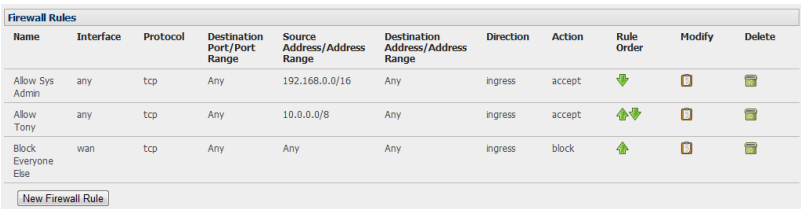
Protocol: TCP

Direction: Egress

Action: Block

The firewall rules are processed in a set order from top to bottom. For example, with the following rules,all traffic coming in over the Network Interface is blocked except when it comes from two nominated IPaddresses (SysAdmin and Tony):

	To allow all incoming traffic on all interfaces from the SysAdmin:	To allow all incoming traffic from Tony:	To block all incoming traffic from the Network Interface:
Interface	Any	Any	Network Interface
Port Range	Any	Any	Any
Source MAC	Any	Any	Any
Source IP	IP address of SysAdmin	IP address of Tony	Any
Destination IP	Any	Any	Any
Protocol	TCP	TCP	TCP
Direction	Ingress	Ingress	Ingress
Action	Accept	Accept	Block

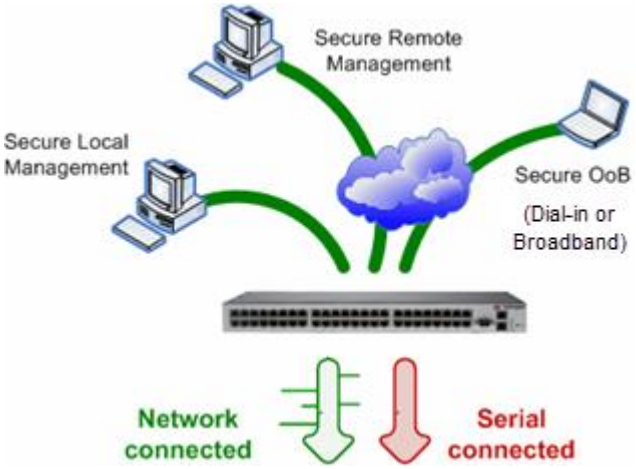


If the **Rule Order** above is changed so the **Block Everyone Else** rule is second on the list, the traffic comingin over the Network Interface from Tony would be blocked.

5. SSH TUNNEL CONFIGURATION

Each Opengear console server has an embedded SSH server and uses SSH tunneling so remote users cansecurely connect through the console server to managed devices - using text-based console tools (such as SSH, Telnet, SoL) or graphical tools (like 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 orthey can be attached to the console server via a serial port. The remote user 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:

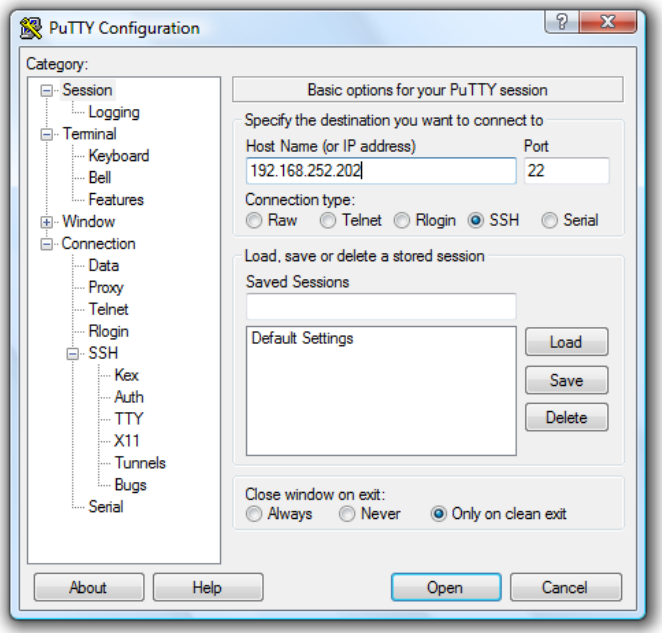


To set up the secure SSH tunnel from the Client PC to the console server, you must install and launch SSHclient software on the user's PC

See also, 3.4 Network Hosts and 12.1 Device Management.

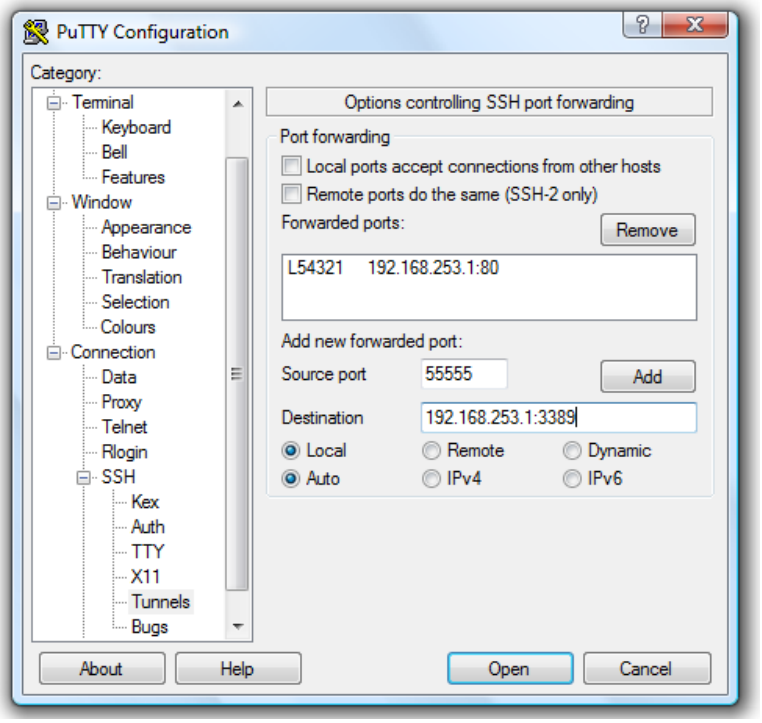
5.1 SSH Tunneling using SSH clients (e.g. PuTTY)

There are commercial, free SSH client programs that can provide the secure SSH connections to the console servers and secure tunnels to connected devices.

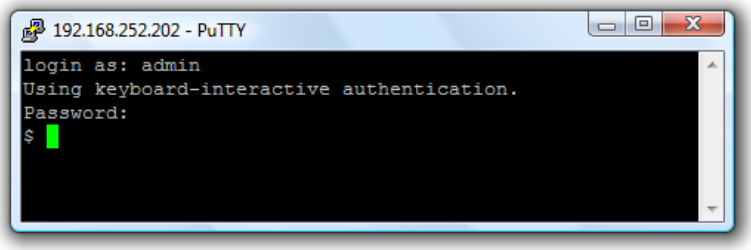


The following is an example of the establishment of an SSH tunneled connection to a network connected deviceusing the PuTTY client software:

1. In the **Session** menu enter the IP address of the console server in the **Host Name or IP address** field.
    - For dial-in connections, this IP address is the **Local** Address that you assigned to theconsole server when you set it up as the Dial-In PPP Server.
    - For Internet (or local/VPN connections) connections this is the public IP address of theconsole server.
2. Select the **SSH Protocol**. The **Port** is set to 22.
3. Go to the **SSH > Tunnels** menu and in Add new forwarded port enter any high unused portnumber for the **Source port** e.g. 54321.
4. Set the **Destination:** IP details.
    - If your destination device is network connected to the console server and you are connecting using RDP, set the Destination as < managed device IP address/DNS Name>:3389 e.g. if when setting up the managed device as Network Host on the consoleserver you specified its IP address to be 192.168.253.1 (or its DNS Name is accounts.myco.intranet.com), specify the Destination as 192.168.523.1:3389 (or accounts.myco.intranet.com:3389).



    - If your destination computer is serially connected to the console server, set the Destination as <port label>:3389 e.g. if the **Label** you specified on the serial port on the console server is win2k3, specify the remote host as win2k3:3389 .
5. Select **Local** and click the **Add** button.
6. Click **Open** to SSH connect the Client PC to the console server. You are prompted for theUsername/Password for the console server user.



- If you are connecting as a user in the users group, you can only SSH tunnel to Serial Ports where you have access permissions.
- If you are connecting as an administrator, you can connect to any configured Serial Ports.

To set up the secure SSH tunnel for a HTTP browser connection to the managed device specify port 80(rather than port 3389 as used for RDP) in the Destination IP address.

To set up the secure SSH tunnel from the Client (Viewer) PC to the console server for VNC follow the steps above. When configuring the VNC port redirection, specify port 5900 in the Destination IP address.

6. ALERTS, AUTO-RESPONSE & LOGGING

This chapter describes the automated response, alert generation and logging features of the consoleserver.

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 initiates a sequenceof actions in response to these triggers. To configure Auto-Response:

1. Set the general parameters.

2. Select and configure the Check Conditions, the conditions that trigger the response.

3. Specify the Trigger Actions, the sequence of actions initiated in event of the trigger condition.

4. Specify the Resolve Actions, the actions performed when trigger conditions have been resolved.

Console servers 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 statusof any attached environmental monitors.

Some models can also log access and communications with network attached hosts and maintain ahistory of the UPS and PDU power status.

If port logs are to be maintained on a remote server, the access path to this location need to be configuredActivate and set the desired levels of logging for each serial and/or network port and/or power and environment UPS.

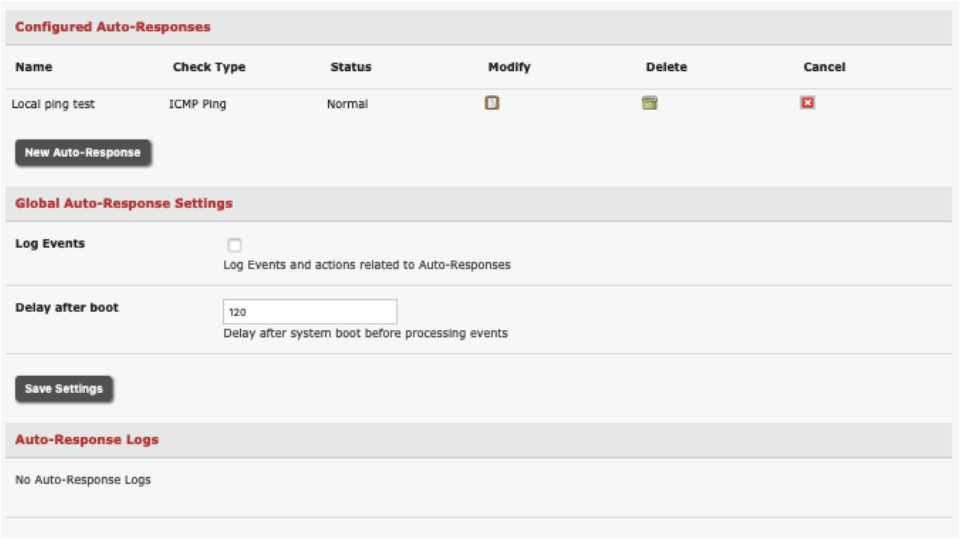
6.1 Configure Auto-Response

With the Auto-Response facility, a sequence of Trigger Actions is initiated in the event of a specified trigger condition (Check Condition). Subsequent Resolve Actions can also be performed when the triggercondition has been resolved.

To configure, set the general parameters that apply to all Auto-Responses:

- Check **Log Events** on **Alerts & Logging > Auto-Response** to enable logging all Auto-Responseactivities.

- Check **Delay after Boot** to set any general delay to be applied after console server systemboot, before processing events.



To configure a new Auto-Response:

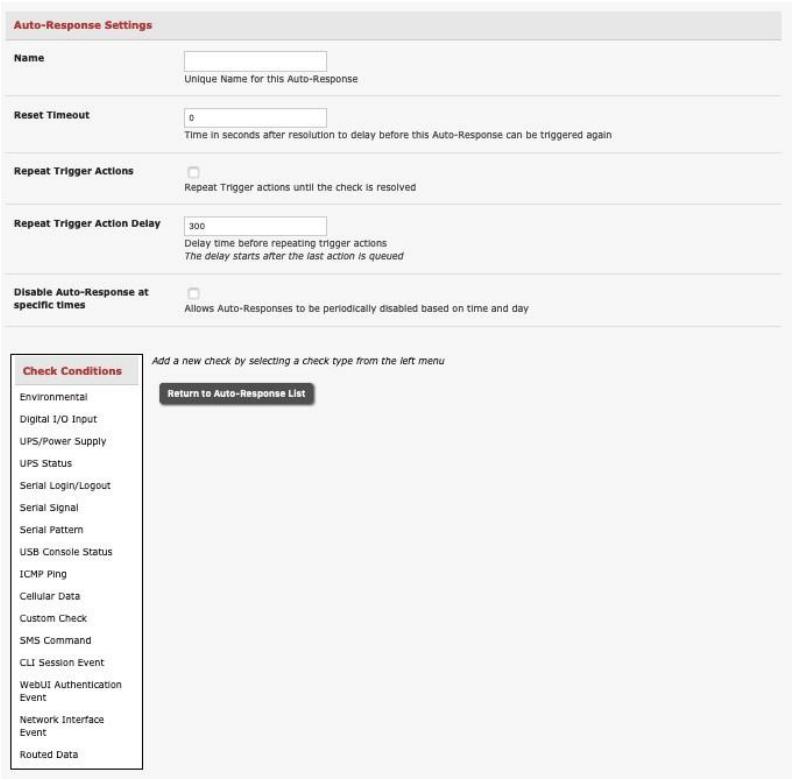
1. Select **New Auto-Response** in the **Configured Auto-Response** field.
   The **Auto-Response Settings** menu appears.

2. Enter a descriptive **Name** for the new Auto-Response.

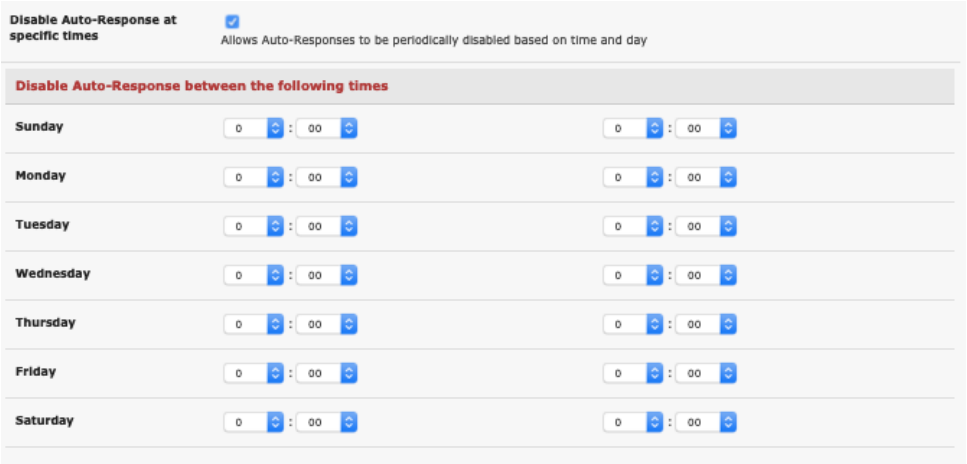
3. Specify the **Reset Timeout** for the time in seconds after resolution to delay before this Auto-Response can be triggered again.

4. Check **Repeat Trigger Actions** to continue to repeat trigger action sequences until the check isresolved.

5. Enter any required delay time before repeating trigger actions in **Repeat Trigger Action Delay**.
   Thisdelay starts after the last action is queued.



Check **Disable Auto-Response at specific times** to periodically disable auto-Responses between specifiedtimes of day.



6.2 Check Conditions

To configure the condition that triggers the Auto-Response:

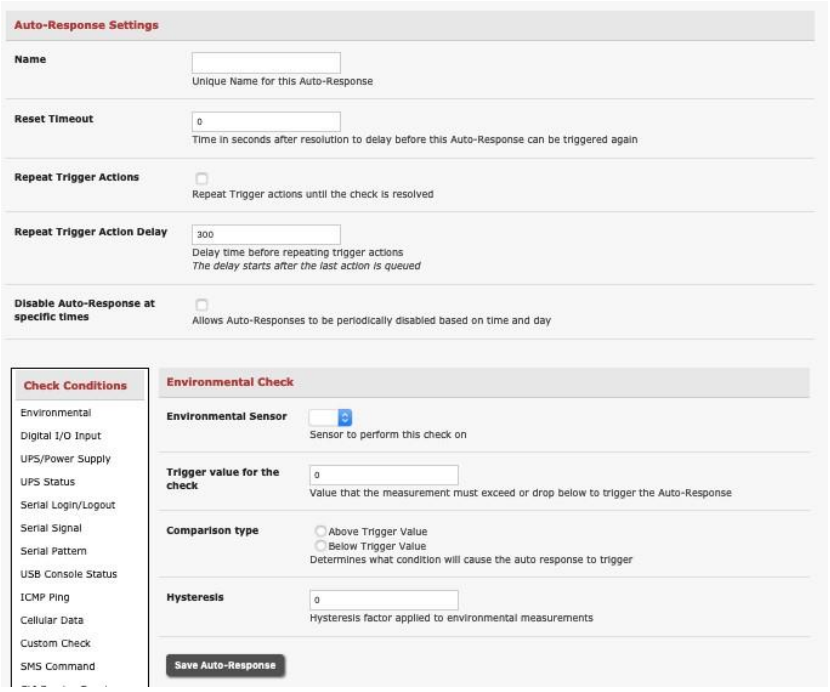
Click on the **Check Condition** type (e.g. Environmental, UPS Status or ICMP ping) to be configured asthe trigger for this new Auto-Response in the **Auto-Response Settings** menu.

6.2.1 Environmental

Before configuring Environmental Checks as the trigger in Auto-Response, configure the Temp and/orHumidity sensors on your attached EMD.

To configure Humidity or Temperature levels as the trigger event:

1. Click on the **Environmental** as the **Check Condition**.



2. In the **Environmental Check** menu, select the **Environmental Sensor** to be checked for thetrigger.

3. Specify the **Trigger value** (in °C / °F for Temp and % for Humidity) that the check measurement must exceed or drop below to trigger the Auto-Response.

4. Select **Comparison type** as being Above Trigger Value or Below Trigger Value to trigger.

5. Specify any **Hysteresis** factor that is to be applied to environmental measurements (e.g. if anAuto-Response is set up with a trigger event of a temp reading above 49°C with a Hysteresis of 4, the trigger condition won't be resolved until the temp reading is below 45°C).

6. Check Save **Auto-Response**.

6.2.2 Alarms and Digital Inputs

Before configuring Alarms / Digital Inputs checks in Auto-Response you first must configure thesensor/DIO that is to be attached to your EMD.

To set the status of any attached Smoke or Water sensors or digital inputs as the trigger event:

1. Click on **Alarms / Digital Inputs** as the **Check Condition**.

2. In the **Alarms / Digital Inputs Check** menu, select the **Alarm/Digital IO Pin** that triggers theAuto-Response.

3. Select **Trigger on Change** to trigger when alarm signal changes, or select to trigger when thealarm signal state changes to either a **Trigger Value** of Open (0) or Closed (1).

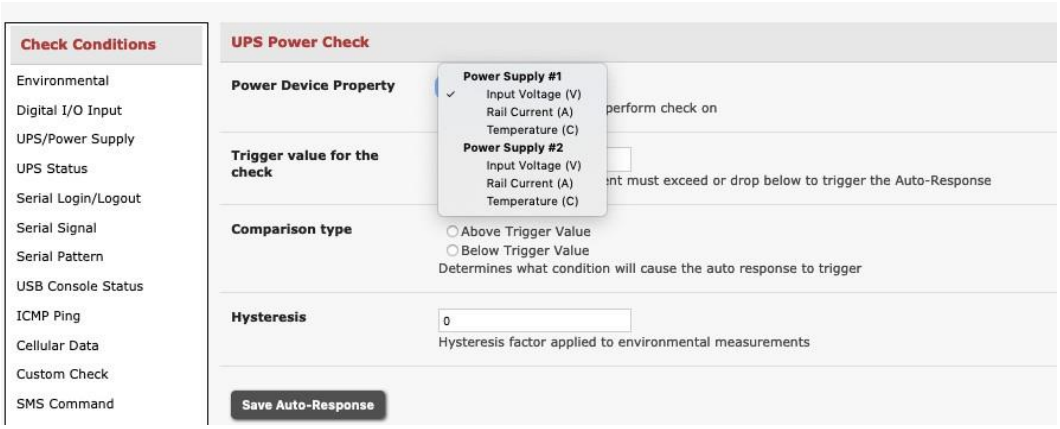
4. Check **Save Auto-Response**.

6.2.3 UPS/Power Supply

Before configuring UPS checks in Auto-Response you first must configure the attached UPS.

To use the properties of any attached UPS as the trigger event:

1. Click on **UPS / Power Supply** as the **Check Condition**.



2. Select UPS **Power Device Property** (Input Voltage, Battery Charge %, Load %, Input

FrequencyHz or Temperature in °C) to be checked for the trigger. Some units have multiple power supplies and allow you to specify **Power Supply #1** or **Power Supply #2**.

3. Specify the **Trigger value** that the check measurement must exceed or drop below to triggerthe Auto-Response.

4. Select Comparison type as being **Above Trigger Value** or **Below Trigger Value** to trigger.

5. Specify any **Hysteresis** factor that is to be applied to environmental measurements (e.g. if anAuto-Response is set up with a trigger event of a battery charge below 20% with a Hysteresisof 5, the trigger condition will not resolve until the battery charge is above 25%).

6. Check Save Auto-Response.

6.2.4 UPS Status

Before configuring UPS state checks in Auto-Response you first must configure the attached UPS.To use the alert state of any attached UPS as the Auto-Response trigger event:

1. Click on UPS Status as the Check Condition.

2. Select the reported **UPS State** to trigger the Auto-Response (either On Battery or Low Battery)**.**The Auto-Response resolves when the UPS state returns to the **Online** state.

3. Select which connected **UPS Device** to monitor and check **Save Auto-Response.**

6.2.5 Serial Login, Signal or Pattern

Before configuring serial port checks in Auto-Response, configure the serial port in Console server mode.Most serial port checks are not resolvable so resolve actions will not be run.

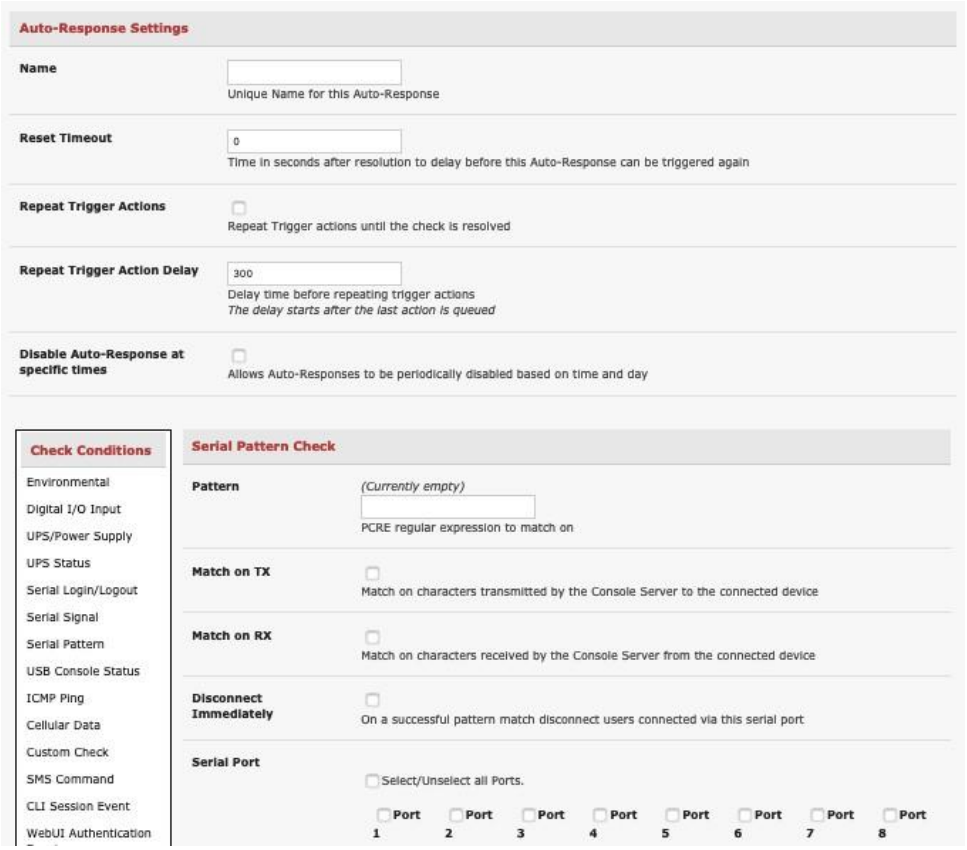
To monitor serial ports and check for login/logout or pattern matches for Auto-Response triggers events:

1. Click on **Serial Login/Logout** as the **Check Condition**. In the **Serial Login/Logout Check** menuselect **Trigger on Login** (to trigger when any user logs into the serial port) or **Trigger on Logout** and specify **Serial Port** to perform check on, and/or.

2. Click on **Serial Signal** as the **Check Condition**. In the **Serial Signal Check** menu select the **Signal** (CTS, DCD, DSR) to trigger on, the **Trigger** condition (either on serial signal change, orcheck level) and specify **Serial Port** to perform check on, and/or.

3. Click on Serial Pattern as the Check Condition. In the Serial Pattern Check menu select the **PCRE** pattern to trigger on and the serial line (**TX** or **RX**) and **Serial Port** to pattern check on.

4. With Serial Pattern, you can check the **Disconnect Immediately** box to disconnect all usersfrom the serial being monitored in event of a successful pattern match.



NOTE: For devices with a cellular modem with GPS enabled, the GPS is displayed as an additional portand can be monitored for trigger events.

5. Check **Save Auto-Response**.

6.2.6 USB Console Status

USB port labels in the Web interface match the USB port labels printed on a console server with two exceptions. Some console servers include pairs of USB ports without printed labels. In this case, the Webinterface denotes them as either Upper or Lower. The Web interface lists them by their physical relationship to each other.

Some console servers have four USB ports. A few of these have ports labeled 1-4 even though the Webinterface denotes them as USB ports A-D.

USB console status checks are not resolvable. Trigger actions run but Resolve actions do not.To monitor USB ports:

1. Click **USB Console Status** as the **Check Condition**.

2. Check the **Trigger on Connect** checkbox, the **Trigger on Disconnect** checkbox, or both checkboxes to set which actions trigger the Auto-Response.

3. Check each USB port to be monitored (or click the **Select/Unselect all Ports** checkbox toselect or deselect all USB ports).

4. Click the **Save Auto-Response** button.

5. Select an option from the **Add Trigger Action** list.

6. Enter a unique **Action Name** for the trigger action being created.

7. Set an **Action Delay Time**.
   By default, this is 0 seconds.

8. Enter the details of the selected action.
   For example, the Send Email action requires aRecipient Email Address and allows for a Subject and Email Text.

9. Click the **Save New Action** button.

6.2.7 ICMP Ping

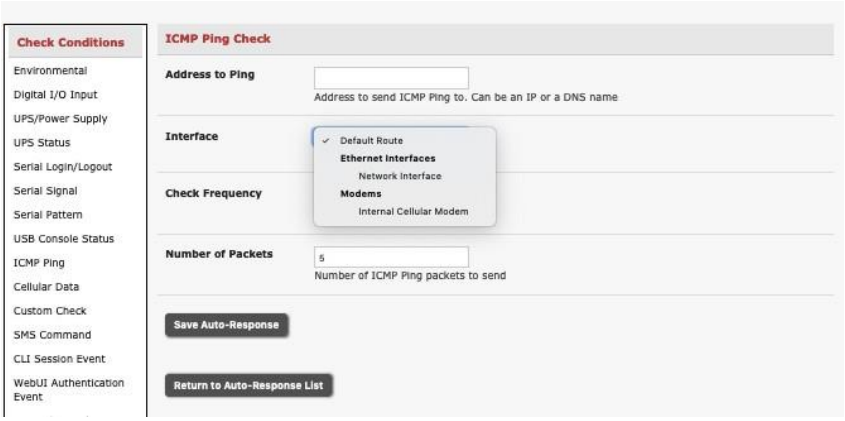
To use a ping result as the Auto-Response trigger event:

1. Click on ICMP Ping as the Check Condition.

2. Specify which **Address to Ping** (i.e. IP address or DNS name to send ICMP Ping to) and which **Interface** to send ICMP Ping from (e.g. Management LAN).

3. Set the **Check Frequency** (i.e. the time in seconds between checks) and the **Number** of ICMPPing packets to send.

4. Check **Save Auto-Response**.



6.2.8 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.

Using LLDP

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

the lldpd daemon. LLDPd is also configured by default to broadcast CDP packets, and monitor both LLDPand CDP neighbors.

When LLDP is granted access to an interface, it uses that interface even if the interface has been disabledvia **System > IP**.

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

NOTE LLDP service can be granted access to non-ethernet interfaces (for example, G3, G4 and PSTNdial-up interfaces), but it currently ignores non-ethernet interfaces.

Customising LLDP

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 placedin /etc/config/lldpd.d/. Custom configuration files — which must have filenames ending with .conf — is read and executed by lldpcli when the LLDP service starts.

NOTE: On Opengear hardware:

- The /etc/ directory is read-only. Most default configuration files otherwise stored in /etc/ are in /etc/config/, which is writeable.
- The default lldpd configuration file — lldpd.conf — is stored in /etc/config/. It is not a safe location to store custom configuration details. There are circumstances in which this file is regenerated automatically, in which customizations will be lost.
- The etc/config/lldpd.d/ directory, which is writable and is created on first boot, is safe to write to. Any Custom LLDP configurations must be stored as *.conf files in this directory.

Security

When enabled, LLDP frames issued by an Opengear Console Manager reveals sensitive information suchas hostname and firmware version.

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

Documentation

Both lldpd and lldpcli have standard man pages but, because of space concerns, these man pages are notshipped with Opengear hardware.

Both man pages are available on the lldpd project web-site:

man lldpd.

man lldpcli.

6.2.9 Cellular Data

Before configuring cellular data checks in Auto-Response the internal cellular modem must be configuredand detected by the console server.

This check monitors the aggregate data traffic inbound and outbound through the cellular modem as anAuto-Response trigger event.

Click on **Cellular Data** as the **Check Condition.**

6.2.10 Custom Check

This check allows users to run a nominated custom script with nominated arguments whose return valueis used as an Auto-Response trigger event:

1. Click on Custom Check as the Check Condition

2. Create an executable trigger check script file e.g.
   /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

   See online FAQ for a sample web page html check and other script file templates.

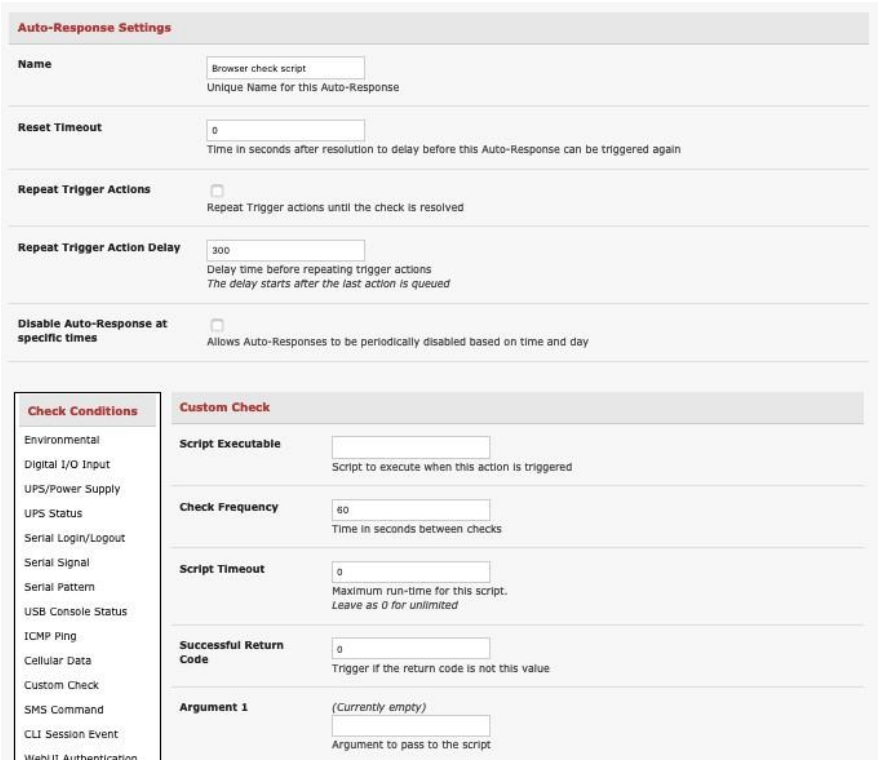
3. Enter the **Script Executable** file name (e.g. /etc/config/test.sh).

4. Set the **Check Frequency** (i.e. the time in seconds between re-running the script) and the **Script Timeout** (i.e. the maximum run-time for the script).

5. Specify the **Successful Return Code**. An Auto-Response is triggered if the return code fromthe script is not this value.

6. Enter **Arguments** that are to be passed to the script (e.g. with a web page html check script,these Arguments might specify the web page address/DNS and user logins).

7. Check **Save Auto-Response**.



6.2.11 SMS Command

The SMS command trigger condition can only be set if there is an internal cellular modem.

An incoming SMS command from a nominated caller can trigger an Auto-Response:

1. Click on SMS Command as the Check Condition.

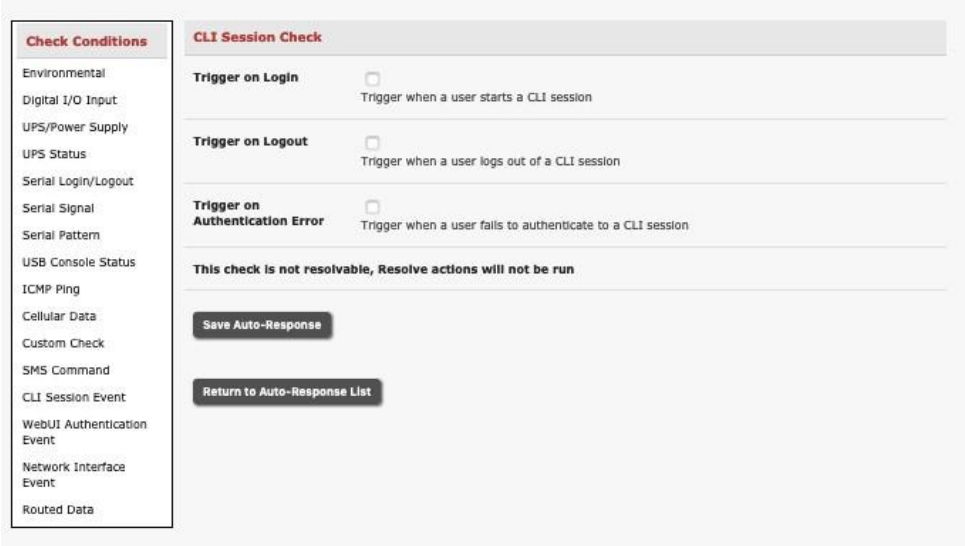
2. Specify which **Phone Number** (in international format) of the phone sending the SMS message.For multiple trusted SMS sources separate the numbers with a comma.

3. Set the **Incoming Message Pattern** (PCRE regular expression) to match to create trigger event.

6.2.12 CLI Log In/Out Check

To configure a CLI Login/Out check:

1. Click on the **CLI Session Event** as the **Check Condition**.



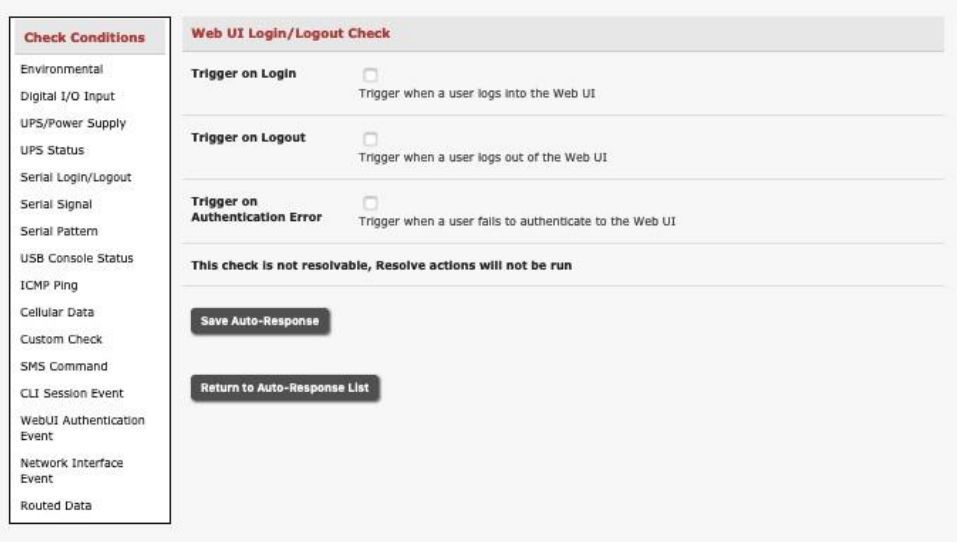
2. Check **Trigger on Login (Logout)** to trigger when a user logs into (or out of) the CLI.

3. Check **Trigger on Authentication Error** to trigger when a user fails to authenticate to the CLI.This check is not resolvable so Resolve actions are not run.

6.2.13 Web UI Log In/Out Check

To configure Web Log In/Out as the trigger event:

1. Click on the **Web UI Authentication** as the **Check Condition**.



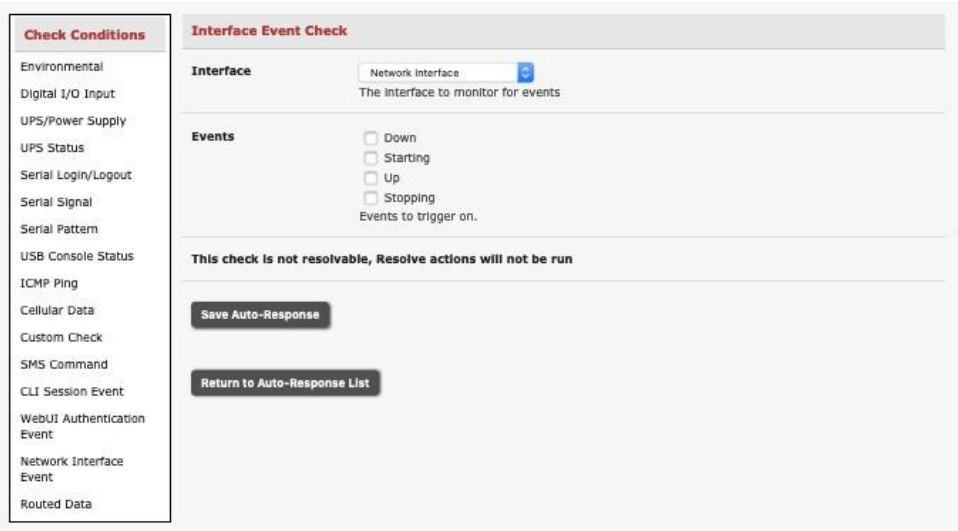
2. Check **Trigger on Login (Logout)** to trigger when a user logs into (or out of) the Web UI.

3. Check **Trigger on Authentication Error** to trigger when a user fails to authenticate to the WebUI. This check is not resolvable so Resolve actions are not run.

6.2.14 Network Interface Event

You may wish to configure a change in the network status as the trigger event (e.g. to send an alert orrestart a VPN tunnel connection):

1. Click on **Network Interface** as the **Check Condition**.



2. Select the **Interface** (Ethernet /Failover OOB Interface or Modem or VPN) to monitor.

3. Check what type of network interface **Event** to trigger on (interface Down, Starting, Up orStopping). This check is not resolvable so Resolve actions are not run.

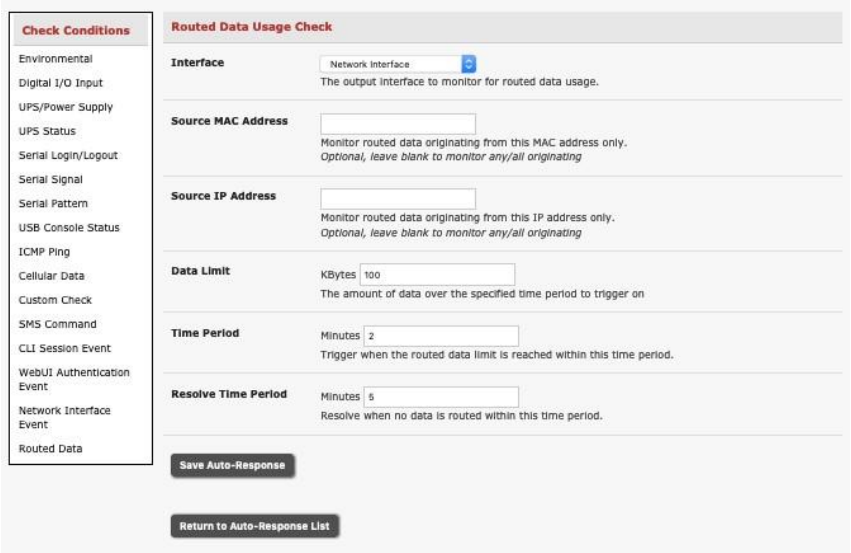
6.2.15 Routed Data Usage Check

This check monitors the specified input interface for data usage that is being routed through theOpengear and out another interface such as the Internal Cellular Modem.

It is useful in IP Passthrough mode to detect when the downstream router has failed over

and is routingvia the Opengear's modem as a backup connection.

This check may be configured with these parameters:

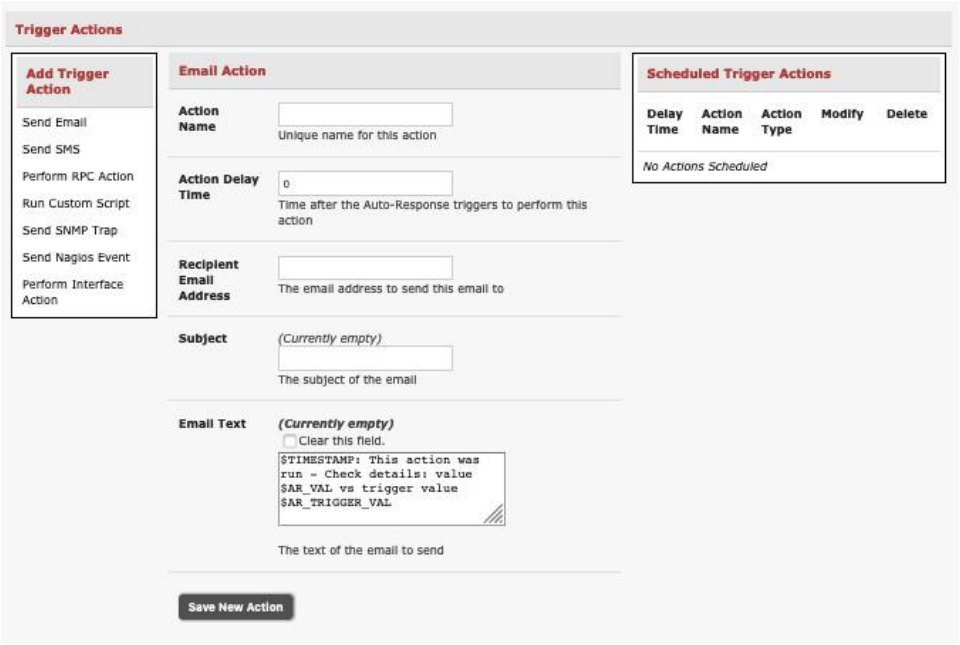


- The Opengear's incoming **Interface** to monitor.
- An optional **Source MAC/IP Address**, to monitor traffic from a host.
- **Data Limit** threshold, the Auto-Response triggers when this is reached in the specified **TimePeriod.**
- The Auto-Response resolves if no matching data is routed for the **Resolve Period.**

6.3 Trigger Actions

To configure the sequence of actions to take in the event of the trigger condition:

1. For a nominated Auto-Response with a defined Check Condition, click on **Add Trigger Action**to select the action type to take. Configure the selected action as detailed in the following sections.
2. **Action Delay Time** specifies how many seconds after the Auto-Response trigger event to waitbefore performing the action. You can add follow-on actions to create a sequence of actions taken in the event of the trigger condition.



3. To edit or delete an existing action, click the **Modify** (or **Delete**) icon in the **Scheduled TriggerAction** table.

A message text can be sent with Email, SMS and Nagios actions. This configurable message can includeselected values:

$AR_TRIGGER_VAL: the trigger value for the check e.g. for UPS Status, it could be onbatt or battlow.

$AR_VAL: the value returned by the check e.g. for ups status, it could be online/onbatt/battlow.

$AR_CHECK_DEV: the device name of the device being checked e.g. 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 triggervalue $AR_TRIGGER_VAL.

6.3.1 Send Email

1. Click on **Send Email** as the **Add Trigger Action**. Enter a unique **Action Name** and set the **Action Delay Time**.

2. Specify the **Recipient Email Address** to send this email to and the **Subject** of the email. Formultiple recipients you can enter comma separated addresses.

3. Edit the **Email Text** message to send and click **Save New Action.**

An SMS alert can also be sent via an SMTP (email) gateway. Enter the Recipient Email Address in theformat specified by the gateway provider (e.g. for T-Mobile it is phone number @tmomail.net).

6.3.2 Send SMS

An SMS alert can only be sent if there is an internal cellular modem.

1. Click on **Send SMS** as the **Add Trigger Action**.
2. Enter a unique **Action Name** and set the **ActionDelay Time**.
3. Specify the **Phone number** that the SMS will be sent to in international format (without the +).
4. Edit the **Message Text** to send and click **Save New Action**.

NOTE: SMS alerts can also be sent via a SMTP SMS gateway as described above.

6.3.3 Perform RPC Action

1. Click on **Perform RPC Action** as the **Add Trigger Action**.
2. Enter a unique **Action Name** and setthe **Action Delay Time**.
3. Select a power **Outlet** and specify the **Action** to perform (power on, off, or cycle).
4. Click **Save New Action**.

6.3.4 Run Custom Script

1. Click on **Run Custom Script** as the **Add Trigger Action**.
2. Enter a unique **Action Name** and setthe **Action Delay Time**.
3. Create a script file to execute when this action is triggered and enter the **Script Executable** filename e.g. /etc/config/action.sh.
4. Set the **Script Timeout** (i.e. the maximum run-time for the script). Leave as 0 for unlimited.
5. Enter any **Arguments** to pass to the script and click **Save New Action.**

6.3.5 Send SNMP Trap

Click on Send SNMP Trap as the Add Trigger Action. Enter a unique Action Name and set the ActionDelay Time.

The SNMP Trap actions are valid for Serial, Web UI & CLI Login, Environmental, UPS and Cellular datatriggers.

6.3.6 Send Nagios Event

1. Click on **Send Nagios Event** as the **Add Trigger Action**.
2. Enter a unique **Action Name** and setthe **Action Delay Time**.
3. Edit the **Nagios Event Message** text to display on the Nagios status screen for the service.

4. Specify the **Nagios Event State** (OK, Warning, Critical or Unknown) to return to Nagios for thisservice.

5. Click **Save New Action**.

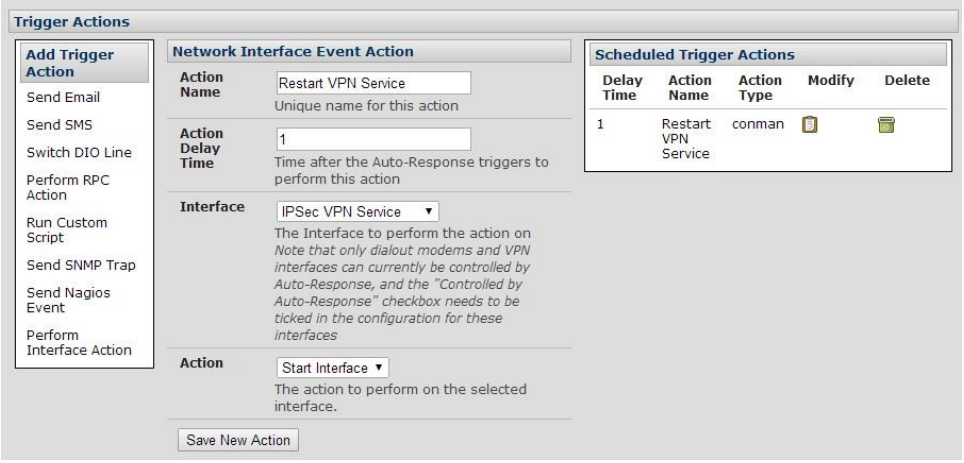
NOTE: To notify the central Nagios server of Alerts, NSCA must be enabled under **System > Nagios** andNagios must be enabled for each applicable host or port..

6.3.7 Perform Interface Action

1. Click on **Perform Interface Action** as the **Add Trigger Action**.

2. Enter a unique **Action Name** andset the **Action Delay Time**.

3. **Select the Interface** (Modem or VPN service) and the **Action** (Start or Stop Interface) to take.
   You can start an IPsec VPN service in response to an incoming SMS or set up an OpenVPN tunnel whenever your Opengear device fails over to use the cellular connection.

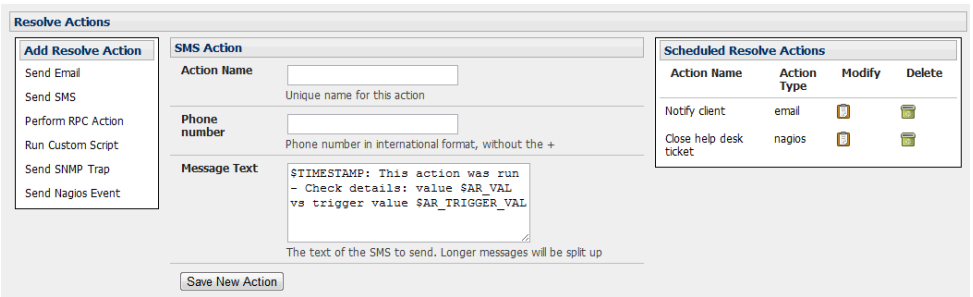


NOTE: If any IPsec service or OpenVPN tunnel is to be controlled by the Network Interface Event Action, check the **Control by Auto-Response** box when configuring that service. Once selected,the default state for the VPN tunnel / service is Down.

6.4 Resolve Actions

Actions can be scheduled when a trigger condition has been resolved. Resolve Actions are configured inthe same way as Trigger Actions.

For a nominated Auto-Response - with a defined trigger Check Condition - click on **Add Resolve Action** (e.g. Send Email or Run Custom Script) to select the action type to take.



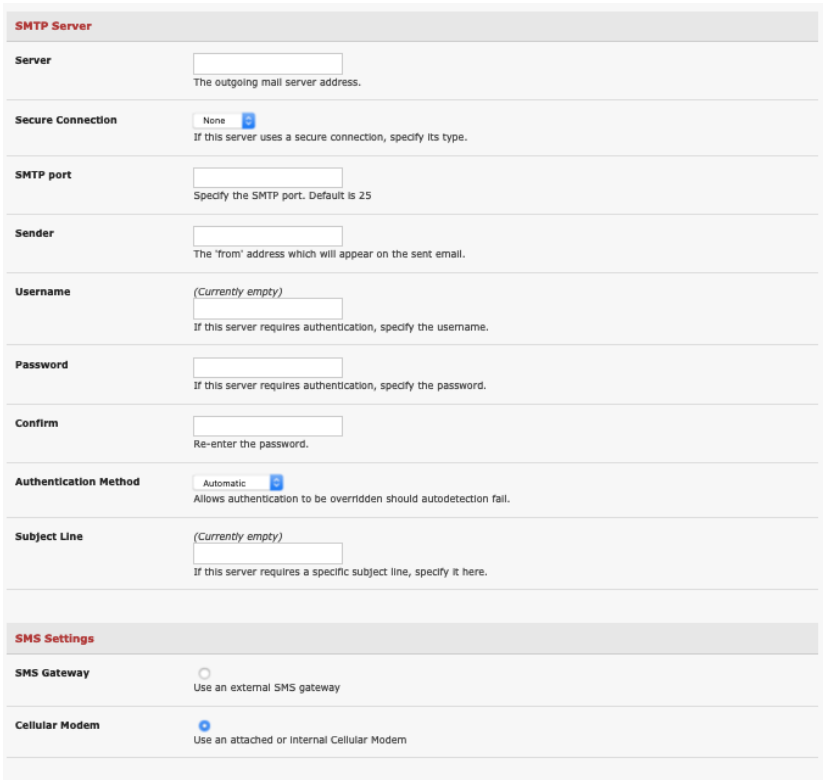
6.5 Configure SMTP, SMS, SNMP and/or Nagios service for alert notifications

The Auto-Response facility enables sending remote alerts as Trigger and Resolve Actions. Before alertnotifications can be sent, you must configure the nominated alert service.

6.5.1 Send Email alerts

The console server uses SMTP (Simple Mail Transfer Protocol) for sending the email alert notifications.To use SMTP, an administrator must configure a valid SMTP server for sending the email:

1. Select **Alerts & Logging > SMTP & SMS**.



2. In the **SMTP Server** field enter the IP address of the outgoing mail **Server.**

3. If this mail server uses a **Secure Connection**, specify its type. You may also specify the IP port touse for SMTP. The default **SMTP Port** is 25.

4. Enter a **Sender** email address which appears as the **from** address in all email notifications sentfrom this console server.

5. Enter a **Username** and **Password** if the SMTP server requires authentication.

6. Specify the **Subject Line** for the email.

7. Click **Apply** to activate SMTP.

6.5.2 Send SMS alerts

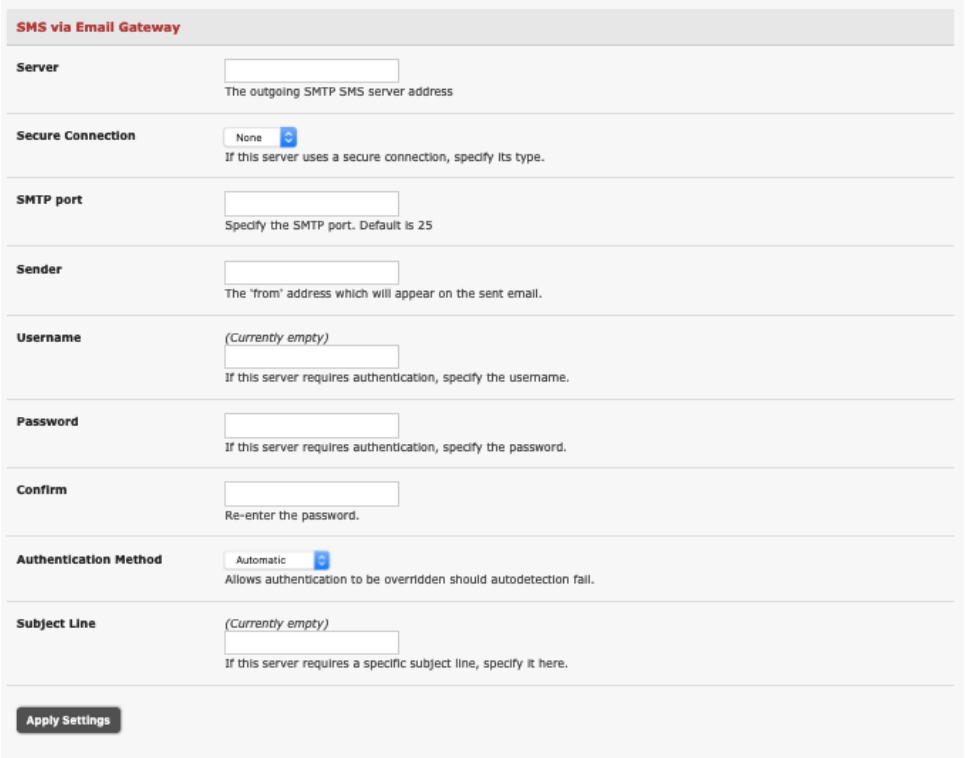
You can use email-to-SMS services to send SMS alert notifications to mobile devices. Almost all mobile phone carriers provide an SMS gateway service that forwards email to

mobile phones on their networks.There's also a wide selection of SMS gateway aggregators who provide email to SMS forwarding to phones on any carriers.

Alternately if your console server has an embedded or externally attached cellular modem, you have theoption to send the SMS directly over the carrier connection.

SMS via Email Gateway

To use SMTP SMS, an administrator must configure a valid SMTP server for sending the email:



1. In the SMTP Settings field in the Alerts & Logging > SMTP &SMS menu select SMS Gateway.
   An SMS via Email Gateway field appears.

2. Enter the IP address of the outgoing mail **Server** SMS gateway.

3. Select a **Secure Connection** (if applicable) and specify the **SMTP port** (if other than the defaultport 25).

4. Enter a **Sender** email address as the **from** address in all email notifications sent from this consoleserver. Some SMS gateway service providers only forward email to SMS when the email has beenreceived from authorized senders.

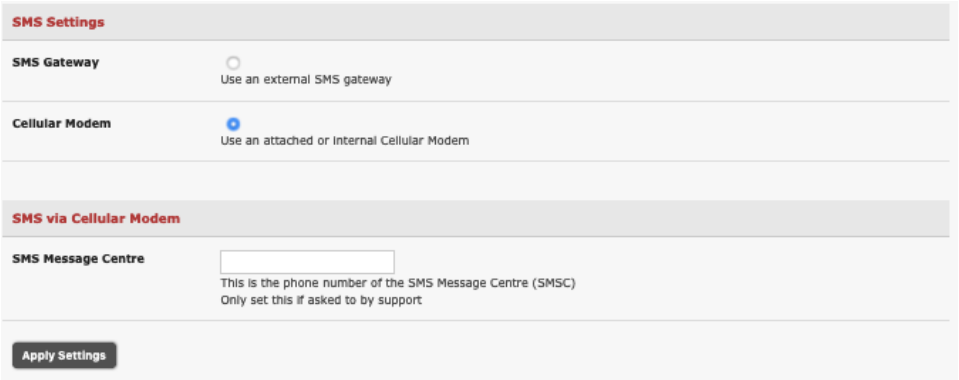
5. Enter a **Username** and **Password** as some SMS gateway service providers use SMTP serverswhich require authentication.

6. Enter the **Subject Line** for the email. The email subject will contain a truncated version of the alertnotification message, contained in full in the body of the email. Some SMS gateway service providers require blank subjects or authentication headers included in the subject line.

7. Click **Apply Settings** to activate SMS-SMTP connection.

SMS via Cellular Modem

To use an attached or internal cellular modem for SMS, an administrator must enable SMS:

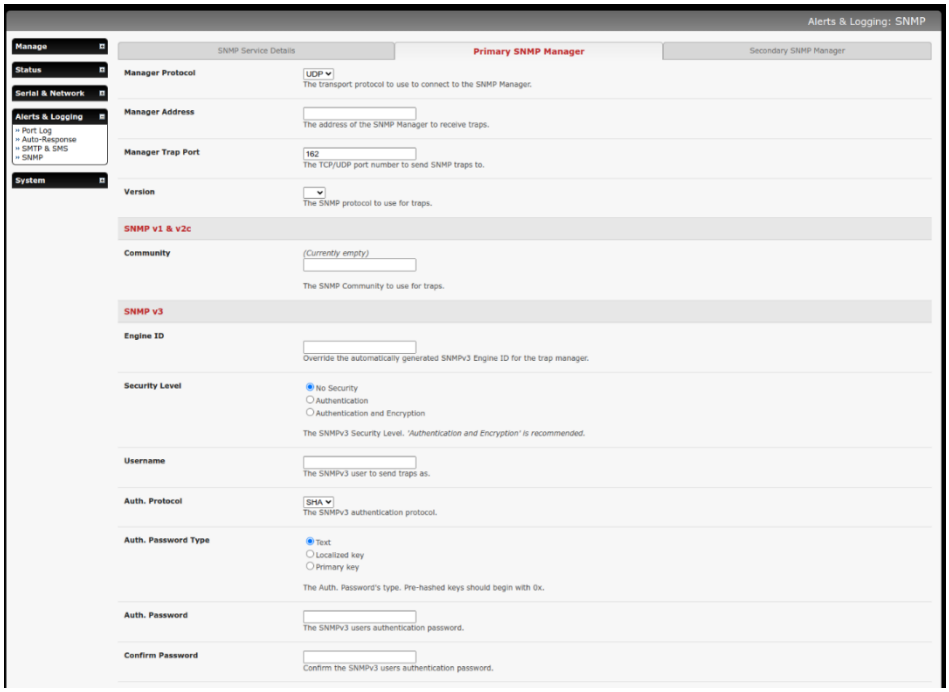


1. Select **Cellular Modem** in the **SMS Settings** field.
2. You may need to enter the phone number of the carrier's **SMS Message Centre** if advised by yourcarrier or Support.
3. Click **Apply Settings** to activate SMS-SMTP connection.

6.5.3 Send SNMP Trap alerts

An administrator can configure the Simple Network Management Protocol (SNMP) agent that resides onthe console server to send SNMP trap alerts to an NMS management application:

1. Select Alerts & Logging > SNMP
2. Select **Primary SNMP Manager** tab.
   The Primary and Secondary SNMP Manager tabs are used to configure where and how outgoing SNMP alerts and notifications are sent. If you require your consoleserver to send alerts via SNMP, at a minimum, 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.



3. Select the **Manager Protocol.** SNMP is generally a **UDP**-based protocol though infrequently it uses **TCP** instead.

4. Enter the host address of the SNMP Network Manager into the **Manager Address** field.

5. Enter the TCP/IP port number into the **Manager Trap Port** field (default =162).

6. Select the **Version** to use. The console server SNMP agent supports SNMP v1, v2 and v3.

7. Enter the **Community** name for SNMP v1 or SNMP v2c. Set a community for either SNMP v1 or v2c traps to work. An SNMP community is the group to which devices and management stations running SNMP belong and defines where information is sent. SNMP default communities are private for Writeand public for Read.

8. Configure **SNMP v3** if required. 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 is rejected unless the SNMPv3 user sending the trap already exists in the user database onthe SNMP Manager. The user database in a SNMP v3 application is 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 as a hex number e.g. 0x8000000001020304.

   - Specify the **Security Level**. The level of security has to be compatible with the settings of theremote SNMP Network Manager.

     noAuthNoPriv No authentication or encryption.

     authNoPriv Authentication only. An authentication protocol (SHA or MD5)and password is required.

     authPriv Uses both authentication and encryption. This is the highest levelof security and requires an encryption protocol (DES or AES) and password in addition to the authentication protocol and 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 consoleserver for SNMPv3.

   - An **Authentication Protocol (SHA** or **MD5**) and **Authentication Password** must be given for aSecurity Level of either **authNoPriv** or **authPriv**. The password must contain at least 8 characters.

   - A **Privacy Protocol** (**DES** or **AES**) must be specified for the **authPriv** level of security used as the encryption algorithm. AES is recommended for stronger security. A password of at least 8characters must be provided for encryption to work.

9. Click **Apply**.

6.5.4 Send Nagios Event alerts

To notify the central Nagios server of Alerts, NSCA must be enabled under **System > Nagios** and Nagiosmust be enabled for each applicable host or port under **Serial & Network > Network Hosts** or **Serial & Network > Serial Ports.**

> **NOTE:** In Lighthouse, 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 is sent to the central Nagios server. This condition is displayed on the Nagios status screen and

triggers a notification, which can cause the Nagios central server to send out an email or an SMS, page, etc.

6.6 Customize an SNMP Interface Description

SNMP interface names may be customized so that they are more recognizable to users; the customized SNMP descriptions will override the automated interface identifiers when displayed. Customized SNMPs can be retrieved via an *snmpwalk*.

NOTE: If no SNMP description override is implemented, the interface description will remain as its default interface name.

Use the following procedure to override the SNMP Interface description with a customized name:

1. Login.
2. In the Navigation Bar, select **Alerts & Logging > SNMP**.
3. Select the **SNMP Service Details** tab.
4. In the **Enable** row, click the check box to **'Enable the SNMP service'**.
5. Open a terminal window: **Manage > Terminal** and click on the **Click here** highlighted text.
6. Scroll down the Service Settings list to **Enable Web Terminal** and click the check box to 'Allow web browser access to the system command line shell via **Manage > Terminal.**
7. Click **Apply** to apply the change you made.
8. Return to the terminal window and left click to place the cursor in the terminal window.
9. Press **Enter** to get a Login prompt (it may be necessary to re-click on the Terminal launcher in the Navigation Bar).
10. Enter your Password.
11. Change directory - *cd /etc/snmp*.
12. Execute a list command: *ls -lrt*.
13. Run snmpwalk: *snmpwalk -v2c -c public -M mibs localhost IF-MIB::ifDescr* (SNMP interfaces are listed).
14. For the interface name you want to override (example, loopback interface, WAN interface, LAN interface):

    config -s config.system.snmp.ifdescr.lo="Loopback Interface"
    config -s config.system.snmp.ifdescr.wan="WAN Interface"
    config -s config.system.snmp.ifdescr.lan="Management LAN Interface"
    config -s config.system.snmp.ifdescr.oobfo
    config -s config.system.snmp.ifdescr.modem
    config -s config.system.snmp.ifdescr.cellmodem
    config -s config.system.snmp.ifdescr.openvpn

15. Re-run the SNMP configurator: config *-r snmp*.

16. Press **Enter**.
    The complete configurator list is displayed.

17. Run grep to display the override changes you made, for example:
    grep override /etc/config/snmpd.conf

Useful SNMP Override command examples:

Override the Default Interface Description & Run Configurator: `config -s config.system.snmp.ifdescr.wan="Network Interface" -r snmp`

Run SNMP Commands To Get MIB Tables With Info:
The overridden ifDescr strings can be accessed by the following command:
 	
`snmpwalk -v 2c -c public -M mibs_5.x 10.0.0.127 IF-MIB::ifDescr`
or
`snmptable -v 2c -c public -M mibs_5.x 10.0.0.127 IF-MIB::ifTable`
Where "-M mibs_5.x" specifies the path for all MIB files and the "10.0.0.127" is the IP address of the device.

Stop overriding an interface's ifDescr OID, by removing the relevant config variable and running the snmp configurator: `config -d config.system.snmp.ifdescr.wan -r snmp`

6.7 Logging

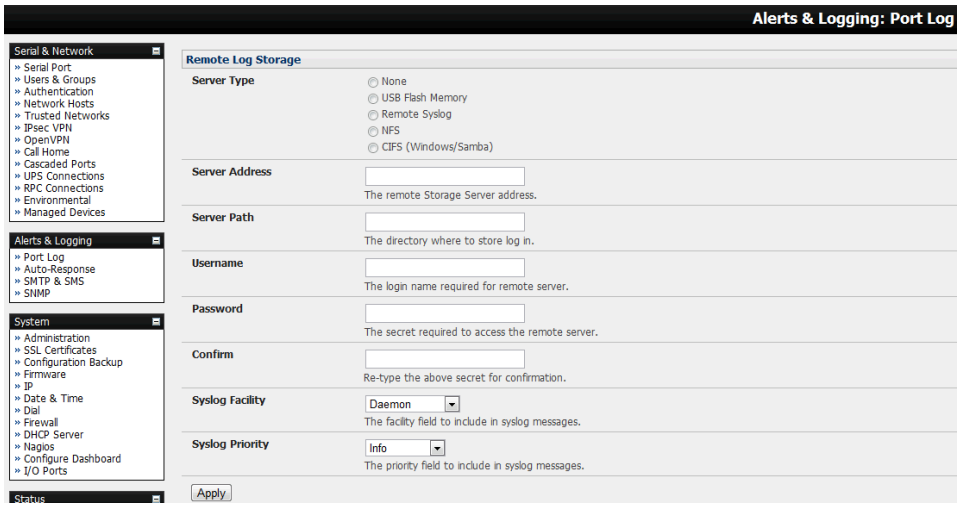
The console server can maintain log records of auto-response events and log records of all access andcommunications events (with the console server and with the attached serial, network and power devices).

A log of all system activity is also maintained by default, as is a history of the status of any attachedenvironmental monitors.

6.6.1 Log storage

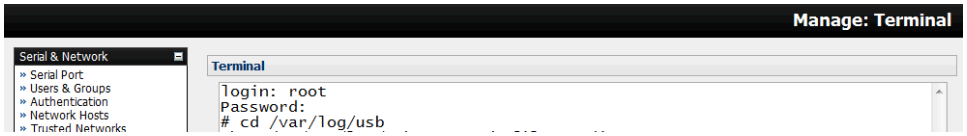
Before activating any Event, Serial, Network or UPS logging, you must specify where to save those logs.These records are stored off-server or in the ACM/IM gateway USB flash memory.

Select the **Alerts & Logging > Port Log** menu option and specify the **Server Type** and the details to enablelog server access.



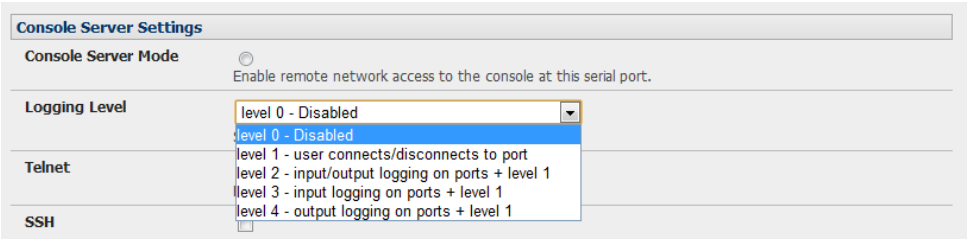
From the **Manage > Devices** menu, administrators can view serial, network and power device logs stored in the console reserve memory (or flash USB). Non-admin users only see logs for managed devices for which they ortheir group have access privileges.

Event logs on the USB can be viewed using the web terminal or by SSH/Telnet connecting to the consoleserver.



6.6.2 Serial port logging

In Console server mode, activity logs can be maintained of all serial port activity. To specify which serialports are to have activities recorded and to what level of data to log:



1. Select Serial & Network > Serial Port and Edit the port to log

2. Specify the **Logging Level** of for each port as:

   Level 0 Turns off logging for the selected port.

   Level 1 Logs all user connection events to the port.

   Level 2 Logs all data transferred to and from the port and all changes in hardware flowcontrol status and all user connection events.

   Level 3 Logs all data transferred from the port and all changes in hardware flow controlstatus and all user connection events.

   Level 4 Logs all data transferred to the port and all changes in hardware flow control status and all user connection events.

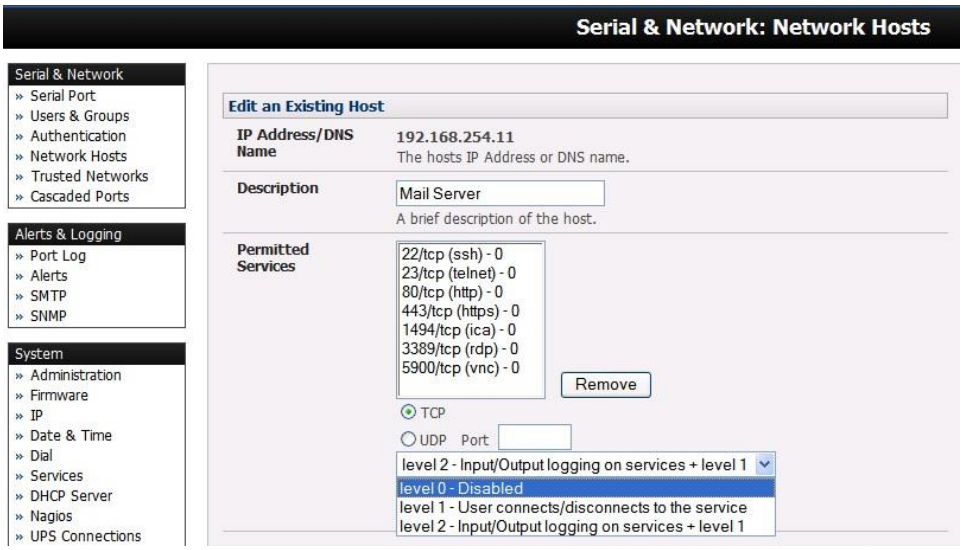
3. Click **Apply**.

> **NOTE:** A cache of the most recent 8K of logged data per serial port is maintained locally (in addition to the logs which are transmitted for remote/USB flash storage). To view the local cache of loggedserial port data select **Manage > Port Logs.**

6.6.3 Network TCP and UDP port logging

The console server support optional logging of access to and communications with network attachedHosts.

1. For each Host, when you set up the Permitted Services are authorized, you also must set up thelogging level for each service.



2. Specify the logging level that for that particular TDC/UDP port/service, on that particular Host:

   Level 0 Turns off logging for the selected TDC/UDP port to the selected Host.

   Level 1 Logs all connection events to the port.

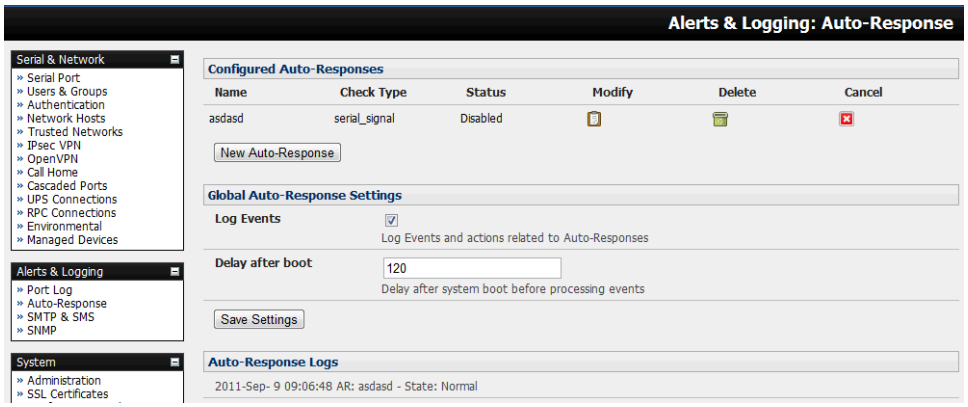
   Level 2 Logs all data transferred to and from the port.

3. Click **Add**.

4. Click **Apply**.

6.6.4 Auto-Response event logging

Check **Log Events** on **Alerts & Logging > Auto-Response** to enable logging all Auto-Response activities.



6.6.5 Power device logging

The console server also logs access and communications with network attached hosts and maintain ahistory of the UPS and PDU power status.

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 environmentsusing 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'spower management software. RPCs include power distribution units (PDUs) and IPMI power devices.

Serial PDUs can be controlled using their command line console, so you can manage the PDU through theconsole server using a remote Telnet client or proprietary software tools supplied by the vendor. This generally runs on a remote Windows PC and you could configure the console server serial port to operatewith a serial COM port redirector in the PC. Network-attached PDUs can be controlled with an SNMP management package or using the vendor supplied control software. Servers and network-attached appliances with embedded IPMI service processors or BMCs are supplied with their own management tools (like SoL) that provide secure management.

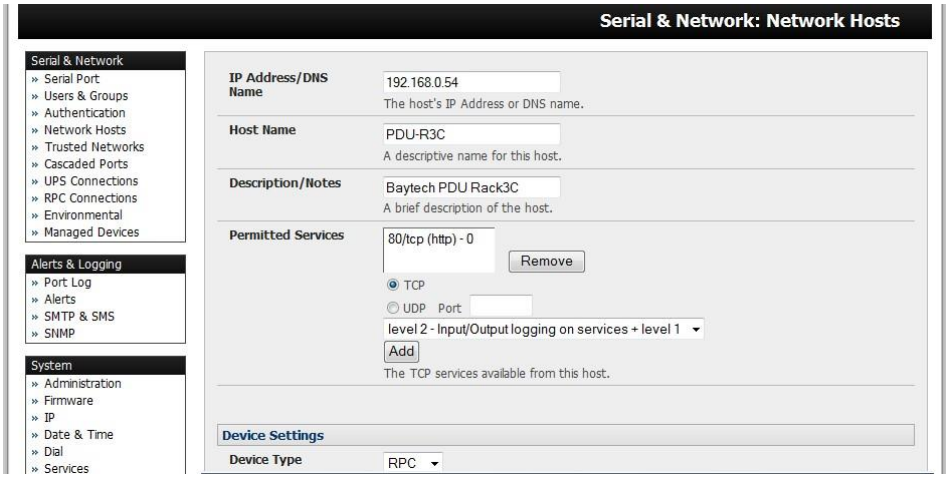
All of these devices can be controlled through the one window using the Management Console's RPCremote power control tools.

7.1.1 RPC connection

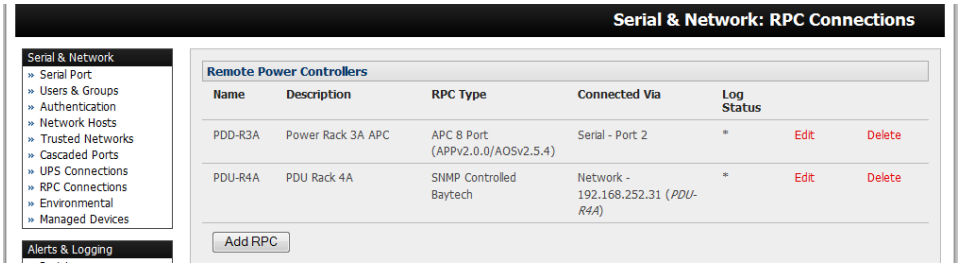
Serial and network connected RPCs must first be connected to, and configured to communicate with theconsole server:

1. For serial RPCs connect the PDU to the selected serial port on the console server and from the **Serial & Network > Serial Port** menu configure the **Common Settings** of that port with the RS232properties required by the PDU. Select **RPC** as the **Device Type.**

2. For each network connected RPC go to **Serial & Network > Network Hosts** menu and configurethe RPC as a connected Host by specifying it as **Device Type > RPC** and clicking **Apply.**



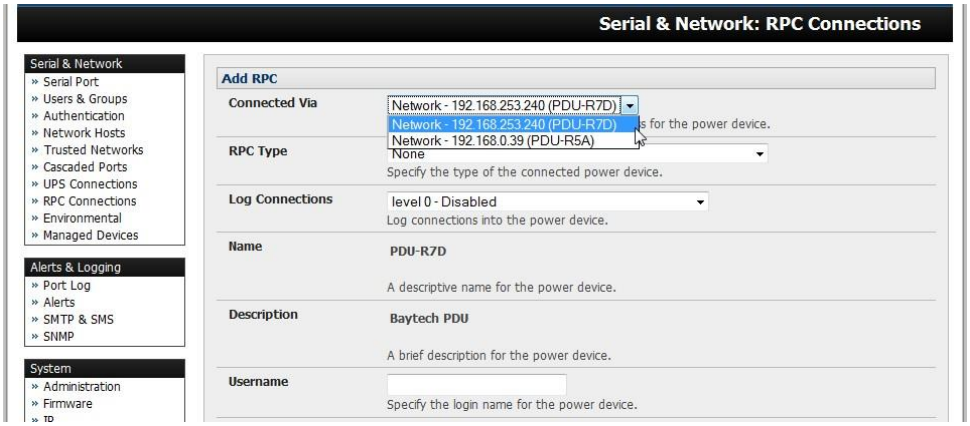
3. Select the **Serial & Network > RPC Connections** menu.
   This displays the RPC connections thathave already been configured.



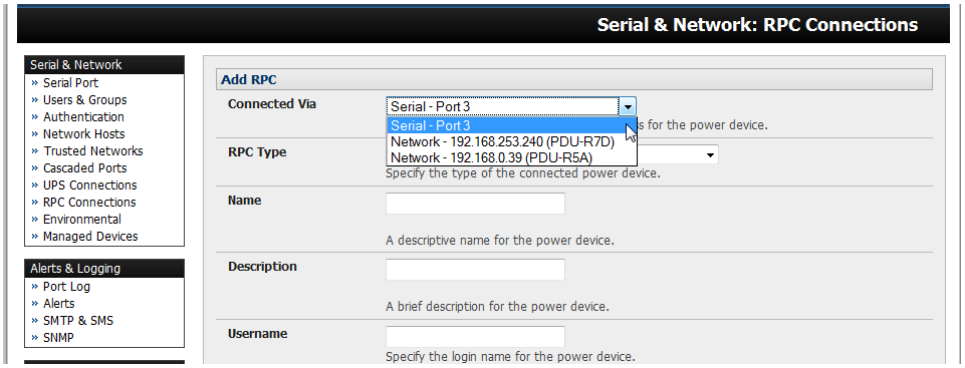
4. Click Add RPC

5. **Connected Via** presents a list of serial ports and network Host connections that you have set upwith device type RPC (but have yet to connect to a specific RPC device):

    - If you select **Connect Via** for a Network RPC connection, enter the Host Name/Descriptionthat you set up for that connection as the **Name** and **Description** for the power device.

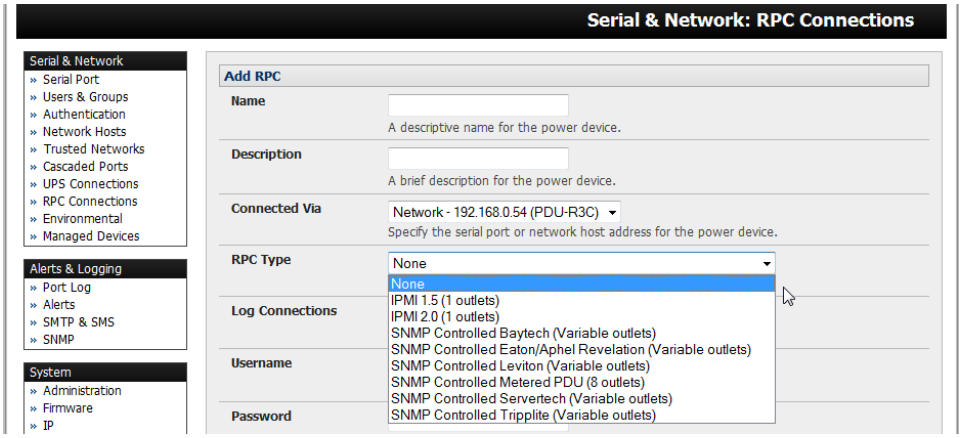


    - If you select **Connect Via** a Serial connection, enter a **Name** and **Description** for the powerdevice.

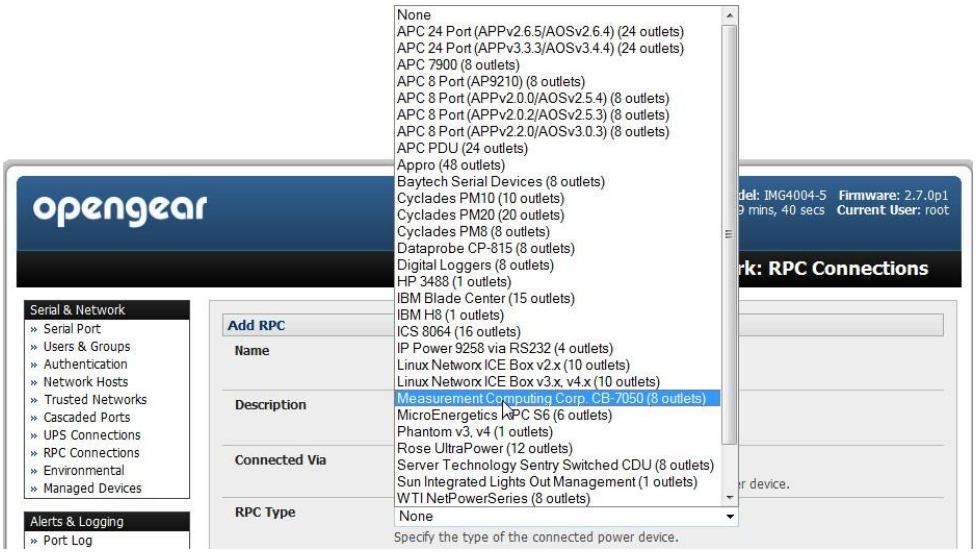


6. Select the appropriate **RPC Type** for the PDU (or IPMI) being connected:

    - If you are connecting to the RPC via the network, you will be presented with the IPMI protocoloptions and the SNMP RPC Types supported by the embedded Network UPS Tools.

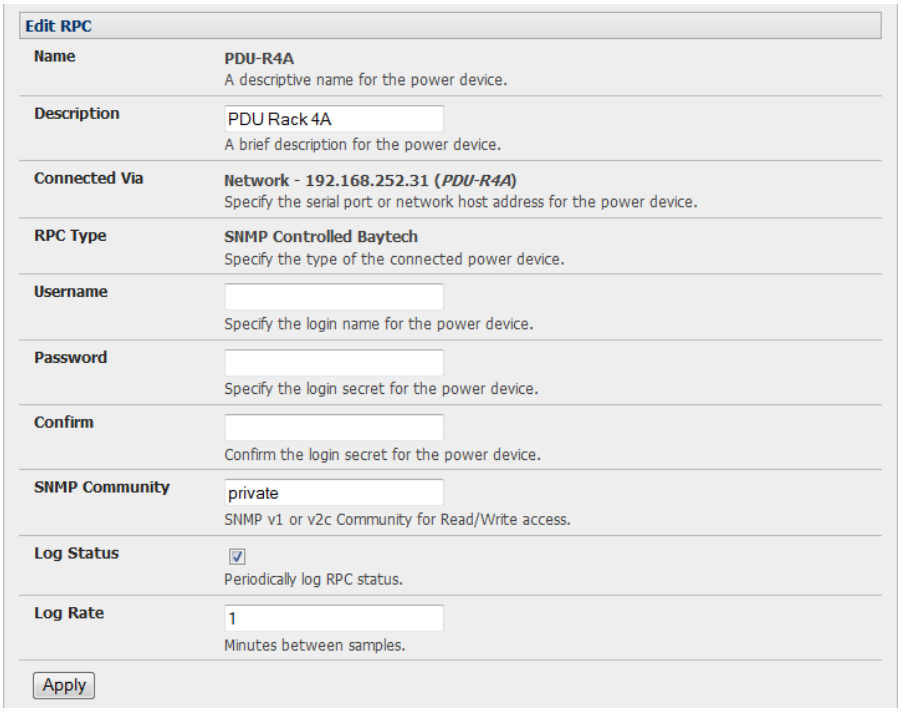


- If you are connecting to the RPC by a serial port, you will be presented with all the serial RPCtypes supported by the embedded PowerMan and Opengear's power manager:



7. Enter the **Username** and **Password** used to login into the RPC. These login credentials are not related the users and access privileges you configured in **Serial & Networks > Users & Groups**.

8. If you selected SNMP protocol, enter the SNMP v1 or v2c Community for Read/Write access. Bydefault, this is *private*.



9. Check **Log Status** and specify the **Log Rate** if you wish to log the status from this RPC. These logscan be viewed from the **Status > RPC Status** screen.

10. Click **Apply**.

11. For SNMP PDUs the console server probes the configured RPC to confirm the RPC Type matchesand will report the number of outlets it finds that can be controlled. If unsuccessful it will report **Unable to probe outlets** and you'll need to check the RPC settings or network/serial connection.

12. For serially connected RPC devices, a new managed device with the same name as given to theRPC will be created.
The console server will configure the RPC with the number of outlets specified in the selected RPC Type or will query the RPC for this information.

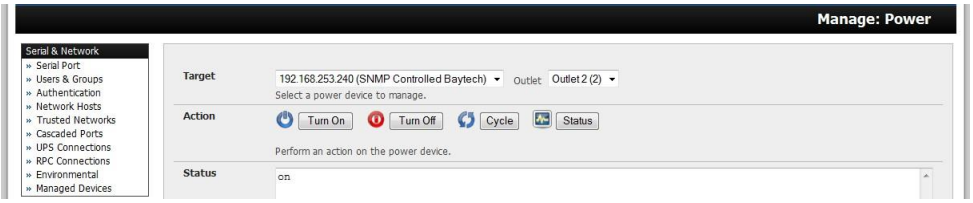
> **NOTE:** Opengear's console servers support the majority of the popular network and serial PDUs. If your PDU is not on the default list, support can be added directly or by having the PDU added to either the Network UPS Tools or PowerMan open-source projects.

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, an administrator enters the IP address/domain name of the BMC or service processor (e.g. a Dell DRAC) in Serial & Network > Network Hosts, in Serial & Network > RPC Connections specifies the RPC Type to be IPMI1.5 or 2.0

7.1.2 RPC access privileges and alerts

Set PDU and IPMI alerts using **Alerts & Logging > Alerts**. You can also assign which user can access andcontrol which particular outlet on each RPC using **Serial & Network > Users & Groups.**

7.1.3 User power management



The Power Manager enables users to access and control the configured serial and network attached PDUpower strips, and servers with embedded IPMI service processors or BMCs:

Select the **Manage > Power** and the particular **Target** power device to be controlled (and the Outlet tobe controlled if the RPC supports outlet level control)

The outlet status is displayed. Initiate the desired **Action** to be taken by selecting the appropriate icon:

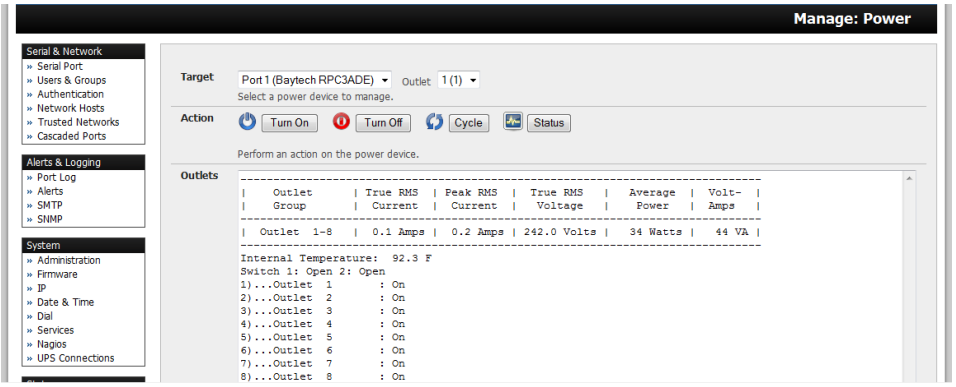
Turn ON

Turn OFF

Cycle

Status

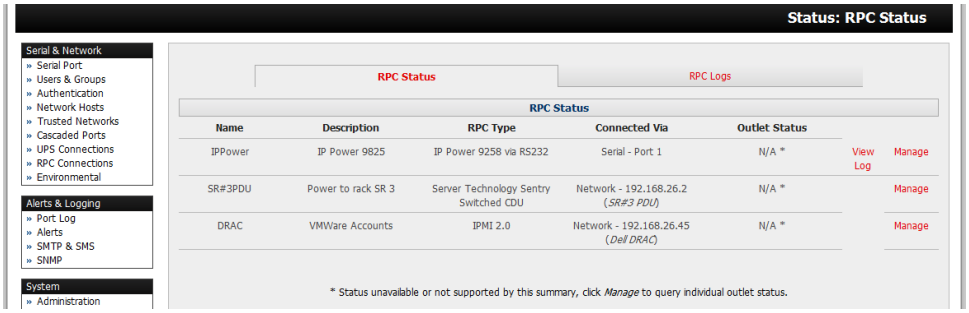
You will be presented with icons for those operations that are supported by the **Target** you haveselected.



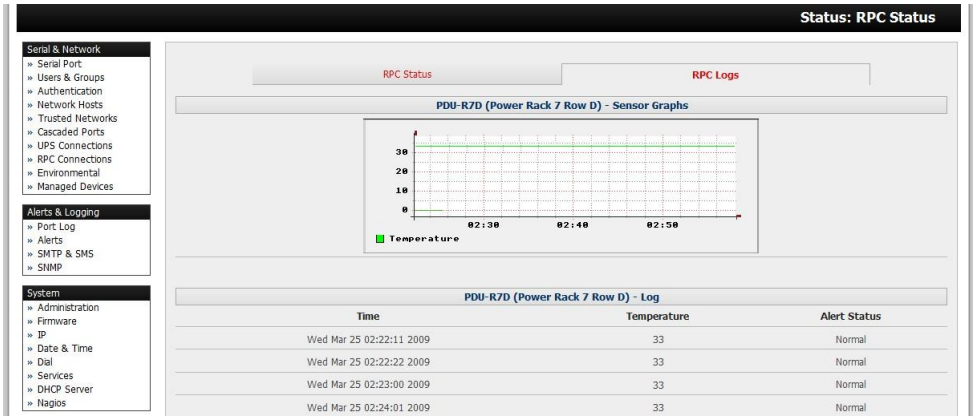
7.1.4 RPC status

You can monitor the current status of your network and serially connected PDUs and IPMI RPCs.

1. Select the **Status > RPC Status** menu and a table with the summary status of all connected RPChardware will be displayed.



2. Click on **View Log** or select the **RPCLogs** menu and you will be presented with a table of thehistory and detailed graphical information on the selected RPC.

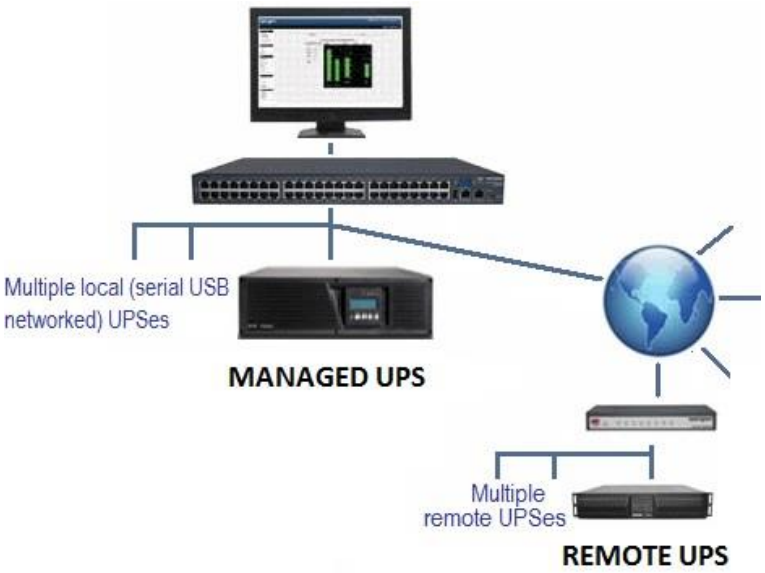


3. Click **Manage** to query or control the individual power outlet. This will take you to the **Manage >Power** screen.

7.2 Uninterruptible Power Supply(UPS) Control

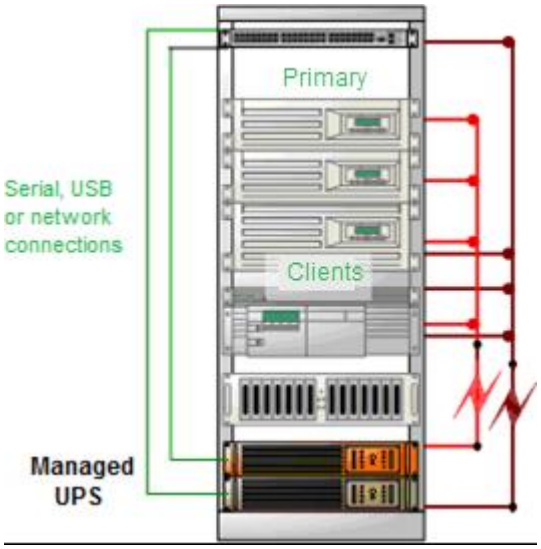
All Opengear console servers can be configured to manage locally and remotely connected UPS hardwareusing Network UPS Tools.

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 areconnected. NUT is built on a networked model with a layered scheme of drivers, server and clients.



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 beconnected by serial or USB cable or by the network. The console server becomes the Primary of this UPS and runs a upsd server to allow other computers that are drawing power through the UPS (Client) to monitor the UPS status and take appropriate action such as shutdown in event of low UPS battery.

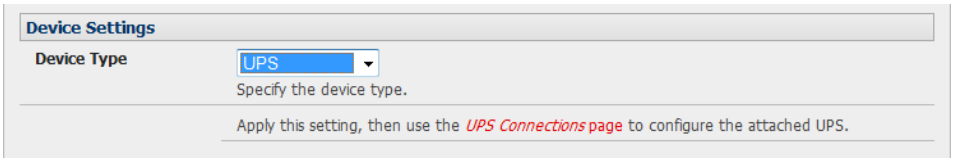


The console server may or may not be drawing power itself through the Managed UPS. When the UPS'sbattery power reaches critical, the console server signals and waits for clients to shut down and powersoff the UPS.

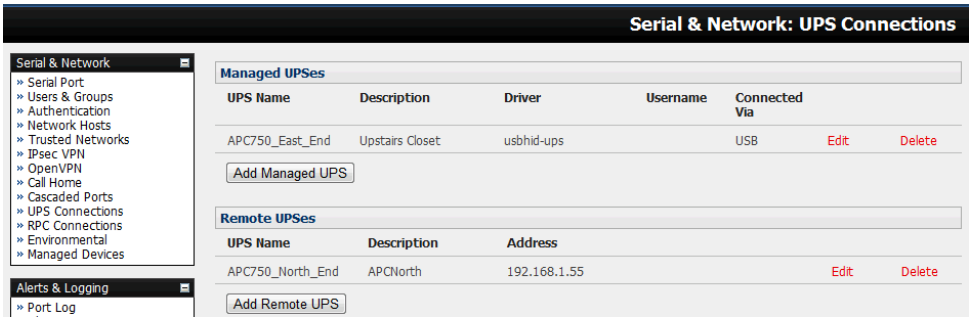
Serial and network connected UPSes must first be connected to, and configured to communicate with theconsole server:

1. For serial UPSes attach the UPS to the selected serial port on the console server, from the **Serial& Network > Serial Port** menu, configure the **Common Settings** of that port with the RS232 properties required by the UPS and select **UPS** as the **Device Type.**

2. For each network connected UPS, go to the **Serial & Network > Network Hosts** menu and configurethe UPS as a connected Host by specifying it as **Device Type > UPS** and clicking **Apply.**

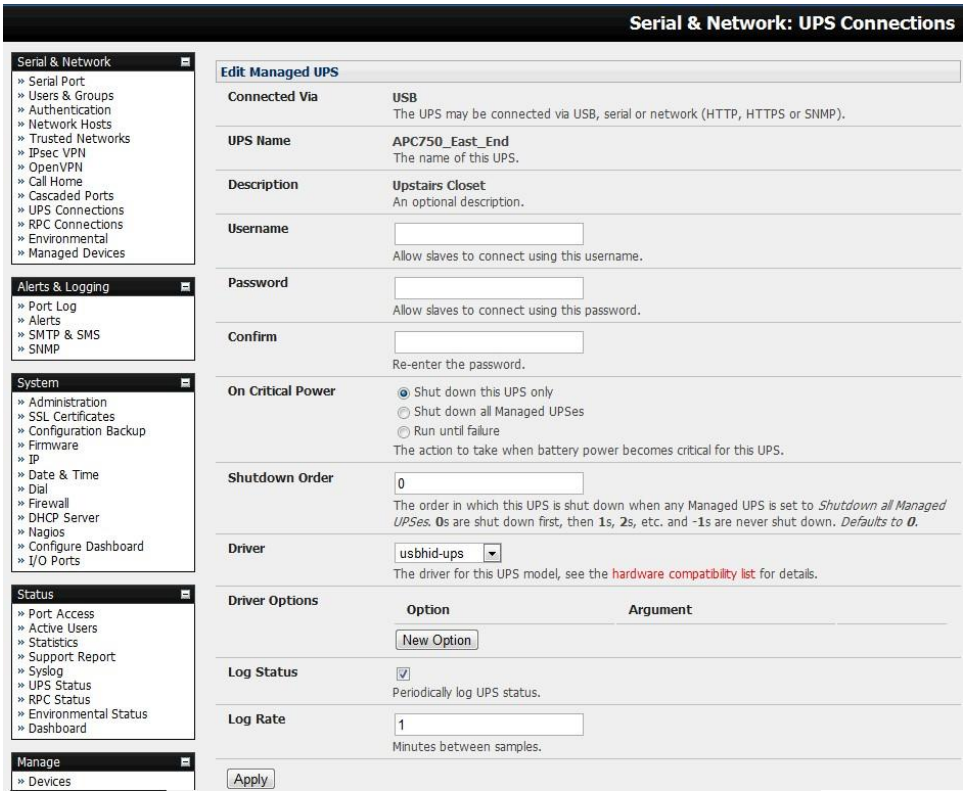


No such configuration is required for USB connected UPS hardware.



3. Select the **Serial & Network > UPS Connections** menu.
The **Managed UPSes** section will displayall the UPS connections that have already been configured.

4. Click **Add Managed UPS**.



5. Select if the UPS will be **Connected Via** USB or over pre-configured serial port or via SNMP/HTTP/HTTPS over the preconfigured network Host connection.

6. When you select a network UPS connection, the corresponding Host Name/Description that youset up for that connection will be entered as the **Name** and **Description** for the power device. Alternately if you selected to **Connect Via** a USB or serial connection, enter a **Name** and **Description** for the power device (and these details will also be used to create a new managed device entry for the serial/USB connected UPS devices).

7. Enter the login details. This **Username** and **Password** is used by Clients of this UPS (i.e. other computers that are drawing power through this UPS) to connect to the console server to monitorthe UPS status so they can shut themselves down when battery power is low. Monitoring will be performed using the upsmon client running on the Client server.

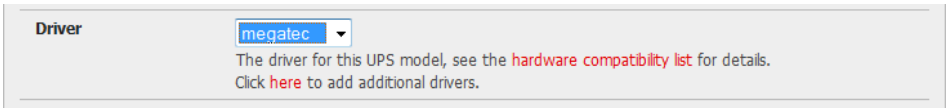
> **NOTE:** These login credentials are not related the users and access privileges you will have configured in **Serial & Networks > Users & Groups**.

8. Select the action to take when UPS battery power becomes critical i.e. Shut down the UPS (orShut down all Managed UPSes) or Run until failure.

> **NOTE:** The shutdown script /etc/scripts/ups-shutdown can be customized so, in the event of a criticalpower failure (when the UPS battery runs out) you can perform program the console server to perform last gasp actions using before power is lost. See online FAQ for details. It is easier to perform last gasp actions by triggering Auto-Response on the UPS hitting batt or lowbatt.

9. If you have more than one UPS and need to shut down in order, specify the **Shutdown Order** for this UPS. This is a whole positive number, or -1. 0s are shut down first, then 1s, 2s, etc. -1s are notshut down at all. Defaults to 0.

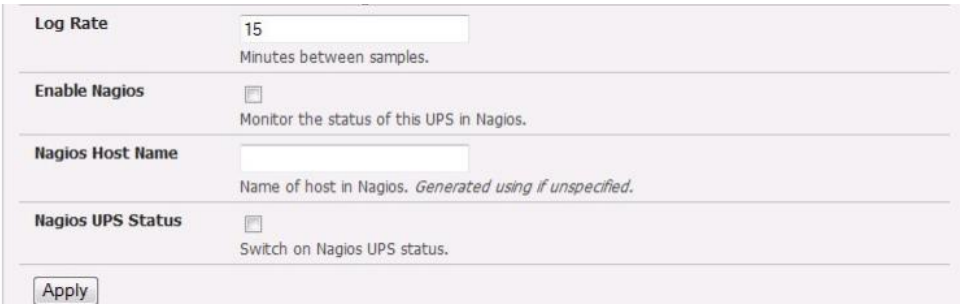
10. Select the **Driver** that will be used to communicate with the UPS.



11. Click **New Options** in **Driver Options** if you need to set driver-specific options for your selectedNUT driver and hardware combination.

12. Check **Log Status** and specify the **Log Rate** (minutes between samples) if you wish the statusfrom this UPS to be logged. These logs can be viewed from the **Status > UPS Status** screen.

13. If you have enabled Nagios services, an option for Nagios monitoring appears, check **EnableNagios** to enable this UPS to be monitored using Nagios central management.



14. Check **Enable Shutdown Script** if this is the UPS providing power to the console server and in the event of a critical power failure you can perform any 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 onlyrun when the UPS reaches critical battery status.

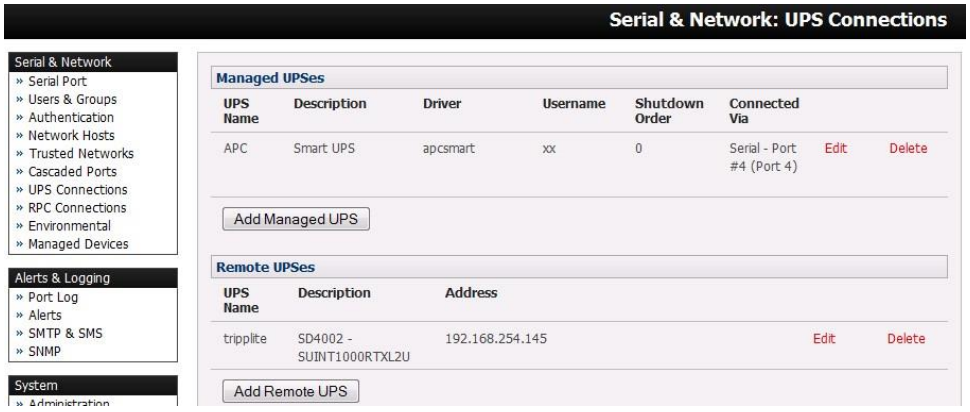
15. Click **Apply**.

> **NOTE:** You can also customize the upsmon, upsd and upsc settings for this UPS hardware from thecommand line.

7.2.2 Remote UPS management

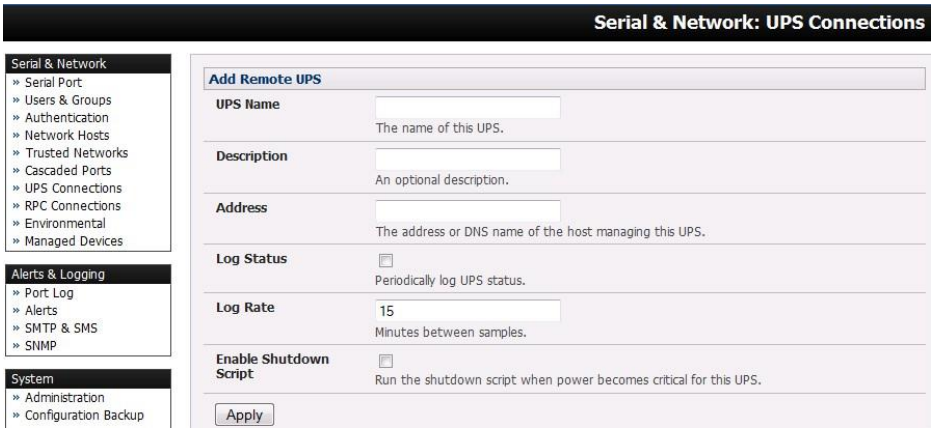
A remote UPS is a UPS that is connected as a managed device to some remote console server which isbeing monitored (but not managed) by your console server.

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 mightbe other Opengear console servers or generic Linux servers running NUT. Distributed UPSes can be centrally monitored through the one central console server window. To add a Remote UPS:



1. Select the **Serial & Network > UPS Connections** menu.
   The **Remote UPSes** section will display allthe remote UPS devices being monitored.

2. Click **Add Remote UPS**.



3. Enter the **Name** of the particular remote UPS to be remotely monitored.
   This name must be thename that the remote UPS is configured with on the remote console server, as the remote console server may have multiple UPSes attached that it is managing locally with NUT. Optionally, enter a **Description.**

4. 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 runningNetwork UPS Tools).

5. Check **Log Status** and specify the **Log Rate** (minutes between samples) if you want the statusfrom this UPS to be logged.
   These logs can be viewed from the **Status > UPS Status** screen.

6. Check **Enable Shutdown Script** if this remote UPS is the UPS providing power to the consoleserver.
   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.

7. Click **Apply**.

7.2.3 Controlling UPS powered computers

One of the advantages of having a Managed UPS is that you can configure computers that draw powerthrough 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 conditions that will be used to initiate a power down of the computer. Non-critical servers may be powered down some second after theUPS starts running on battery, whereas more critical servers may not be shut down until a low battery warning is received.

An example upsmon.conf entry might look like:

MONITOR managedups@192.168.0.1 1 username password Client.

- managedups is the UPS Name of the Managed UPS.
- 192.168.0.1 is the IP address of the Opengear console server.
- 1 indicates the server has a single power supply attached to this UPS.
- username is the Username of the Managed UPS.
- password is the Password of the Manager UPS.

There are NUT monitoring clients available for Windows computers (WinNUT).

If you have an RPC (PDU) it is also possible to shut down UPS powered computers and other equipment without them having a client running (e.g. communications and surveillance gear). Set up a UPS alert andusing this to trigger a script which control a PDU to shut off the power.

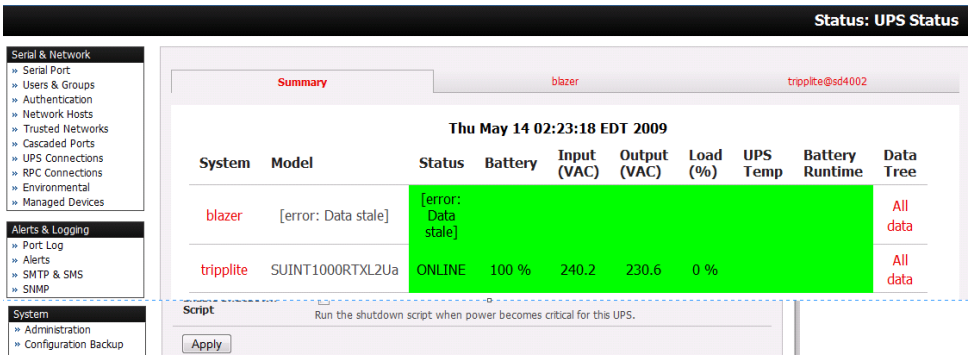
7.2.4 UPS alerts

You can set UPS alerts using **Alerts & Logging > Alerts.**

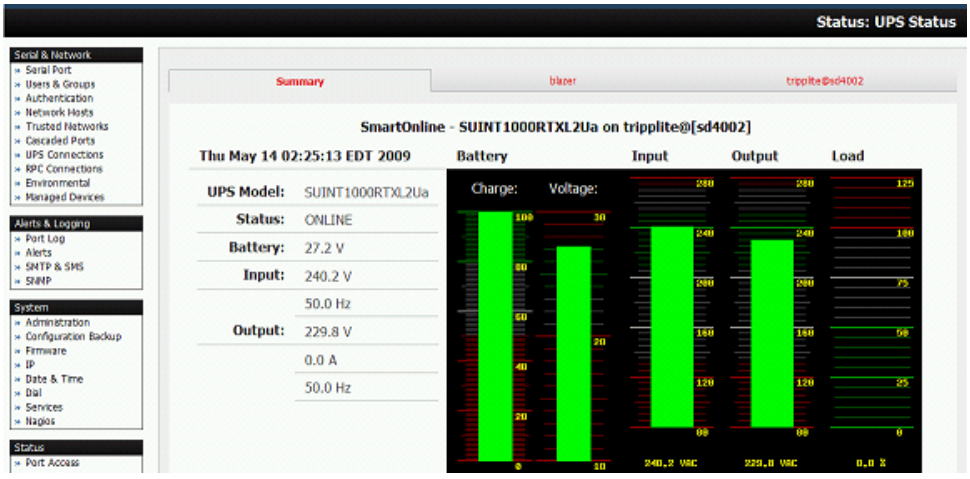
7.2.5 UPS status

You can monitor the current status of your network, serially or USB connected Managed UPSes and anyconfigured Remote UPSes.

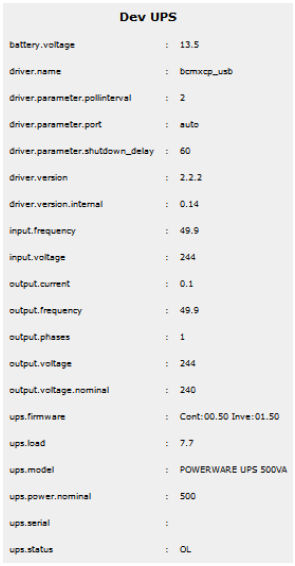
1. Select the **Status > UPS Status** menu and a table with the summary status of all connected UPShardware will be displayed.



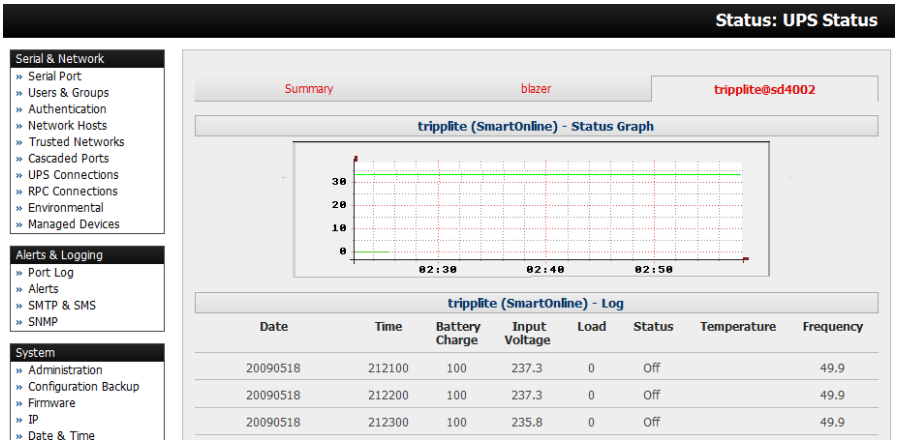
2. Click on any particular UPS **System** name in the table.
A more detailed graphical information onthe select UPS System appears.



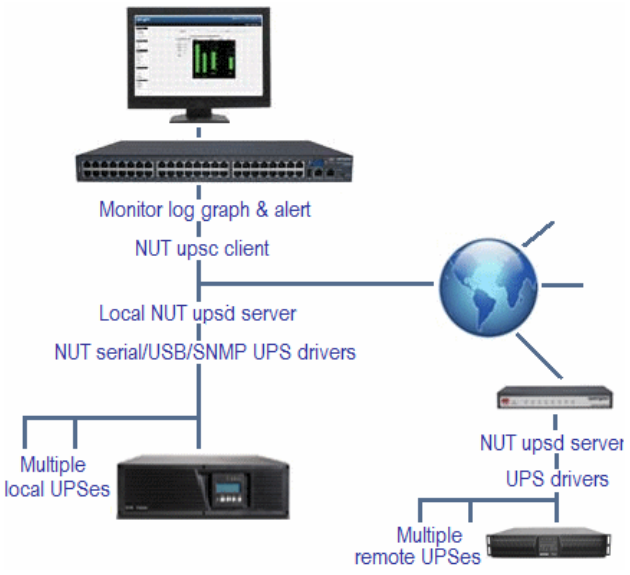
3. Click on any particular **All Data** for any UPS System in the table for more status and configurationinformation on the select UPS System.



4. Select **UPS Logs**.
   The log table of the load, battery charge level, temperature and other status information from all the Managed and Monitored UPS systems appears. This information will be logged for all UPSes which were configured with **Log Status** checked. The information is alsopresented graphically.



7.2.6 Overview of Network UPS Tools (NUT)



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 from the command line. This section provides an overview of NUT. You can find fulldocumentation at http://www.networkupstools.org/documentation.

NUT is built on a networked model with a layered scheme of drivers, server and clients:

- The **driver** programs talk 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 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 power strip model can be handledtransparently.

- 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 serve this status data to many clients. upsd also contains access control features to limit the abilities ofthe clients (e.g. 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 perform tasks based on the status. These clients can run on the same host as the NUTserver or they can communicate with the NUT server over the network (enabling them to monitorany 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 thefull 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 (2.4) 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 also isembedded in Opengear console servers).

These NUT clients and servers all are embedded in each Opengear console server (with a ManagementConsole presentation layer added) … and they also are 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 - with 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 and there's 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 anddistributed office environments where many UPSes from many vendors power many systems with many clients - and each of the larger UPSes power multiple devices - and many of these devices are in turn dualpowered.

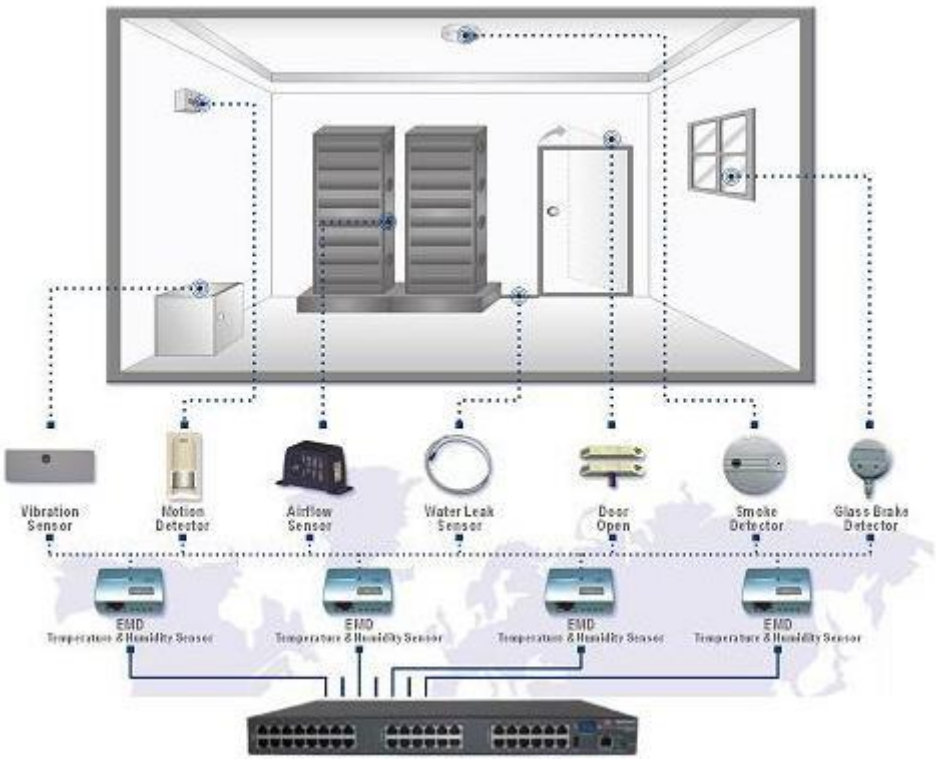
7.3 Environmental Monitoring

All Opengear console servers can be configured to monitor their operating environment.

External Environmental Monitor Devices (EMDs) can be connected to any Opengear console server serialport. Each console server can support multiple EMDs.

Each EMD device has an internal temperature and humidity sensor plus one or two general purpose statussensor ports which can be connected to smoke detectors, water detectors, vibration sensors or open-doorsensors.

Using the Management Console, administrators can view the ambient temperature (in °C or °F) andhumidity (percentage) and configure alerts to monitor the status and sensors to send alarms progressively from warning levels to critical.



7.3.1 Connecting the EMD and its sensors

The Environmental Monitor Device (EMD) connects to any serial port on the console server via aspecial EMD Adapter and standard CAT5 cable. The sensors screw into the EMD:

1. The EMD is powered over the serial port connection and communicates using a custom handshake protocol. It is not an RS232 device andshould not be connected without the adapter.

EMD

2. 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. Ifthe 6-foot (2 meter) UTP cable provided with the EMD is not long enough it can be replaced with a standard Cat5 UTP cable up to 33 feet (10 meters) in length.

EMD Adapter

3. Screw the bare wires on any smoke detector, water detector, vibration sensor, open-door sensoror general purpose open/close status sensors into the terminals on the EMD.

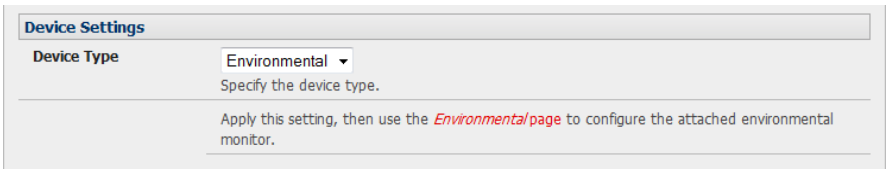
EMD sensor

NOTE: You can attach two sensors onto the terminals on EMDs that are connected to console servers withOpengear Classic pinouts. Console servers with -01 and -02 pinouts only support attaching a single sensor to each EMD.

The EMD can only be used with an Opengear console server and cannot be connected to standardRS232 serial ports on other appliances.

1. Select **Environmental** as the **Device Type** in the **Serial & Network > Serial Port** menu for the portto which the EMD is to be attached.
   No specific Common Settings are required.

2. Click **Apply**.

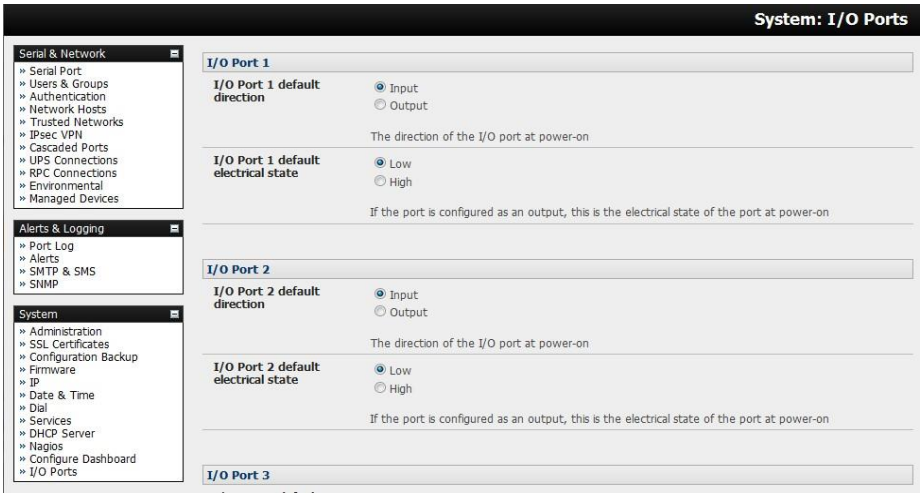


7.3.2 Connecting sensors to ACM7000s

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

ACM7000 models have dedicated I/O (DIO1 & DIO2) and output only pins (OUT1 & OUT2), the later havinginverting outputs with higher voltage/current transistor.

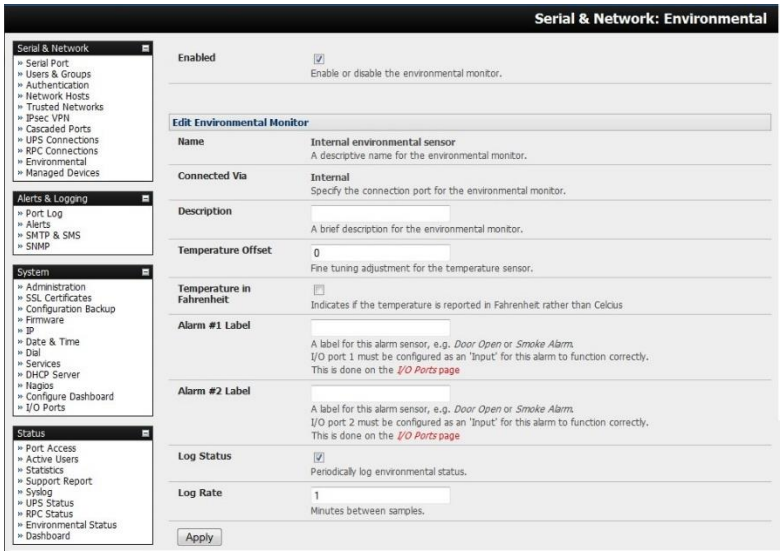
1. To confirm the direction and state configurations for these ports you can select the **System > I/O Ports** menu and a table with the summary status of the four digital I/O ports will be displayed. I/OPort1 = DIO1 or SENSOR1, I/O Port2 = DIO2 or SENSOR2, I/O Port3 = SENSOR3 and I/O Port4 = SENSOR 4).



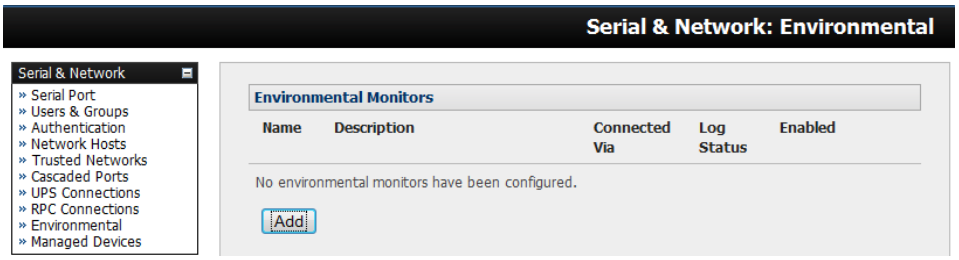
2. Screw the bare wires on any smoke detector, water detector, vibration sensor, open-door sensor or general purpose open/close status sensors into the SENSORor DIO terminals on the green connector block.

3. When configured as Inputs, the SENSOR and DIO ports are notionally attached to the internal EMD. Go to the **Serial & Network > Environmental** page and enable the **Internal EMD.** Configurethe attached sensors as alarms as covered in the next section.

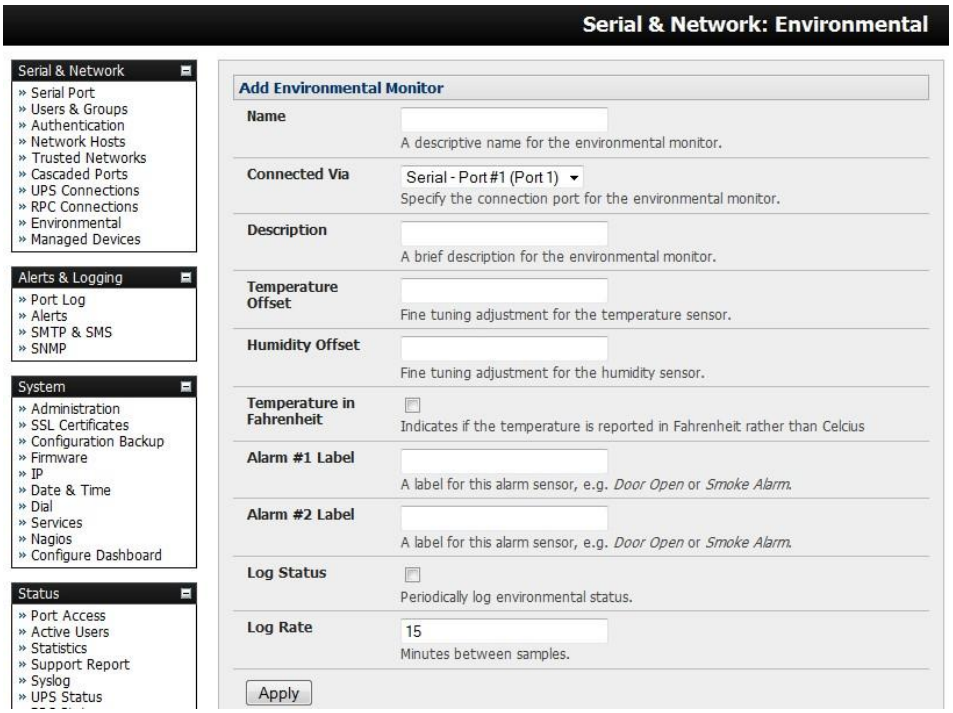
7.3.3 Adding EMDs and configuring the sensors



1. Select the **Serial & Network > Environmental** menu.
   This will display any external EMDs or anyinternal EMD (i.e. sensors that may be attached to an ACM) that have already been configured.



2. To add a new EMD click **Add and** configure an external EMD enter a **Name** and optionally a **Description** and select the pre-configured serial port that the EMD will be **Connected Via.**

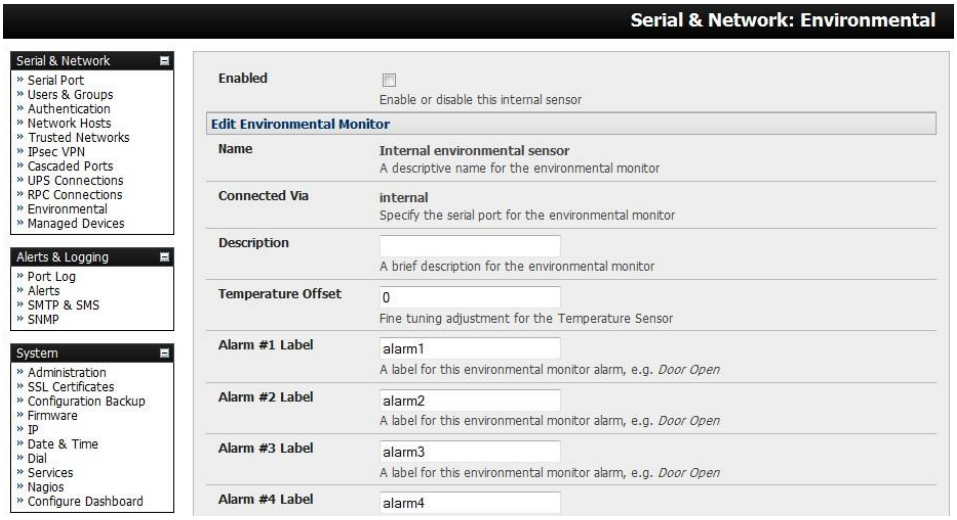


3. You may optionally calibrate the EMD with a Temperature Offset (+ or - °C) or Humidity Offset (+or percent).
   If you check **Temperature in Fahrenheit**, the temperature is reported in Fahrenheit. Otherwise, it is reported in degrees Celsius.

4. Provide **Labels** for each of the alarm sensors, e.g. Door Open or Smoke Alarm.

5. Check **Log Status** and specify the **Log Rate** (minutes between samples) if you want the statusfrom this EMD to be logged.
   These logs can be views from the **Status > Environmental Status**screen.

6. Click **Apply**.
   This will also create a new managed device (with the same name).



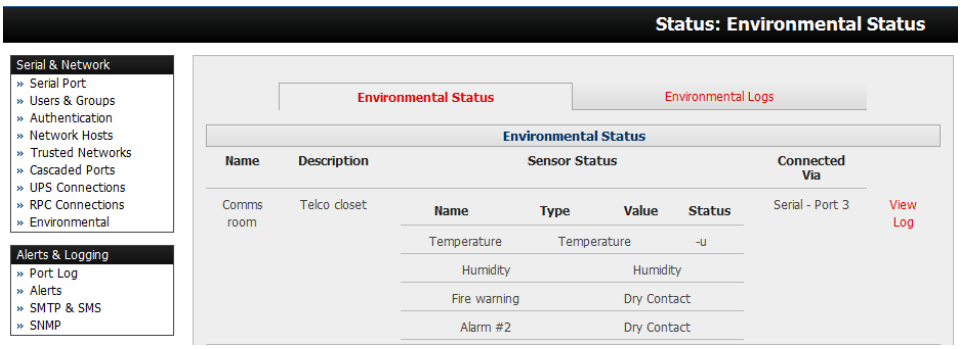
7.3.4 Environmental alerts

Set temperature, humidity and probe status alerts using **Alerts & Logging > Alerts.**

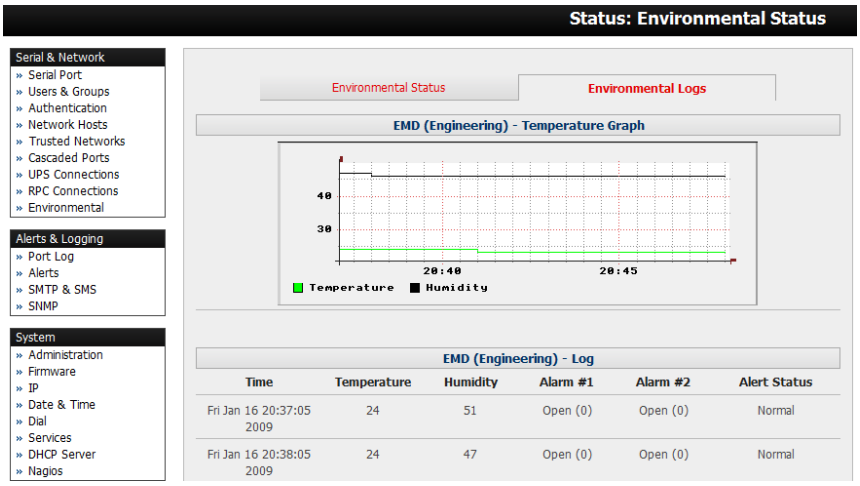
7.3.5 Environmental status

You can monitor the current status of all any configured external EMDs and their sensors, and any internalor directly attached sensors.

1. Select the **Status > Environmental Status** menu and a table with the summary status of allconnected EMD hardware will be displayed.



2. Click on **View Log** or select the **Environmental Logs** menu.
A table and graphical plot of the loghistory of the select EMD appears.

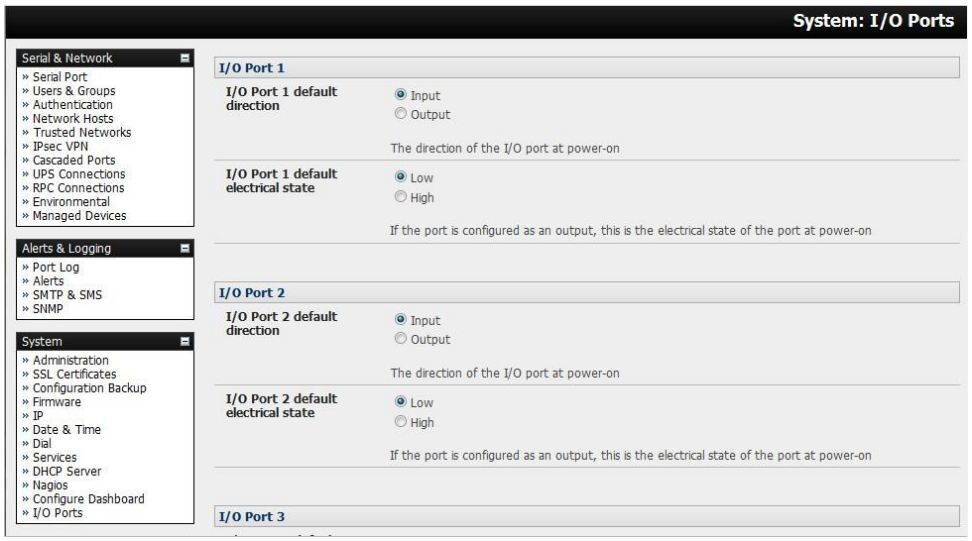


7.4 Digital I/O Ports

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

These I/O ports are configured via System > I/O Ports. Each port can be configured with a defaultdirection and state.

Select the **System > I/O Ports** menu.



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 usethem as digital outputs first configure the port direction on the **System > I/O Ports** menu page.

The DIO1 and DIO2 pins are current limited by the chip to 20mA and accept 5V levels – so they cannotdrive a relay etc.

Alternately you can change the output states using the ioc command line utility. The following text is theusage message from the ioc usage:

```
ioc: digital io-port controller:
        -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 will set the output high for 1 second, return 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/OPorts**, it can be used to monitor the current status of any attached sensor.

When configured as inputs (and this is the factory default) these first two ports are notionally attached toan internal EMD. To configure them as alarms, go to the Environmental page and edit and enable the Internal EMD.

The low voltage circuits in DIO1 and DIO2 should not be wired to voltages greater than 5V DC.

These input ports can be monitored using the ioc command line utility (as detailed in the previous section).

7.4.3 High Voltage Outputs

OUT1 and OUT2 (internally DIO3 & DIO4) outlets are wired as high voltage outputs. The way these outputsare expected to be used is to pull a power connected line to ground (i.e. 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 arelay circuit you must guarantee it doesn't provide more than 100mA when set to 1.

7.4.4 DIO SNMP status

There is a SNMP status table (with V3.9 and later) which reports on the status of the digital IO ports. Thetable OID is OG-STATUSv2-MIB::ogEmdDioTable. Performing an snmpwalk on this table on a console server with DIO produces something like (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 andproven Linux software modules for networking, secure access (OpenSSH) and communications (OpenSSL) and sophisticated user authentication (PAM, RADIUS, TACACS+, Kerberos and LDAP).

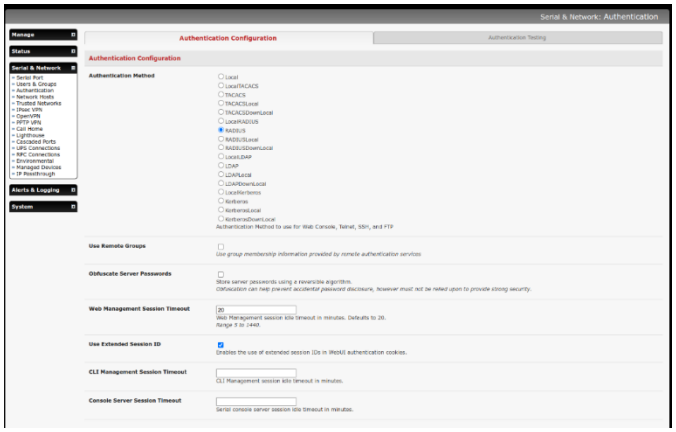
- This chapter details how an administrator uses the Management Console to establish remote AAA authentication for all connections to the console server and attached serial and network hostdevices.

- This chapter also covers establishing a secure link to the Management Console using HTTPS andusing 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 on the online FAQs.

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 tolog 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 remoteauthentication is to be used:

Local *TACACS /RADIUS/LDAP/Kerberos*: Tries local authentication first, falling back to remote iflocal fails.

***TACACS /RADIUS/LDAP/Kerberos* Local**: Tries remote authentication first, falling back to local ifremote 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 serveris down or inaccessible).

8.1.1 Local authentication

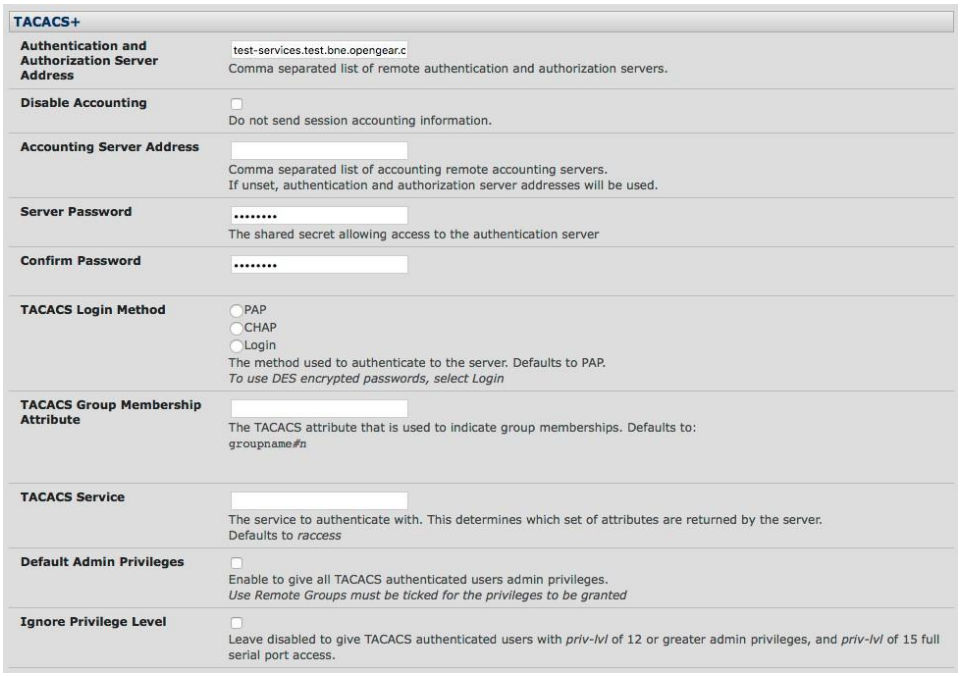
1. Select **Serial & Network > Authentication** and check **Local**.

2. 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:

1. Select **Serial & Network > Authentication** and check **TACAS**, **LocalTACACS**, **TACACSLocal** or **TACACSDownLocal**.



2. 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.

3. 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.)

4. In addition to multiple remote servers you can also enter for separate lists of Authentication/Authorization servers and Accounting servers. If no Accounting servers arespecified, the Authentication/Authorization servers are used instead.

5. Enter and confirm the **Server Password**. Select the method to be used to authenticate to theserver (defaults to **PAP**). To use DES encrypted passwords, select **Login.**

6. If required enter the **TACACS Group Membership Attribute** that is to be used to indicate groupmemberships (defaults to groupname#n).

7. If required, specify **TACACS Service** to authenticate with. This determines which set of attributesare returned by the server (defaults to raccess).

8. If required, check **Default Admin Privileges** to give all TACAS+ authenticated users

adminprivileges. **Use Remote Groups** must also be ticked for these privileges to be granted.

9. The TACACS **Privilege Level** feature only applies to TACACS remote authentication. When **IgnorePrivilege 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 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 configuredserial ports. When the **Ignore Privilege Level** option is enabled (i.e. checked in the UI) there are no escalations of privileges based on the priv-lvl value from the TACACS server.
>
> Also note that if the only thing configured for one or more TACACS users is the priv-lvl (e.g. no specific port access or group memberships set), 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 RetrieveRemote groups option in the Authentication menu is enabled.

10. Click **Apply.**
    TACAS+ remote authentication is used for all user access to console server andserially or network attached devices

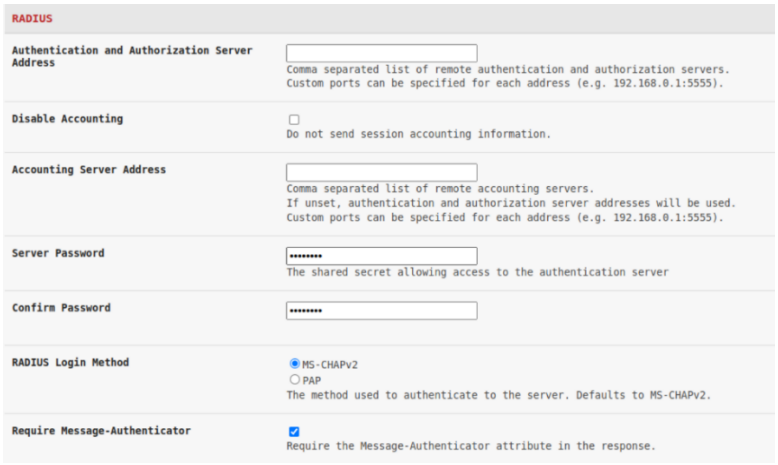
    TACACS+The Terminal Access Controller Access Control System (TACACS+) security protocol is a recent protocol developed by Cisco. It provides detailed accounting information and flexible administrative control over the authentication and authorization processes. TACACS+ allows for asingle access control 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

> **NOTE:** PAP or MS-CHAPv2 authentication is supported from release 4.12.0. MS-CHAPv2 is the default for new configurations, however, devices with existing RADIUS configuration will remain configured for PAP when upgrading from an earlier version.

Perform the following procedure to configure the RADIUS authentication method to be used whenever theconsole server or any of its serial ports or hosts is accessed:

1. Select **Serial & Network > Authentication** and check **RADIUS** or **LocalRADIUS** or **RADIUSLocal** or **RADIUSDownLocal**.



2. 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.

3. 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).

4. In addition to multiple remote servers you can also enter for separate lists of Authentication/Authorization servers and Accounting servers.
   If no Accounting servers arespecified, the Authentication/Authorization servers are used instead.

5. Enter the Server Password.

6. Select the **RADIUS Login Method** to use to authenticate to the server.
   You can select from **MS-CHAPv2** (default) or **PAP**.

7. Select the Require Message-Authenticator check box to require the Message-Authenticator attribute in the response.
   When selected, the pam_radius_auth.so module verifies the existence of the “Message-Authenticator“ attribute in the Access-Accept response from the RADIUS server and fails the authentication if it is not available.
   This attribute is required to counterstrike the BlastRADIUS attack.
   This attribute is disabled by default after config erase.

8. Click **Apply.**
   RADIUS remote authentication is used for all user access to console server andserially or network attached devices.

8.1.4 LDAP authentication

LDAP authentication supports OpenLDAP servers, using the Posix style schema for user and groupdefinitions.

Performing authentication against any LDAP server (AD or OpenLDAP) is straightforward, as they bothfollow the common LDAP standards and protocols. The harder part is configuring how to get the extradata about the users (the groups they are in, etc).

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 stored in a number of different ways. ActiveDirectory has one method, and OpenLDAP has two other methods:

- Active Directory: 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: Each entry for a user must have a 'gidNumber' attribute. This will be an integervalue, which is the user's primary group (eg. mapping to the /etc/passwd file, with the group ID field). To determine which group this is, we must search for an entry in the directory that has that group ID, which will give us the group name. (The users are of objectClass "**posixAccount**", and the groups are of objectClass "**posixGroup**").

- OpenLDAP / Posix: Each group entry in the group tree (of objectClass '**posixGroup**') may havemultiple 'memberUid' attributes. These represent secondary groups (eg. mapping to the /etc/groups file). Each attribute would contain a username.

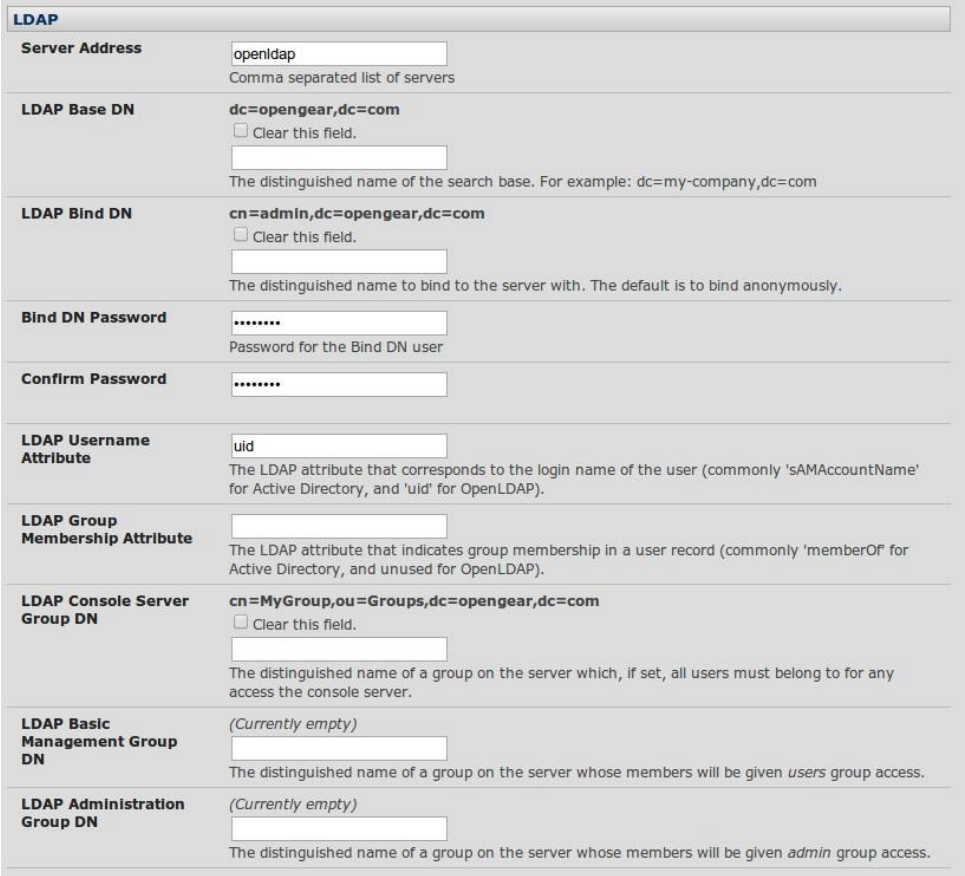
To cater to all these possibilities, the pam_ldap module has been modified to do group lookups for each ofthese three styles. This allows us to have a relatively 'generic' configuration, and not be concerned with how the LDAP directory is set up.

There are two parameters that need to be configured based on what the user wishes to look up: these arethe LDAP username and group membership attributes.

To clarify to the user what parameters to use, the descriptions for these fields have been updated toprompt 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).

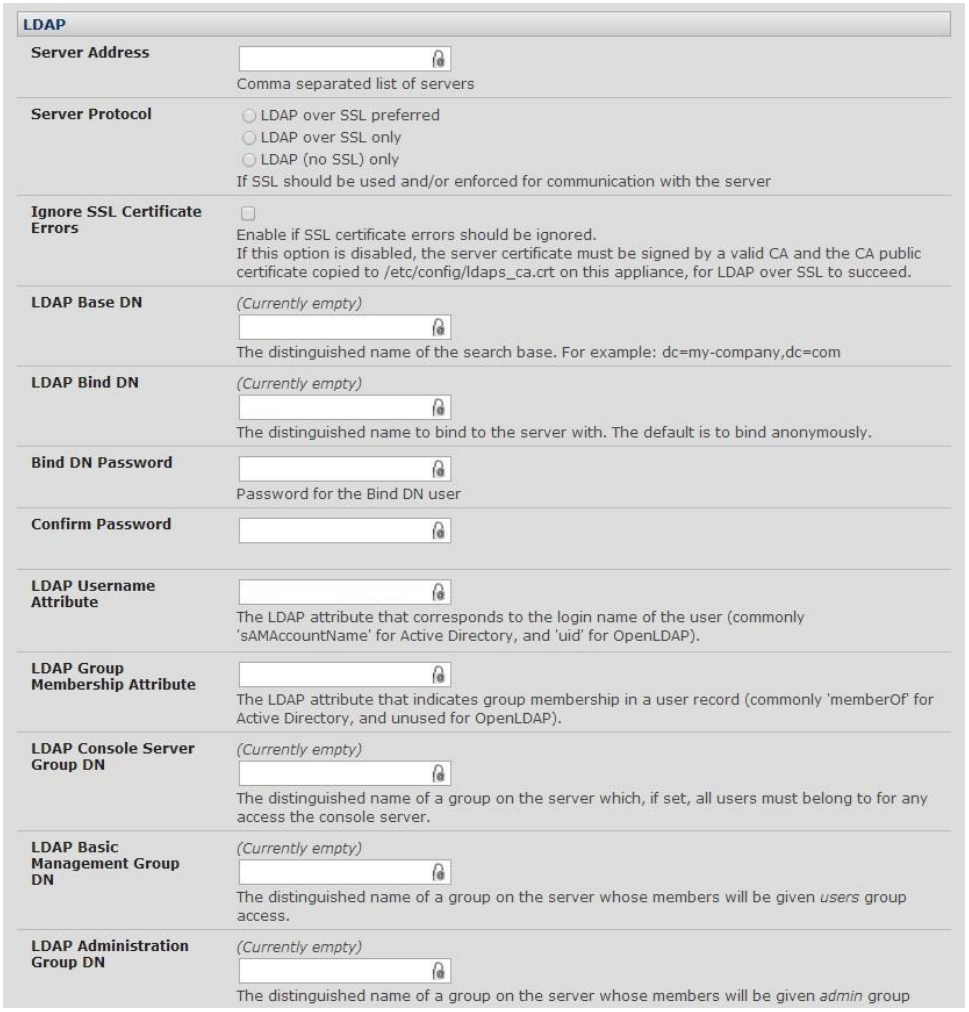
LDAP Group Membership Attribute: The LDAP attribute that indicates group membership in a userrecord (commonly 'memberOf' for Active Directory, and unused for OpenLDAP).



NOTE: The libldap library ensures SSL connections are using certificates signed by a trusted CA so it isoften not easy to set up a connection to an LDAP server using SSL. See https://portal.opengear.com/s/article/LDAPoverSSL661d3467ebfe2.

Perform the following procedure to configure the LDAP authentication method to be used whenever theconsole server or any of its serial ports or hosts is accessed:

1. Select Serial & Network > Authentication and check **LDAP**, **LocalLDAP**, **LDAPLocal**, or **LDAPDownLocal**.



2. Enter the **Server Address** (IP or host name) of the remote Authentication server. Multiple remoteservers may be specified in a comma separated list. Each server is tried in succession.

3. Check the **Server Protocol** box to select if SSL is to be used and/or enforced for communicationswith the LDAP server. Console servers offer three options for LDAPS (LDAP over SSL):

   - **LDAP over SSL preferred** will attempt to use SSL for authentication, but if it fails it will fallback to LDAP without SSL. As an example LDAP over SSL may fail due to certificate errors or the LDAP server not be contactable on the LDAPS port etc.

   - **LDAP over SSL only**: this setting configures the Opengear device to only accept LDAP over SSL. If LDAP over SSL fails, only the root account will be able to log in to the consoleserver.

   - **LDAP (no SSL) only**: this setting will configure the Opengear device to only accept LDAPwithout SSL. If LDAP without SSL fails, only the root account will be able to log in to the console server.

4. The **Ignore SSL Certificate Error** checkbox enables you 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 withwhich the LDAP server's certificate was signed, onto the console server. For example, the LDAP server is serving with a certificate singed using the certificate myCA.crt.

> **NOTE:** The certificate needs to be in CRT format and myCA.crt needs to be installed onto console server at /etc/config/ldaps_ca.crt. Also the file name must be ldaps_ca.crt. You need to copy thefile to this location and file name manually using 'scp' or the like e.g.
>
> scp /local/path/to/myCA.c
> rt root@console_server:/etc/config/ldaps_ca.crt.

5. Enter the Server Password.

6. Click **Apply.**
   LDAP remote authentication is used for all user access to console server and seriallyor network attached devices.

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 remoteAAA, 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 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 / authorized from the remote AAA server, depending onthe 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 orTACACS 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 Lynn is only defined on the TACACS server, which says she has access to ports 5 and 6.When she attempts to log in a new user will be created for him, and she will be able to accessports 5 and 6. If the TACACS server is down she 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 onthe 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, root will be authenticated locally.

Remote users may be added to the admin group via either RADIUS or TACACS. Users may have a set ofauthorizations set on the remote TACACS server. Users automatically added by RADIUS will have authorization for all resources, whereas those added locally will need their authorizations specified.

LDAP has not been modified and needs locally defined users.

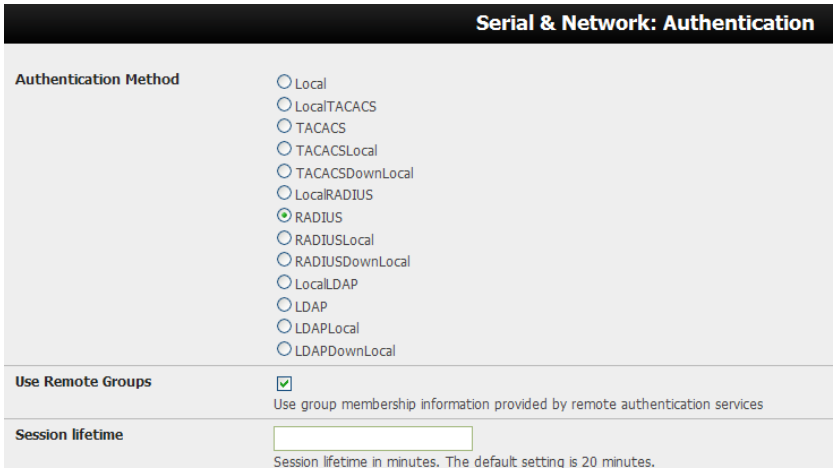
8.1.6 Group support with remote authentication

All console servers allow remote authentication via RADIUS, LDAP and TACACS+. RADIUS and LDAP canprovide 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 groupname 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 thelocal groups.

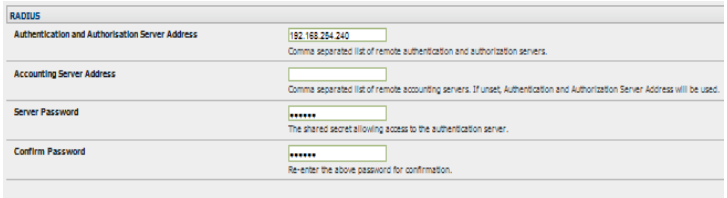
To enable group support to be used by remote authentication services:

1. Select **Serial & Network > Authentication**.
2. Select the relevant **Authentication Method**.
3. Check the **Use Remote Groups** button.



8.1.7 Remote groups with RADIUS authentication

1. Enter the **RADIUS Authentication and Authorization Server Address** and **Server Password**.
2. Click **Apply**.



3. 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 thatauthenticate via RADIUS.

To interoperate with other devices using this field, the group names can be added to the end of anyexisting content in the attribute, in the following format:

:group_name=testgroup1,users:

The above example sets the remote user as a member of testgroup1 and users if groups with those names exist on the console server. Any groups which 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 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, the user will have no userInterface and serial port access but limited console 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 groupseasier. The console server will retrieve a list of all the remote groups that the user is a direct member ofand compare their names with local groups on the console server. Spaces in 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 accessto port 2 (connected to the UPS). Once LDAP is setup, users that are members of each group will have theappropriate 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:

1. Complete the fields for standard LDAP authentication including LDAP Server Address, ServerPassword, LDAP Base DN, LDAP Bind DN and LDAP User Name Attribute.

2. Enter memberOf for **LDAP Group Membership Attribute** as group membership is currently onlysupported on Active Directory servers.

3. If required, enter the group information for **LDAP Console Server Group DN** and/or **LDAPAdministration Group DN**.

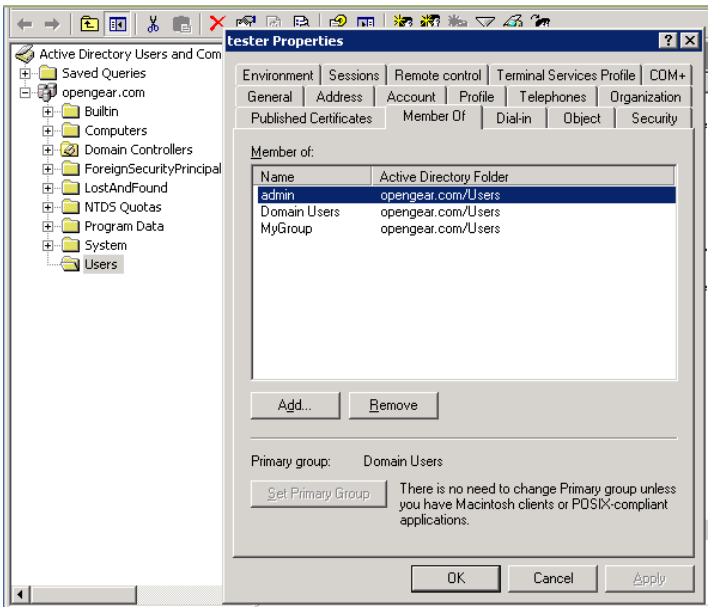
A user must be a member of the LDAP Console Server Group DN group in order to gain access to the console and user interface. For example, the user must be a member of **MyGroup** on the Active Server togain access to the console server.

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** onthe Active Server to receive administration privileges on the console server.

4. Click **Apply**.

5. 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 localgroups on the console server BUT where the LDAP group names can contain upper case and space characters 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** needs a corresponding local group on the console server called **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, discussed furtherin section 8.2. Also, 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:

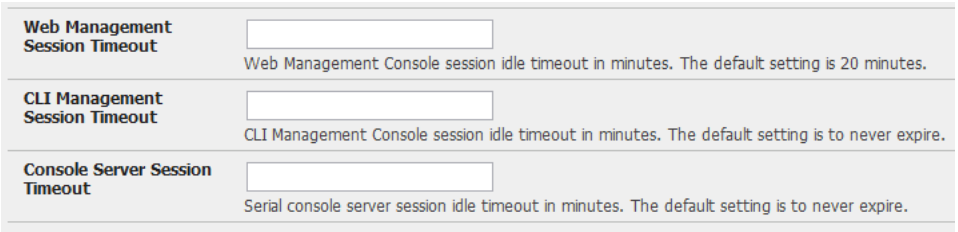
```
user = myuser {
        service = raccess {
                groupname="users"
                groupname1="routers"
                groupname2="dracs"
        }
}
```

You may also specify multiple groups in one comma-delimited, e.g. groupname="users,routers,dracs" butbe aware that the maximum length of the attribute value string is 255 characters.

To use an attribute name other than *groupname*, set Authentication > TACACS+ > TACACS GroupMembership Attribute.

8.1.10 Idle timeout

You can specify amount of time in minutes the console server waits before it terminates an idle SSH,pmshell or web connection.



Select **Serial & Network > Authentication**.

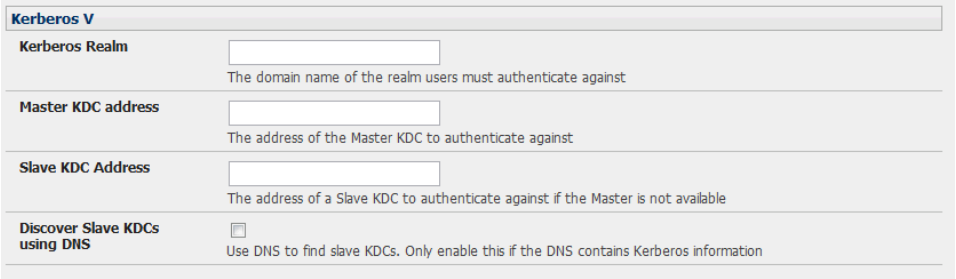
- **Web Management Session Timeout** specifies the browser console session idle timeout inminutes. The default setting is 20 minutes.
- **CLI Management Session Timeout** specifies the SSH console session idle timeout in minutes.The default setting is to never expire.
- **Console Server Session Timeout** specifies the pmshell serial console server session idle timeoutin minutes. The default setting is to never expire.

8.1.11 Kerberos authentication

The 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 usernamemust be created, and permissions set.

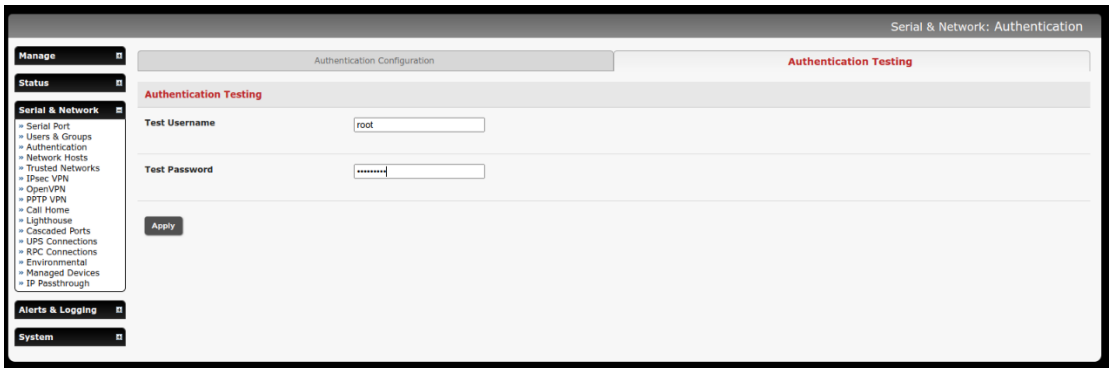
> **NOTE:** Kerberos is sensitive to time differences between the Key Distribution Center (KDC) authentication server and the client device. Make sure that NTP is enabled, and the time zone isset correctly on the console server.

When authenticating against Active Directory, the Kerberos Realm will be the domain name, and thePrimary KDC will be the address of the primary domain controller.



8.1.12 Authentication testing

The Authentication Testing tab enables the connection to the remote authentication server to be tested.



8.2 PAM (Pluggable Authentication Modules)

The console server supports 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 newauthentication 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 to be attached to them at run-time in order to work. Which authentication module is to be attached is dependent upon the local system setup and is at the discretionof the local administrator.

The console server family supports PAM to which we have added the following modules for remoteauthentication:

RADIUS	- pam_radius_auth	(http://www.freeradius.org/pam_radius_auth/)
TACACS+	- pam_tacplus	(http://echelon.pl/pubs/pam_tacplus.html)
LDAP	- pam_ldap	(http://www.padl.com/OSS/pam_ldap.html)

Further modules can be added as required.

Changes may be made to files in /etc/config/pam.d / which will persist, even if the authenticationconfigurator is run.

- Users added on demand:

  When a user attempts to log in but does not have an account on the console server, a new user account is created. This account will have no rights and no password set. They will not appear inthe 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 of above indicates an administrator. For RADIUS, administrators are indicated via the Framed FilterID. (See the example configuration files below).

- Authorization via TACACS, LDAP or RADIUS for using remote groups.

- Authorization via TACACS for both serial ports and host access.

  Permission to access resources may be granted via TACACS by indicating an Opengear Applianceand 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 isincluded, the user will be 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 AAA Network Connection Configurable Timeout

As of release 5.1.0, Opengear console devices support user-definable AAA server timeouts of up to 60 seconds when authenticating with a AAA authentication server. Configuring the timeout duration may be done via the WebUI or the CLI; the configured timeout will result in a single global setting for AAA so that there is no need to change if users switch services.

> **NOTE:** The user-configured timeout will be applied to the currently enabled remote AAA server **except** KERBEROS, which does not support such timeout at the client side.

8.3.1 Configuring the Timeout in the WebUI

Navigate to the **Authentication** page, at the last of the top generic/common settings for various AAA server, the **Connection Timeout** input field allows users to specify a number up to 60 (in seconds) as the network connection timeout.

If the timeout value input is greater than 60, then 60 seconds is applied. If the timeout value is deleted or set to 0 (zero), the default configuration will be used:

- For LDAP, the default bind timeout is 10 seconds. This value is not related to LDAP's search timeout, which remains at a default to unlimited, or no timeout.
- For RADIUS, the default network connection timeout is 3 seconds.
- For TACACS, the default network connection timeout is 10 seconds.

8.3.2 Configuring the Timeout in the CLI

Users can specify the timeout on CLI with the following command:

```
config -s config.auth.connection.timeout=<num of seconds> -r auth
```

Use `config -g config.auth.connection.timeout` to verify the current timeout.

8.4 SSL Certificate

The console server uses the Secure Socket Layer (SSL) protocol for encrypted network traffic between itself and a connected user. During the 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 theconsole server device upon delivery is for testing purpose only and should not be relied on for secured global access.

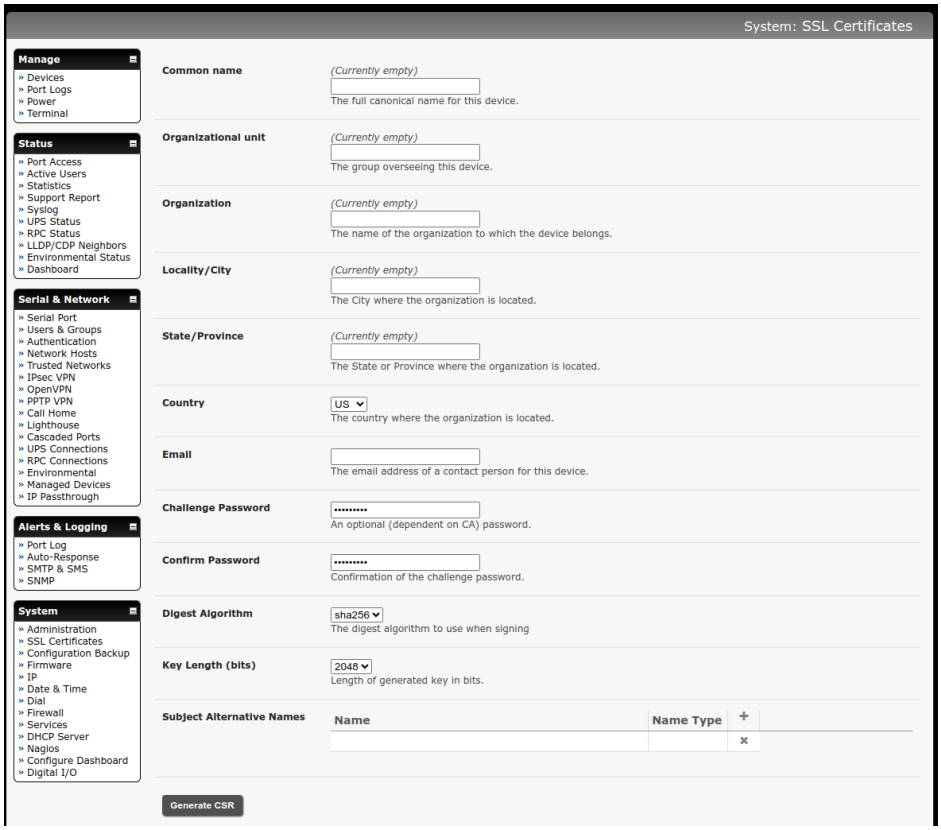
The System Administrator should not rely on the default certificate as the secured globalaccess mechanism for use through Internet

1. Activate your preferred browser and enter https://IP address. Your browser may respond with a message that verifies the security certificate is valid but notes that it is not necessarily verified bya 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.

2. You will be prompted for the administrator account and password.

It is recommended you generate and install a new base64 X.509 certificate that is unique for aparticular console server.



To do this 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 SSLcertificate to you. To create and install an SSL certificate for the console server:

1. Select **System > SSL Certificate** and fill out the fields as explained below:

   - **Common name** This is 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 that is used to access the console server with a web browser (without the http:// prefix). In case 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 organizationthe 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 country where the organization is located. This is the two-letter ISO

code, e.g. DE forGermany, or US for the USA. (Note: the country code has to be entered in CAPITAL LETTERS).

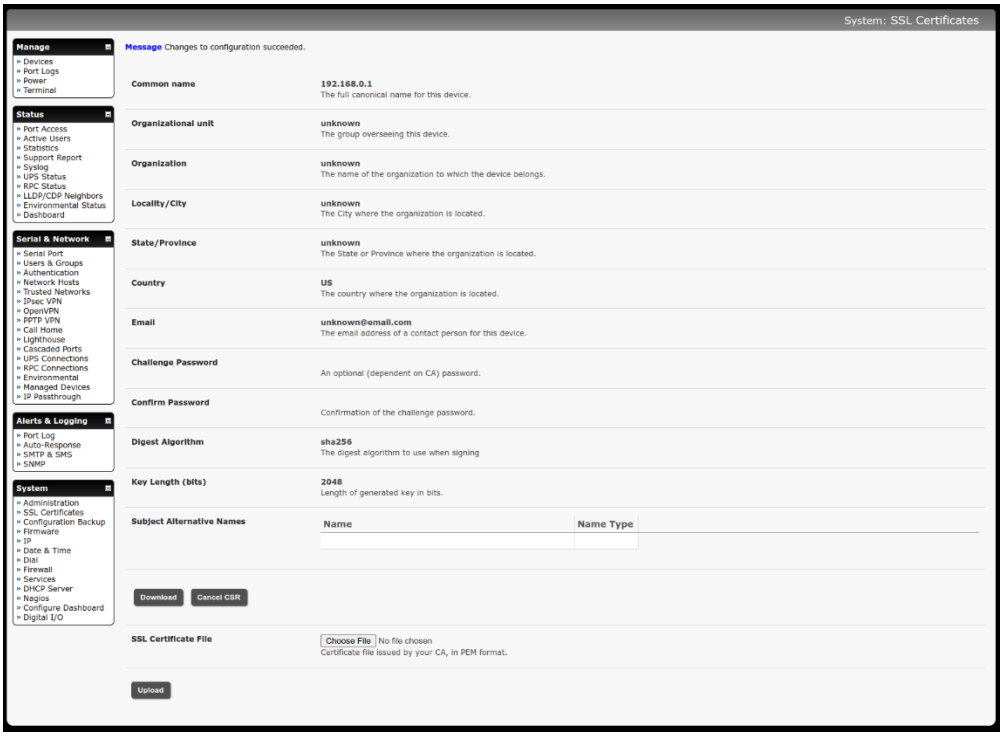
- **Email** The email address of a contact person that is responsible for the console server and itssecurity.
- **Challenge Password** Some certification authorities require a challenge password to authorizelater changes on the certificate (e.g. revocation of the certificate). The minimal length of this password is 4 characters.
- **Confirm Challenge Password** Confirmation of the Challenge Password.
- **Key length** This is the length of the generated key in bits. 2048 bits is the default and recommended key length.
- **Subject Alternative Names** set one or more Subject Alternative Name certificate entries to allowfor multi-homing the device.

> **NOTE:** Set the Common Name of the device as a Subject Alternative Name when the CSR isgenerated as some Chrome and Firefox versions will give warnings if this is not done.

2. When this is done, click on the button **Generate CSR** which will initiate the Certificate Signing Requestgeneration.
   The CSR can be downloaded to your administration machine with the **Download** button.

3. 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 (dependingon the CA).

4. Upload the certificate to the console server using the **Upload** button as shown below.



After you complete these steps, the console server has its own certificate that is used for identifying theconsole server to its users.

8.5 Adding Opengear custom attributes

You can use an Opengear Vendor Specific Attribute when specifying group mappings via RADIUS. Opengear has an IANA enterprise number of 25049 with our own vendor specific attributes under thatenterprise number.

Create a file called /etc/freeradius/$VERSION/dictionary.opengear containing:

```
VENDOR     Opengear    25049

BEGIN-VENDOR     Opengear

ATTRIBUTE  Opengear-MappedGroups   1     string

END-VENDOR       Opengear
```

Edit /etc/freeradius/$VERSION/dictionary to include that file:

```
$INCLUDE dictionary.opengear
```

Add the following “update reply {}” block to /etc/freeradius/$VERSION/sites-enabled/default inside the“authorize {}” section at the end. (

> **NOTE:** The ‘&' before 'Opengear’ should not be there in some older versions of freeradius eg. 2.1.12.

NOTE

```
authorize {

...

...

...

     update reply {

           &Opengear-MappedGroups = "group1,group2,group3"

     }

}
```

Check if configuration is correct and restart the server.

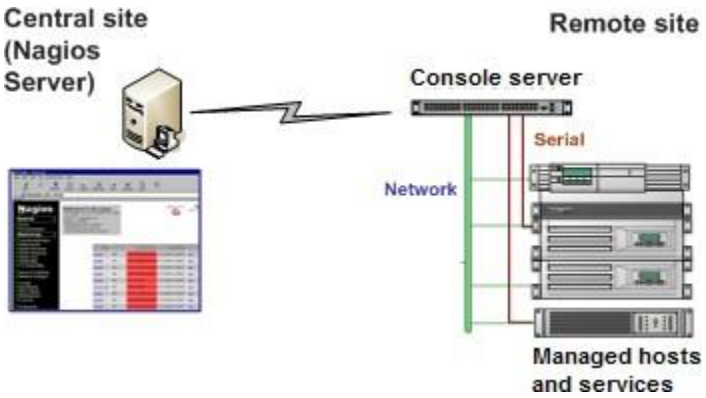
```
sudo freeradius -CX

sudo service freeradius restart
```

9. NAGIOS INTEGRATION

Nagios is a powerful, highly extensible open-source tool for monitoring network hosts and services. Thecore Nagios software package is installed 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 ChecksAcceptor) and NRPE (Nagios Remote Plug-in Executor) add-ons – this allows them to communicate withthe central Nagios server, eliminating the need for a dedicated Client 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, toprovide 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 section 9.3.

9.1 Nagios Overview

Nagios provides central monitoring of the hosts and services in your distributed network. Nagios is freelydownloadable, open source software. This section offers a quick background of Nagios and its capabilities. A complete overview, FAQ and comprehensive documentation are available at: http://www.nagios.org

Nagios forms the core of many leading commercial system management solutions such as GroundWork:http://www.groundworkopensource.com.

Nagios 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 – e.g.check that a database can validate requests and return real data.
- Display warnings and send warning e-mails, pager or SMS alerts when a service failure ordegradation is detected.
- Assign contact groups who are responsible for specific services in specific time frames.

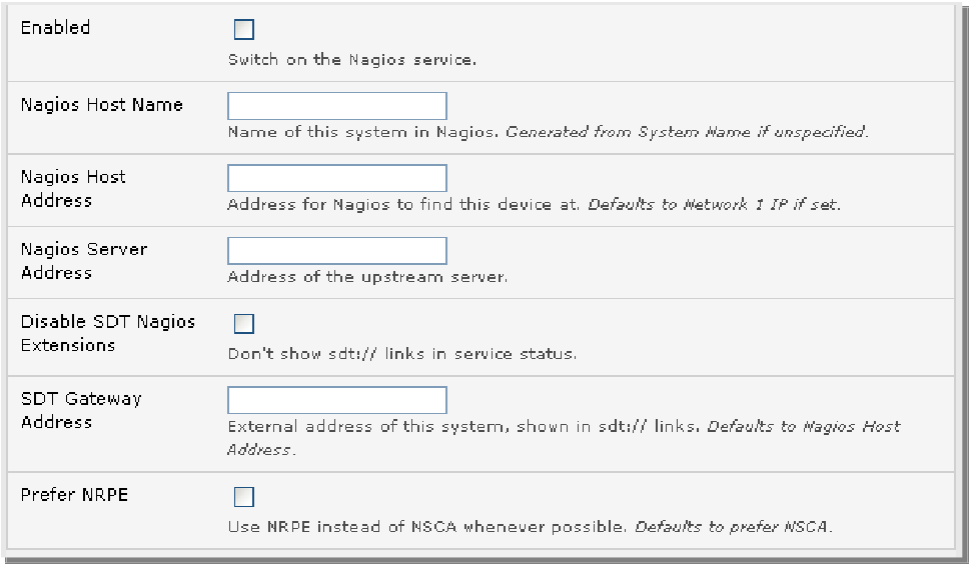
9.2 Configuring Nagios distributed monitoring

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, 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, the NRPE serverembedded 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 bemonitored 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

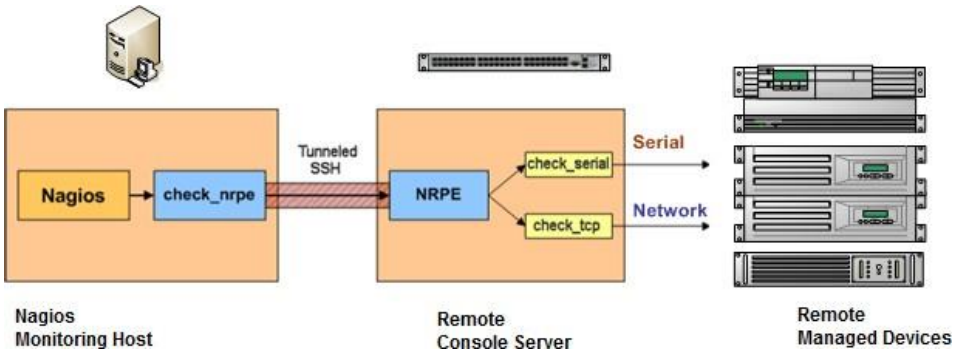
1. Select **System > Nagios** on the console server Management Console and tick the Nagios service **Enabled**.



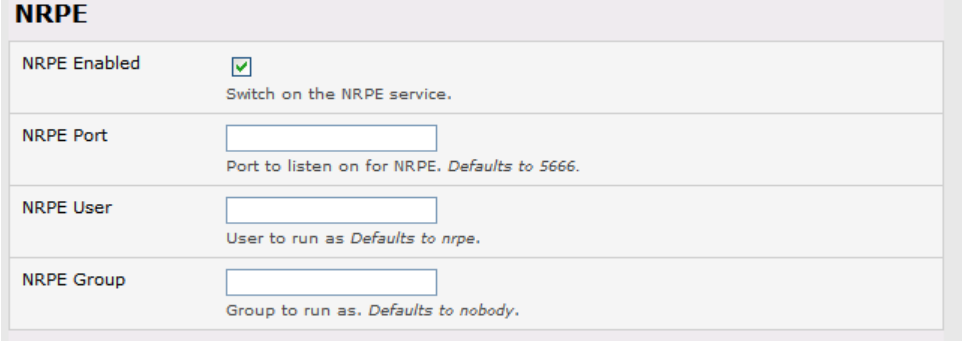
2. Enter the **Nagios Host Name** that the Console server will be referred to in the Nagios central server – this will be generated from local System Name (entered in **System > Administration**) ifunspecified.
3. In **Nagios Host Address** enter the IP address or DNS name that the upstream Nagios server willuse to reach the console server – if unspecified this will default to the first network port's IP (Network (1) as entered in **System > IP**).
4. In **Nagios Server Address** enter the IP address or DNS name that the console server will use toreach the upstream Nagios monitoring server.
5. When NRPE and NSCA are both enabled, NSCA is preferred method for communicating with theupstream Nagios server – check **Prefer NRPE** to use NRPE

whenever possible (i.e. for all communication except for alerts).

9.2.2 Enable NRPE monitoring



Enabling NRPE allows you to execute plug-ins (such as check_tcp and check_ping) on the remote Consoleserver to monitor serial or network attached remote servers. This will offload CPU load from the upstreamNagios monitoring machine which is especially valuable if you are monitoring hundreds or thousands of hosts. To enable NRPE:

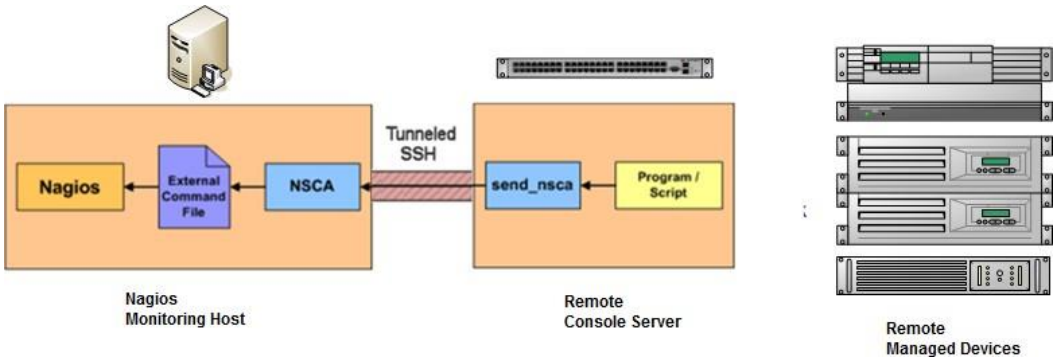


1. Select **System > Nagios** and check **NRPE Enabled**.

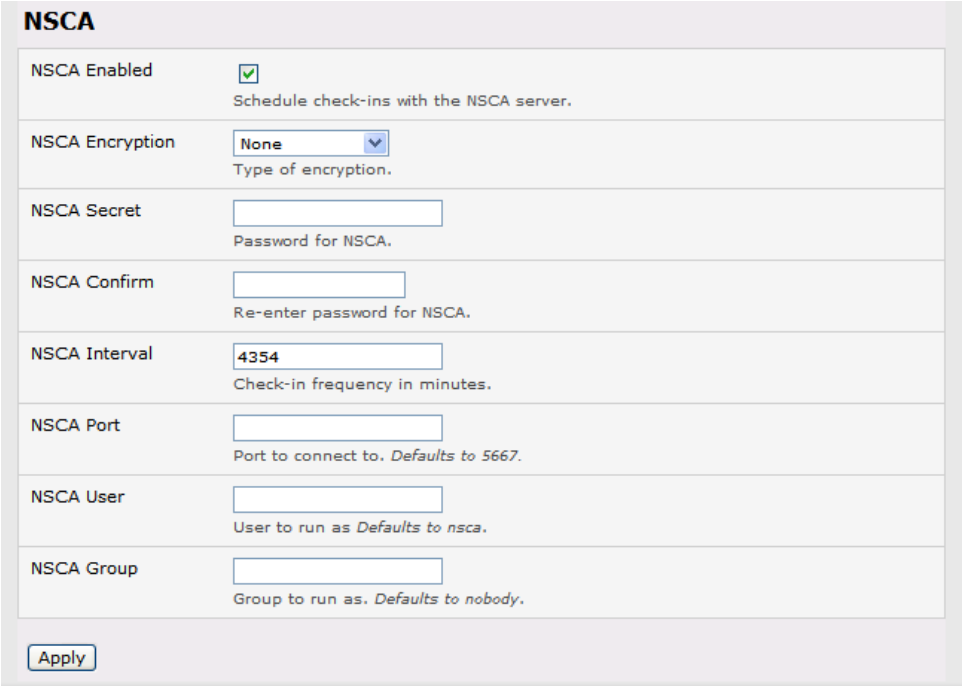
2. Enter the details the user connection to the upstream Nagios monitoring server and see the sample Nagios configuration example below for details of configuring specific NRPE checks.

The console server accepts a connection between the upstream Nagios monitoring server and the NRPEserver 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 tothe Nagios daemon running on the monitoring server. To enable NSCA:



1. Select System > Nagios and check NSCA Enabled.

2. Select the **Encryption** from the drop-down list and enter a **Secret** password and specify a check **Interval**.

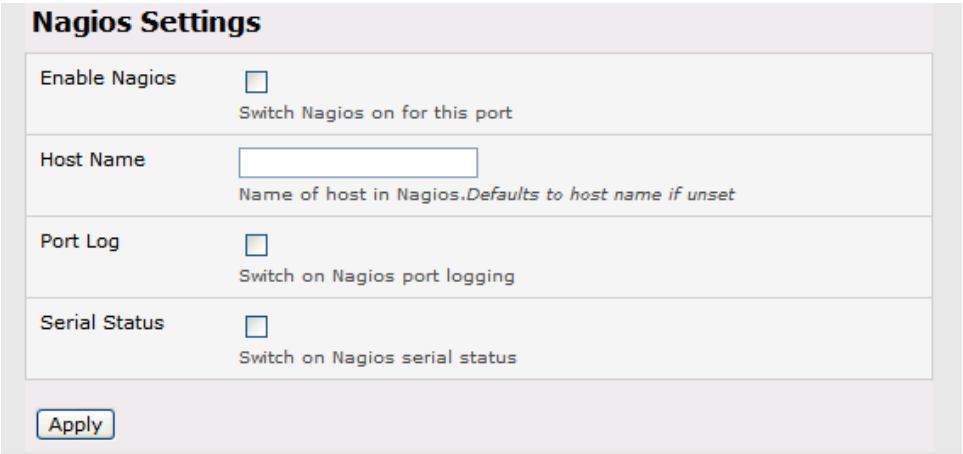
See the sample Nagios configuration section below for some examples of configuring specificNSCA checks.

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. To enable Nagios to monitor on a device connected to the console server serial port:

1. Select **Serial & Network > Serial Port** and click **Edit** on the serial Port # to be monitored.

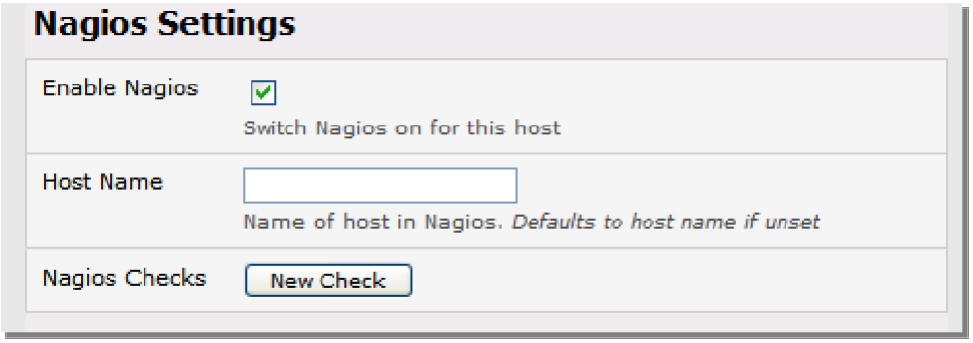
2. Select **Enable Nagios,** specify the name of the device on the upstream server and determine thecheck to be run on this port. **Serial Status** monitors the handshaking lines on the serial port and**Check Port** monitors the data logged for the serial port.



9.2.5 Configure selected Network Hosts for Nagios monitoring

The individual Network Hosts connected to the console server to be monitored must also be configuredfor Nagios checks:

1. Select **Serial & Network > Network Port** and click **Edit** on the **Network Host** to be monitored.



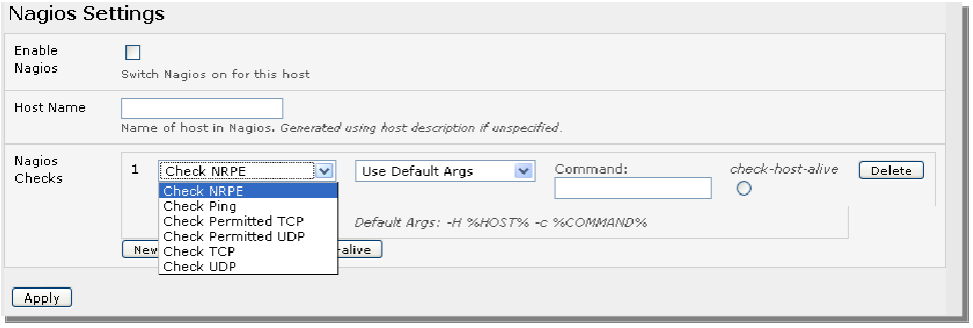
2. Select **Enable Nagios,** specify the name of the device as it will appear on the upstream Nagiosserver.

3. Click **New Check** to add a check which will be run on this host.

4. Select **Check Permitted TCP/UDP** to monitor a service that you have previously added as a **Permitted Service**.

5. Select **Check TCP/UDP** to specify a service port that you wish to monitor, but do not wish to allowexternal access.

6. Select **Check TCP** to monitor.



7. The **Nagios Check** nominated as the **check-host-alive** check is the check used to determinewhether the network host is up or down.

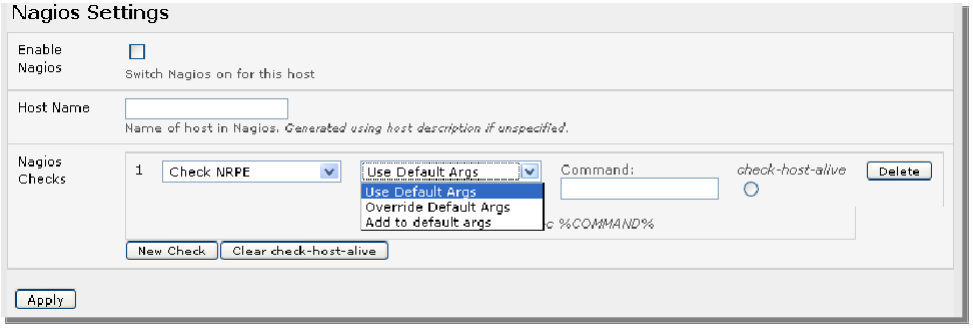
8. This will be *Check Ping* – although in some cases the host will be configured not to respond topings.

9. If no **check-host-alive** check is selected, the host will always be assumed to be up.

10. You may deselect check-host-alive by clicking **Clear check-host-alive**.

11. If required, customize the selected **Nagios Checks** to use custom arguments.

12. Click **Apply**.



9.2.6 Configure the upstream Nagios monitoring host

See the Nagios documentation (http://www.nagios.org/documentation/) for configuring the upstreamserver:

The section entitled *Distributed Monitoring* steps through what you need to do to configure NSCA on theupstream server (under *Central Server Configuration*).

NRPE Documentation has recently been added which steps through configuring NRPE on the upstreamserver http://nagios.sourceforge.net/docs/nrpe/NRPE.pdf.

At this stage, Nagios at the upstream monitoring server has been configured, and individual serial port andnetwork 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, 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 each for NRPE and NSCA. In practice, these would be combined into a single check which used NSCAas a primary method, falling back to NRPE if a check was late – for details see the Nagios documentation http://www.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 -ccheck_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 check the status of a connected host or service. This status is communicated to the upstream Nagios server which uses the results to monitor the current status of the distributed network. Each console serveris preconfigured with a selection of the checks that are part of the Nagios plug-ins package:

check_tcp and check_udp are used to check open ports on network hosts

check_ping is used to check network host availability.

check_nrpe used to execute arbitrary plug-ins in other devices.

Each console server is preconfigured with two checks:

check_serial_signals used to monitor the handshaking lines on the serial ports.

check_port_log used to monitor the data logged for a serial port.

9.3.3 Additional plug-ins

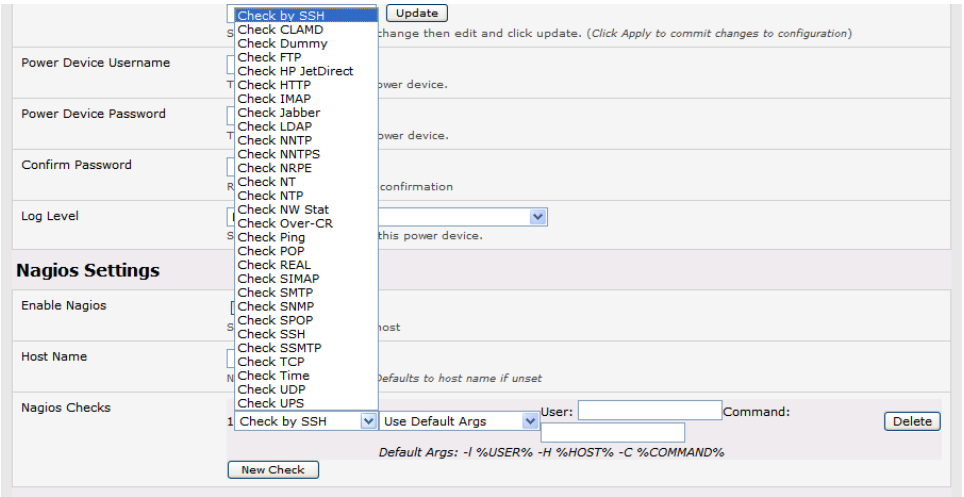
Additional Nagios plug-ins (listed below) are available for all the CM7100 or IM7200 products:

```
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.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 addinsdirectory on the USB flash and the downloaded text plug-in file saved in /etc/config.

To enable these new additional checks you select **Serial & Network > Network Port**, **Edit** the NetworkHost to be monitored, and select **New Checks**. The additional check option will have been included inthe updated **Nagios Checks** list, and you can again customize the arguments.



If you need other plug-ins to be loaded into the CM7100 or IM7200 firmware:

- If the plug-in in a Perl script, it must be rewritten as the console server does not support Perl.However, if you do require Perl support, make a feature request to support@opengear.com.

- Individual compiled programs may be generated using gcc for ARM. Contact support@opengear.com for details.

9.3.4 Number of supported devices

The number of devices that can be supported by any particular console server is a function of the numberof 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) tabulating:

Time	No encryption	3DES	SSH tunnel
NSCA for single check	~ ½ second	~ ½ second	~ ½ second
NSCA for 100 sequential checks	100 seconds	100 seconds	100 seconds
NSCA for 10 sequential checks, batched upload	1 ½ seconds	2 seconds	1 second
NSCA for 100 sequential checks, batched upload	7 seconds	11 seconds	6 seconds

	No encryption	SSL	no encryption - tunneled over existing SSH session
NRPE time to service 1 check	1/10th second	1/3rd second	1/8th second
NRPE time to service 10 simultaneous checks	1 second	3 seconds	1 ¼ seconds
Maximum number of simultaneous checks before timeouts	30	20 (1,2 and 8) or 25 (16 and 48 port)	25 (1,2 and 8 port), 35 (16 and 48 port)

The results were from running tests 5 times in succession with no timeouts on any runs. However thereare 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 SSHwill take care of the security.

When the console server submits NSCA results it staggers them over a certain time period (e.g. 20 checksover 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 throughin a single transaction.

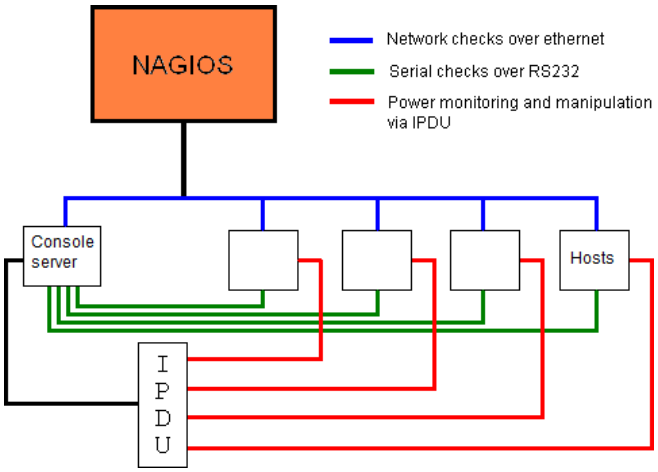
9.3.5 Distributed Monitoring Usage Scenarios

Below are a number of distributed monitoring Nagios scenarios:

Local office

In this scenario, the console server is set up to monitor the console of each managed device. It can beconfigured 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.

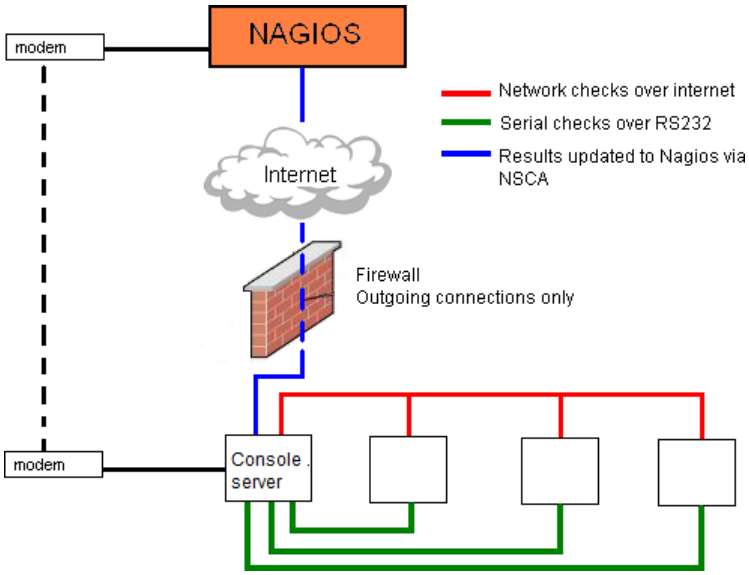
The console server may be augmented at the local office site by one or more Intelligent Power DistributionUnits (IPDUs) to remotely control the power supply to the managed devices.



Remote site

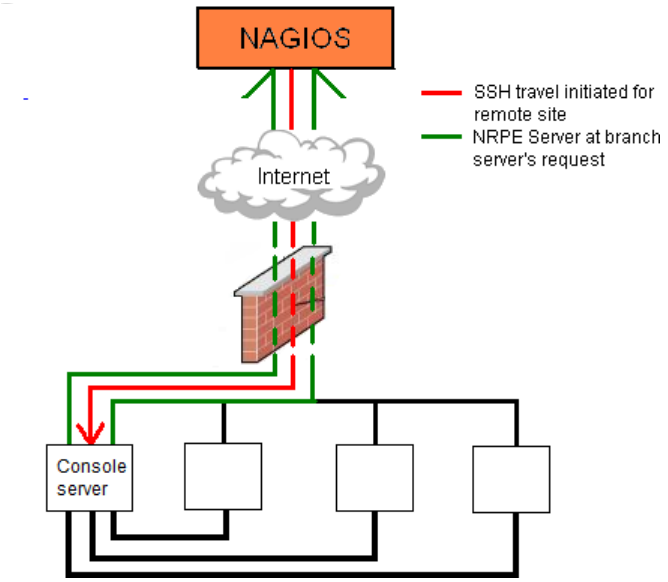
In this scenario the console server NRPE server or NSCA client can be configured to make active checksof configured services and upload to the Nagios server waiting passively. It can also be configured to service NRPE commands to perform checks on demand.

In this situation, the console server will perform checks based on both serial and network access.



Remote site with restrictive firewall

In this scenario the role of the console server will vary. One aspect may be to upload check results throughNSCA. 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 establishes a connection to the console server and execute any NRPE commands before droppingthe connection.

10. SYSTEM MANAGEMENT

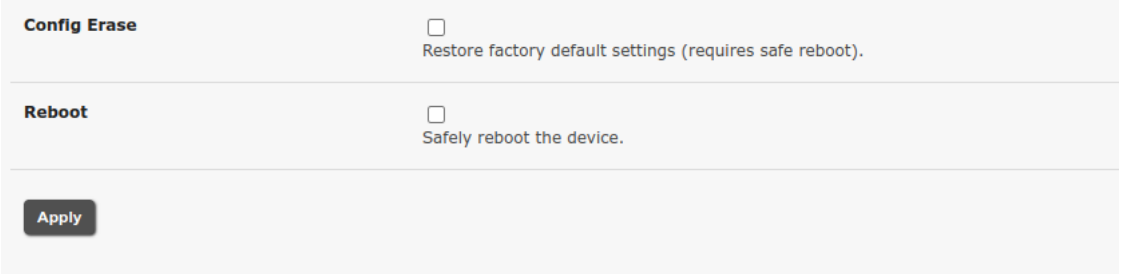
This chapter describes how an administrator can perform a range of general console server systemadministration and configuration tasks such as:

- 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.

10.1 System Administration and Reset

Administrators can reboot or reset the gateway to default settings.

To perform a soft reset, select **Reboot** in the **System > Administration** menu and clicking **Apply**



The console server reboots with all settings (e.g. the assigned network IP address) preserved. This softreset disconnects all users and ends any SSH sessions that had been established.

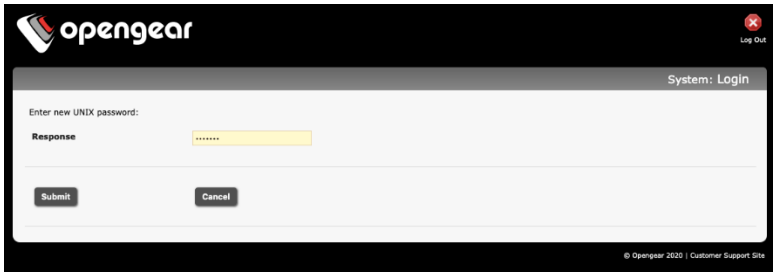
A soft reset will also occur when you switch OFF power from the console server and switch the power back ON. However, if you cycle the power and the unit is writing to flash you could corrupt or lose data, sothe software reboot is the safer option.

To perform a hard erase (hard reset), with the unit ON, push the Erase button on the rear panel **twice** witha ball point pen or bent paper clip.

This resets the console server back to its factory default settings and clears the console server's stored configuration information (i.e. the IP address will be reset to 192.168.0.1). You will be prompted to log inand must enter the default administration username and password:

Username: *root*

Password: *default*



You will then be required to change the root password.

To complete the change, you will enter the new password again.

10.2 Upgrade Firmware

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. **Status > Support Report** also reports the **Firmware Version**.

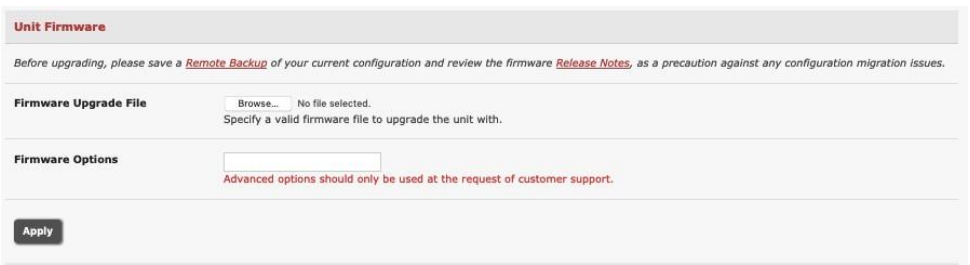
1. Download the latest firmware image from: https://ftp.opengear.com/download/opengear_appliances/ACM/current/.

   > **NOTE:** For end of sale products, down load the latest firmware from: https://ftp.opengear.com/download/opengear_appliances/end_of_sale_products/current/.

2. Save the downloaded file on a system on the same subnet as the Opengear device.

3. Download and read the Release Notes file for the latest information.

4. To up-load the firmware image file, select **System > Firmware.**



5. Specify the address and name of the downloaded Firmware Upgrade File or **Browse** the localsubnet and locate the downloaded file.

6. Click **Apply** and the Opengear device will undertake a soft reboot and commence upgrading thefirmware.
   This process will take several minutes.

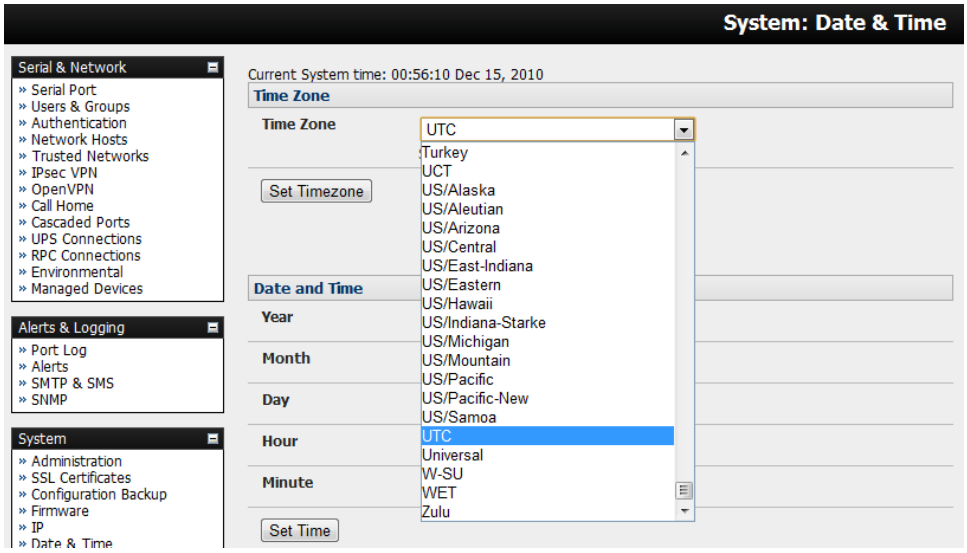
7. After the firmware upgrade has completed, click **here** to return to the Management Console.
   YourOpengear device will have retained all its pre-upgrade configuration information.

10.3 Configure Date and Time

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 (UTC) for all time synchronizations so it is not affected bydifferent time zones.

You need to specify your local time zone so the system clock shows correct local time. Set yourappropriate region/locality in the **Time Zone** selection box and click **Set Timezone.**



NOTE: Time Zone can also be set to UTC which replaced Greenwich Mean Time as the World standard fortime in 1986.

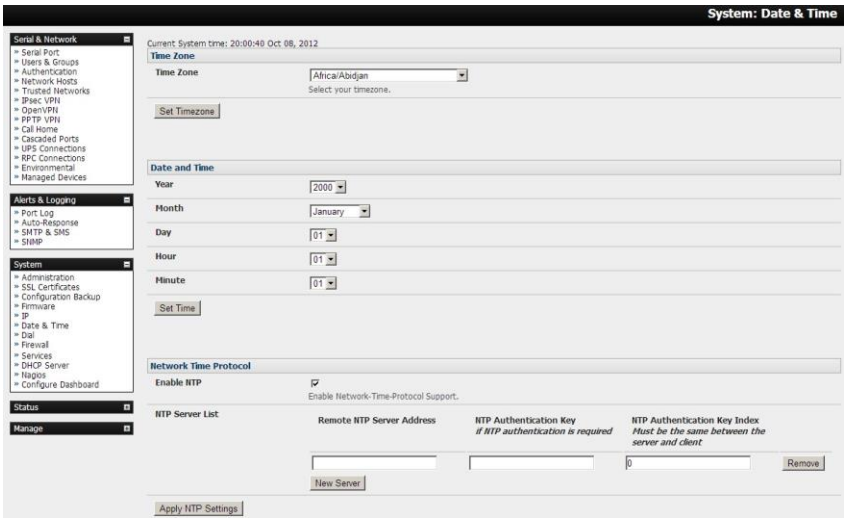
Configuring NTP ensures the Opengear appliance clock is kept accurate (once Internet connection hasbeen established).

1. Select the **Enable NTP** checkbox in the **Network Time Protocol** section of the **System > Date &Time** page.

2. Enter the IP address of the remote **NTP Server.**

3. If your external NTP server requires authentication, you need to specify the **NTP AuthenticationKey** and the K**ey Index** to use when authenticating with the NTP server.

4. Click **Apply NTP Settings**.

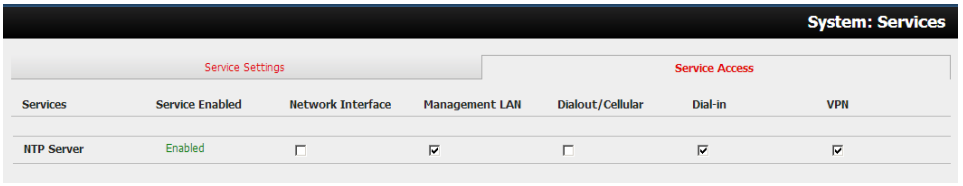


If remote NTP is not used, the time can be set manually:

1. Enter the **Year**, **Month**, **Day**, **Hour** and **Minute** using the **Date** and **Time** selection boxes.
2. Check **Set Time**.
3.

NOTES: All Opengear appliances have an internal battery-backed hardware clock. When the time and date isset through the management console or retrieved from an NTP server, the hardware clock of the Opengear appliance is automatically updated. The hardware clock uses a battery to allow the current time and date to be maintained across reboots or when the appliance has been powered down for longer periods of time.

With the NTP peering model, the Opengear appliance can share its time information with other devices connected to it, so all devices can be time synchronized. To do this, tick Enable NTP onthe Time and Date page, and ensure that the appropriate networks are selected on the Service Access page.

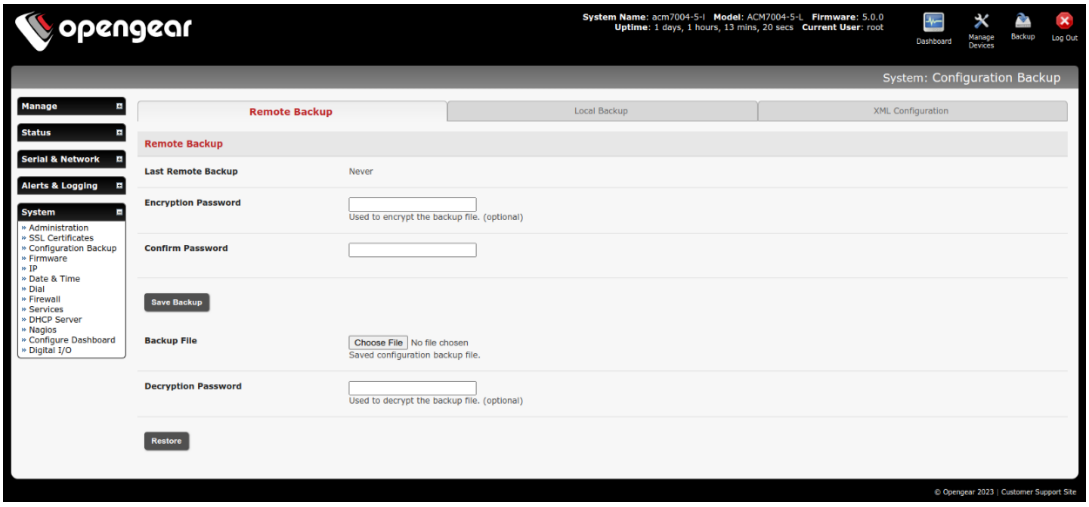


10.4 Configuration Backup

It is recommended that you back up the console server configuration whenever you make significantchanges, such as adding new users or managed devices, before performing a firmware upgrade. You can also encrypt the backup by providing a password.

1. Select the **System > Configuration Backup** menu option or click the

icon.



With all console servers you can save the backup file remotely on your PC and you can restoreconfigurations from remote locations:

2. Enter the **Encryption Password** to be used to encrypt the backup.

3. Re-enter password to **Confirm**.

4. Click **Save Backup** in the **Remote Configuration Backup** menu.

5. The config backup file (System Name_date_config.opg) is downloaded to your PC and saved inthe location you nominate.

> **NOTE:** To export or import a backup without encryption (original behaviour), leave the password fields blank.

You can also use the CLI to set up encryption and decryption, use -e or -i for exporting or restoring backups respectively. You can pass in the password as plaintext, or through the use of a file descriptor. A prefix of either "pass:" or "fd:" is used to indicate what method is being used to pass in the password.

Example:

```
config -e /tmp/config-backup.opg -X pass:password123

config -i /tmp/config-backup.opg -X pass:password123 && reboot
```

exec 9</secure/tmp/password && config -i /tmp/config-backup.opg -X fd:9 && reboot

To restore a remote backup:

1. Click **Browse** in the Remote Configuration Backup menu and select the **Backup File** you want torestore.

2. Enter the **Encryption Password** to be used to decrypt the backup file.

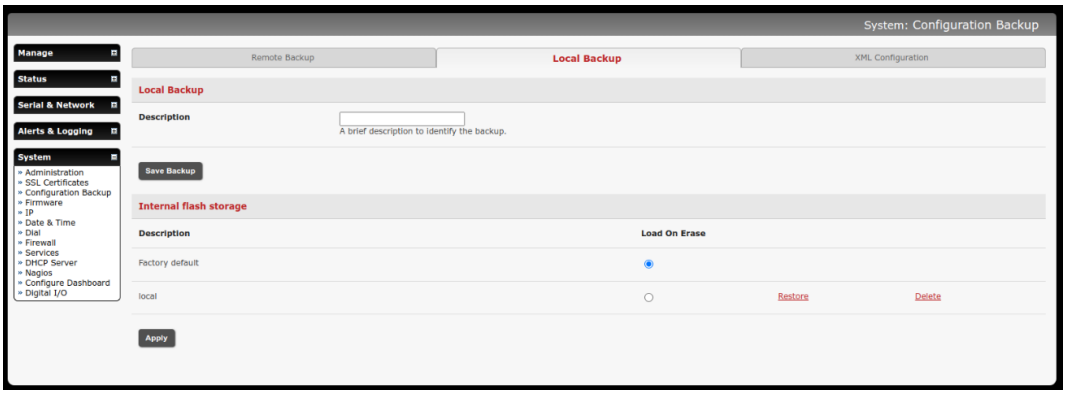
3. Click **Restore** and click **OK.**
   This will overwrite all the current configuration settings in yourconsole server.

With some console servers, you can save the backup file locally onto the USB storage. Your consoleserver must support USB and you must have an internal or external USB flash drive installed.

To backup and restore using USB:

1. Ensure the USB flash is the only USB device attached to the console server.

2. Select the **Local Backup** tab and **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 otherinformation you have saved onto the USB storage device. We recommend 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, a warning to remove them appears.



3. To back up to the USB enter a brief **Description** of the backup in the Local Backup menu andselect **Save Backup.**

4. The Local Backup menu will display all the configuration backup files you have stored onto theUSB flash.

5. To restore a backup from the USB, select **Restore** on the particular backup you wish to restoreand 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 load your alternate default configuration instead of its factory settings:

To set an alternate default configuration, check **Load On Erase** and click **Apply.**

NOTE: Before selecting Load On Erase, ensure you have tested your alternate default configuration byclicking Restore.

If for some reason your alternate default configuration causes the console server to become unbootable recover your unit to factory settings using the following steps:

- If the configuration is stored on an external USB storage device, unplug the storage device andreset to factory defaults as per section 10.1.
- If the configuration is stored on an internal USB storage device reset to factory defaults using aprepared USB storage device:
  - The USB storage device must be formatted with a Windows FAT32/VFAT file systemon the first partition or the entire disk, most USB thumb drives are 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 andreset to factory defaults as per section 10.1.

After recovering your console server, ensure the problematic configuration is no longer selectedfor Load On Erase.

To encrypt a configuration backup and restore using USB:

1. Select the **System > Configuration Backup** menu option or click the

icon.

2. Select the **Local Backup** tab and **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 otherinformation you have saved onto the USB storage device. We recommend 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, a warning to remove them appears.

3. To back up to the USB enter a brief **Description** of the backup in the Local Backup menu andselect **Save Backup.**

4. The Local Backup menu will display all the configuration backup files you have stored onto theUSB flash.

5. To restore a backup from the USB, select **Restore** on the particular backup you want to restoreand click **Apply.**

10.5 Delayed Configuration Commit

This mode allows the grouping or queuing of configuration changes and the simultaneous application ofthese changes to a device. For example, changes to authentication methods or user accounts may be grouped and run once to minimize system downtime. To enable:

1. Check the **Delayed Config Commits** button under **System > Administration**.

2. Click **Apply**.
The Commit Config icon is displayed in top right-hand corner of the screen between the Backup andLog Out icons.

To queue and run configuration changes:

1. Apply all the required changes to the configuration e.g. modify user accounts, amend authentication method, enable OpenVPN tunnel or modify system time.

2. Click the **Commit Config** button.
This will generate the **System > Commit Configuration** screendisplaying all the configurators to be run.

3. Click **Apply** to run all the configurators in the queue or click **Cancel** if you want to discard all thedelayed configuration changes.

> **NOTE:** All the queued configuration changes will be lost if Cancel is selected.

To disable the Delayed Configuration Commits mode:

1. Uncheck the **Delayed Config Commits** button under **System > Administration** and click **Apply**.

2. Click the **Commit Config** button in top right-hand corner of the screen to display the **System >Commit Configuration** screen.

3. Click **Apply** to run the system settings configurator.
The **Commit Config** button will no longer be displayed in the top right-hand corner of the screen andconfigurations will no longer be queued.

10.6 FIPS Mode

The console servers use an embedded cryptographic module that has been validated to meet the FIPS140-2 standards.

> **NOTE:** Opengear console servers use an embedded OpenSSL cryptographic module that has beenvalidated to meet the FIPS 140-2 standards.

When configured in FIPs mode, access to some services on the console servers will use the embedded FIPS compliant cryptographic module, see the table under FIPS Compliance. To connect you must also be usingcryptographic algorithms that are FIPs approved in your browser or client or the connection will fail.

1. Select the **System > Administration** menu option.

2. Check **FIPS Mode** to enable FIPS mode on boot, and check **Reboot** to reboot the console server.

3. Click **Apply** and the console server reboots.
It takes several minutes to reconnect as secure communications with your browser are validated, and when reconnected it will display **FIPS mode:Enabled** in the banner.

> **NOTE:** 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 bootinto FIPS mode. To disable FIPS mode:
>
> config -d config.system.fips
>
> rm /etc/config/FIPS
>
> flatfsd –b

10.7 FIPS Compliance

The Federal Information Processing Standard Publication 140-2 (FIPS 140-2) is a U.S. government computer security standard that is used to approve cryptographic modules. Opengear appliances operating in FIPS mode provide FIPS 140-2 level one compliance by utilizing FIPS validated OpenSSL 3.0.9 cryptographic library while in FIPS mode.

NOTE: The default module will be Openssl 3.1.4, however, Openssl 3.0.9, is the standard for base and the FIPS modules.

10.7.1 Considerations when Using the FIPS Feature

In organizations where FIPS is required, the following points should be noted:

OpenSSL 3.0.9 FIPS provider limits the available cryptography ciphers/algorithms only those that have been validated by laboratory to be FIPS compliant.

CAUTION: Configuration backup should be taken before enabling or disabling FIPS.
FIPS has the potential to break any service with secure connectivity, including services listed in the following table.

Table of FIPS Service Compliance:

Feature	Affected Process/Service	Impact
Lighthouse Enrollment	Open VPN	OpenVPN is relying on Openssl as cryptographic module and the security negotiation and authentication is FIPS compliant and MD5 is only allowed for pseudo random function (PRF) generation in initialization.
IPsec	Strongswan	The FIPS module is not supported at version 5.1.0.
Remote authentication	RADIUS, TACACS+, LDAP*, Keberos	* Only the “LDAP over SSL only“ method is supported in FIPS mode. Others are not FIPS compliant.
SNMP	snmpstatusd, snmpd, snmptrapd	Authentication and Encryption should be used as the security policy as V1 and V2 have no encryption. SNMPv3 with MD5 encryption is not FIPS compliant and will be overridden with SHA in the configuration in FIPS mode. Use an algorithm that is FIPS compliant. It is recommended that authPriv security policy is used when in FIPS mode for SNMPv3.
PPTP VPN/PPP		Not FIPS compliant.
OpenSSL	Certificates	SSL cert must be signed with a key size of 2048 or greater.
NetOps Modules	gre (Secure Provisioning) nom-ipaccess-lhvpn (IP access).	Opengear NetOps Modules are not functional when FIPS mode is enabled.

Feature	Affected Process/Service	Impact
Routing protocols	Quagga	Routing protocols should not select an MD5 cipher.

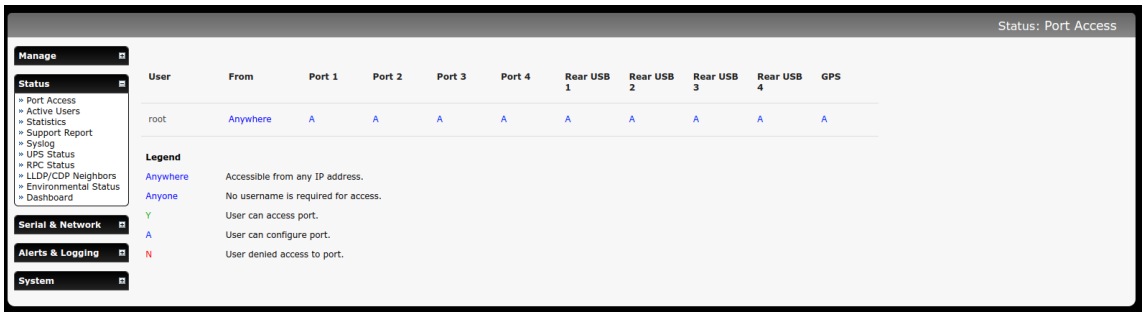
11. STATUS REPORTS

This chapter describes the dashboard feature and the status reports that are available:

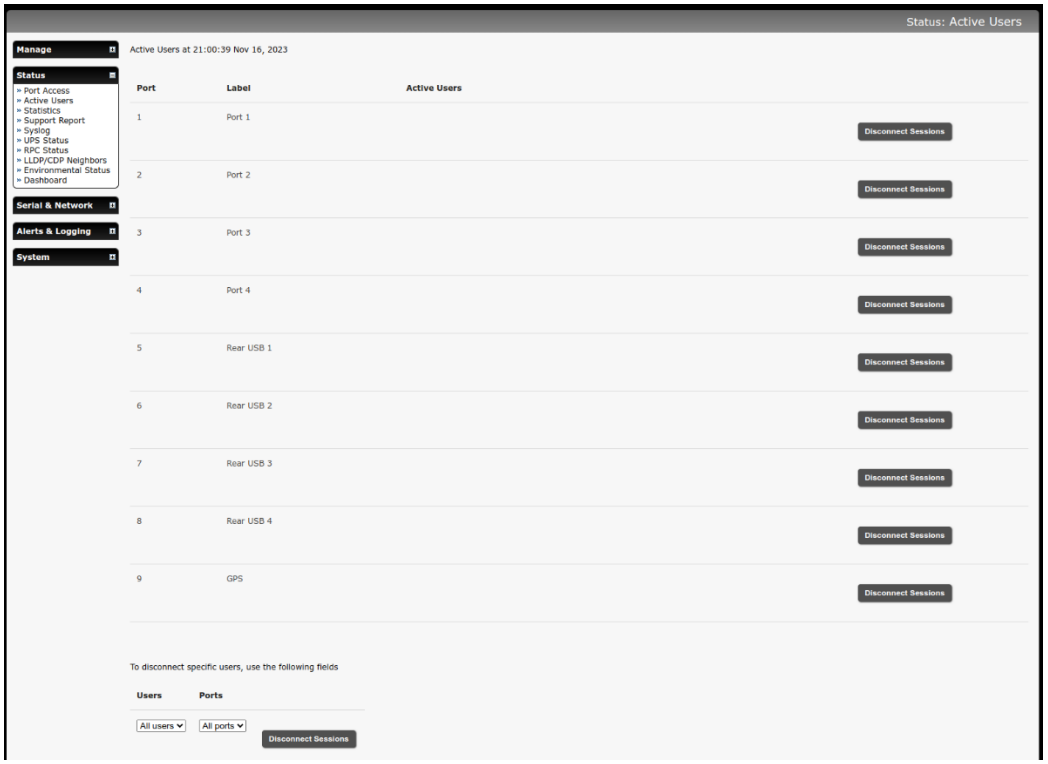
- Port Access and Active Users
- Statistics
- Support Reports
- Syslog
- Dashboard

11.1 Port Access and Active Users

Administrators can see which users have access privileges with which serial ports. Select the **Status >Port Access.**



Administrators can also see the current status of users who have active sessions on those ports. Selectthe **Status > Active Users.**



The **Status > Active Users** menu enables administrators to selectively terminate serial sessions. Connection types Telnet, SSH, raw TCP and unauthenticated Telnet can be disconnected. You cannotdisconnect an RFC2217 session.

The root user, any user in the admin group, and port-level administrators 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. This page shows the local console ports and not any cascaded ports, or in the case of port admins, the ports they have permission to administer.

There are **Disconnect Sessions** buttons along the right-hand side of the table listing active users. Thesebuttons 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 ofdisconnect 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. If you wish to disconnect the user *tester* from all ports, choose *tester* in the user's box, and Allports in the Ports box and hit the Disconnect Sessions button.

NOTE: You can also disconnect serial sessions from the command line using the --disconnect option withthe 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 submenus.

11.3 Support Reports

The Support Report provides useful status information that will assist the Opengear technical supportteam to solve any problems you may experience with your console server.

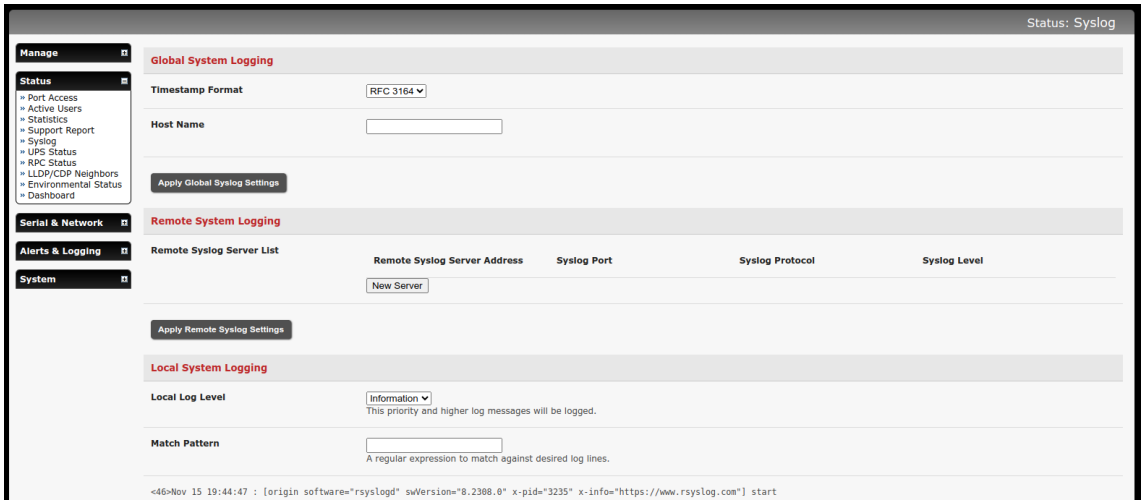
If you do experience a problem and have to contact support, ensure you include the Support Report withyour email support request. The Support Report should be generated when the issue is occurring and attached in plain text format.

1. Select **Status > Support Report**.
   A status snapshot appears.

2. Save the file as a text file and attach it to your support email.

11.4 Syslog

The Linux System Logger in the console server maintains a record of all system messages and errors,select **Status > Syslog.**



11.4.1 Global System Logging

The **Global System Logging** setting lets you specify the level of detail of the timestamp and domain namein the syslog. The options are:

- **RFC 3164** This option displays a timestamp in seconds and IP addresses, for example:

  ```
  <14>Jun  5 23:22:01 cgi[3176]: INFO   /home/httpd/cgi-
  bin/index.cgi -WebUI User: root - LOGIN from 192.168.100.1:51380
  ```

- **RFC 3339** This option displays a timestamp in milliseconds as well as fully qualified domainnames (FQDN), for example:

  ```
  <46>2019-06-05T23:25:52.547326-04:00 syslog:  [origin
  software="rsyslogd" swVersion="8.33.0" x-pid="3492" x-
  info="http://www.rsyslog.com"] start
  ```

11.4.2 Syslog Server Address and Port

The syslog record can be redirected to a remote Syslog Server. Enter the remote **Syslog Server Address** and Syslog Server Port details and click **Apply**.

11.4.3 Power State Changes in Syslog

Power state changes are captured in the syslog for:

- All DDC devices.
- IM72xx DDC or rev6a AC models (IM7200-DAC devices manufactured after April 16, 2019) withpower monitoring capabilities.

Voltage transitions from about 0 to about 10-13 will emit syslog("PSU xxx power up").

Voltage transitions from about 12 to < 9 for over a period of time (for example 5 to 10 seconds) will emitsyslog("PSU xxx power down")..

When both PSU #1 and #2 are on, the syslog reports it. For example:

```
<14>May 7 16:57:37 psmon[2508]: INFO psmon - Internal Voltage[PSU
#1] statusOPERATIONAL, value  12.025001

<14>May 7 16:57:37 psmon[2508]: INFO psmon - Internal Voltage[PSU
#2] statusOPERATIONAL, value  12.050000
```

If PSU #1 is turned off, the syslog reports it. For example:

```
<14>May 7 16:59:08 psmon[2508]: INFO    psmon - Internal
Voltage[PSU #1]status LOW, value 8.100000
```

If PSU #1 is turned on again, the syslog captures that. For example:

```
<14>May 7 16:59:23 psmon[2508]: INFO    psmon - Internal
Voltage[PSU #1]status OPERATIONAL, value 12.025001
```

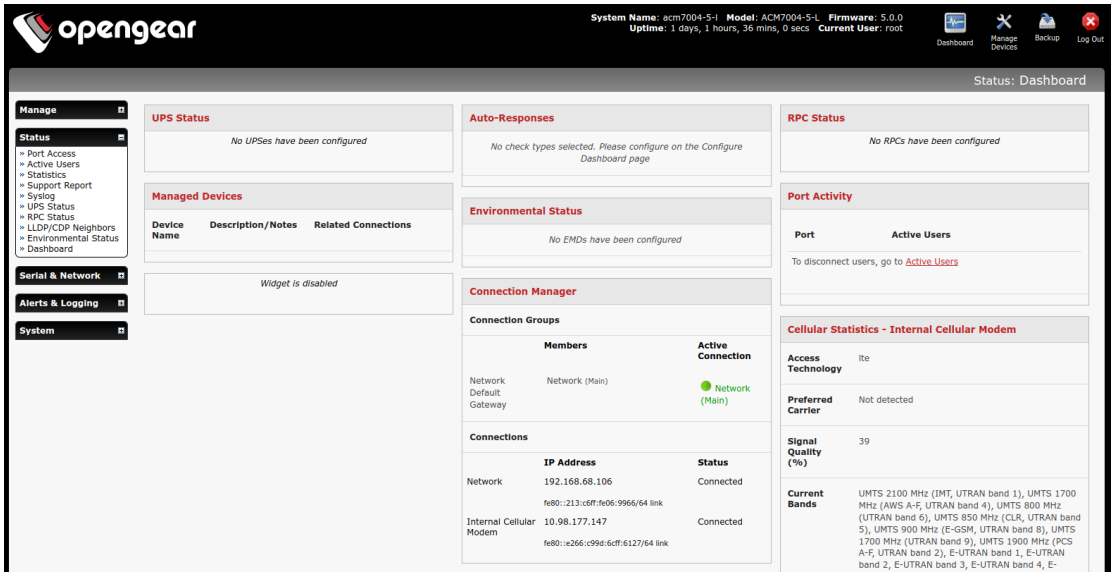
11.4.4 Syslog Match Pattern

To make it easier to find information in the local Syslog file, a pattern matching filter tool is provided.

Specify the **Match Pattern** that is to be searched for (e.g. the search for mount is shown below) and click **Apply.** The Syslog will be represented with those entries that include the specified pattern.

11.5 Dashboard

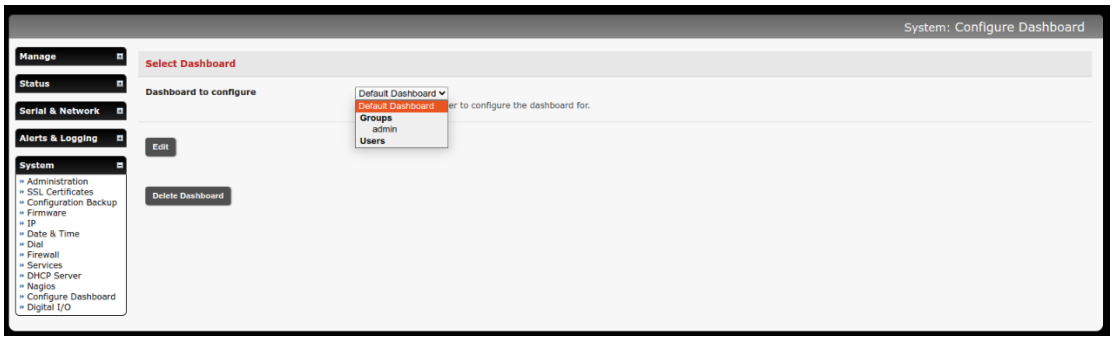
The Dashboard provides administrators with a summary of the status of the console server and itsmanaged devices. Custom dashboards can be configured for each user groups.



11.5.1 Configuring the Dashboard

Admin group users can configure and access the dashboard. To configure a custom dashboard:

Select **System > Configure Dashboard** and select the user (or group) you are configuring this customdashboard layout for.



You can configure a custom dashboard for any admin user or for the admin group or you can reconfigurethe default dashboard.

The **Status > Dashboard** screen is the first screen displayed when admin users (other than root) log intothe console manager. If you log in as John, are in the admin group, and there is a dashboard layout configured for John, the dashboard for John appears on log-in and when 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, yousee the admin group dashboard. You will see the default dashboard if there is no user dashboard or admingroup dashboard configured.

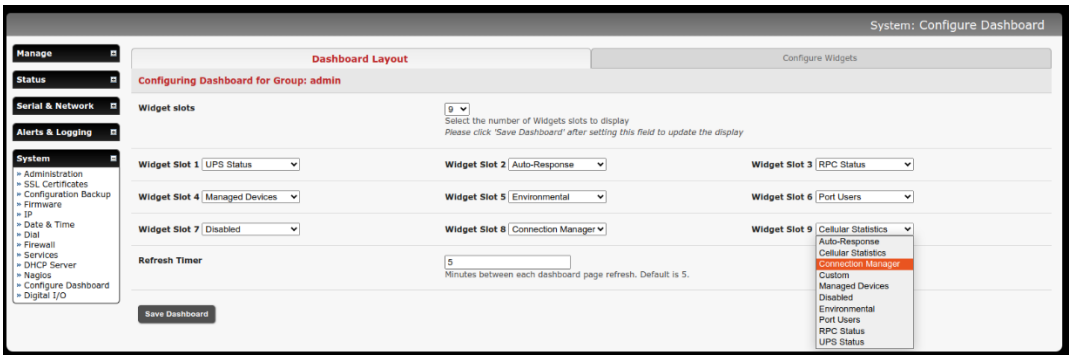
The root user does not have its own dashboard.

The above configuration options are intended to enable admin users to setup their own customdashboards.

The Dashboard displays a configurable number of widgets. These widgets include status for majorsubsystems such as connection manager, Auto-Response, Managed Devices, and cellular. The admin user can configure which of these widgets is to be displayed where:

1. Go to the **Dashboard layout** panel and select which widget is to be displayed in each of the **WidgetSlots.**

2. Click **Save Dashboard**.

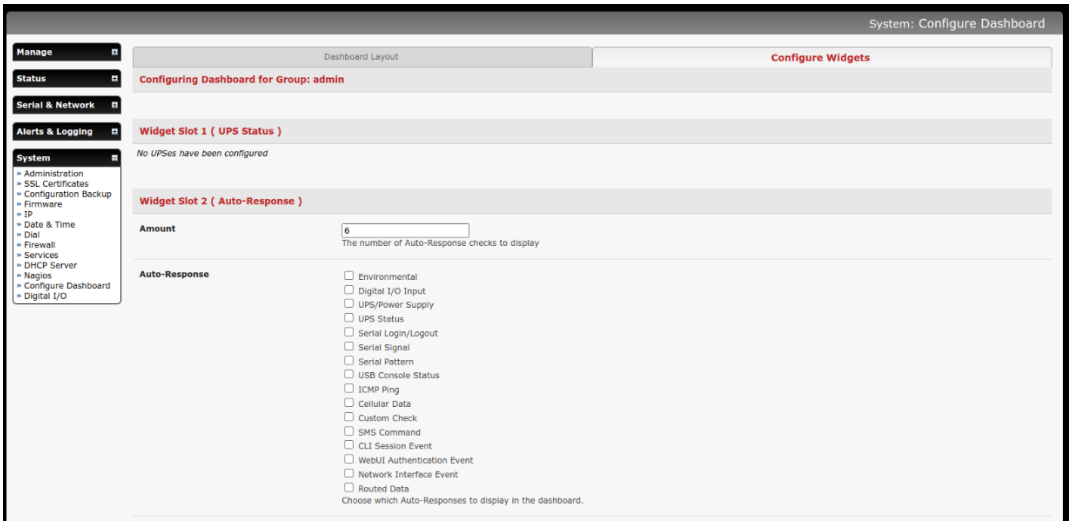


NOTE: The Alerts widget is a new screen that shows the current alerts status. When an alert is triggered, a corresponding .XML file is created in /var/run/alerts/. The dashboard scans all the se files and displays a summary status in the alerts widget. When an alert is deleted the corresponding .XML files that belong to that alert are also deleted.

To configure what is to be displayed by each widget:

3. Go to the **Configure widgets** panel and configure each selected widget (e.g. specify which UPSstatus is to be displayed on the ups widget or the maximum number of managed devices to bedisplayed in the devices widget.

4. Click **Apply**.



NOTE: Dashboard configuration is stored in the /etc/config/config.xml file. Each configured dashboardwill increase the config 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 inside a dashboard widget:

Create a file called *widget-<name>.sh* in the folder /etc/config/scripts / where <name> can be anything.You can have as many custom dashboard files as you want.

Inside this file you can put any code you wish. When configuring the dashboard, choose *widget-<name>.sh*in the drop-down list. The dashboard will run the script and display the output of the script commands on the screen inside the widget.

The best way to format the output would be to send HTML commands back to the browser by addingecho commands in the script:

echo '<table>'

You can run any command and its output will be displayed in the widget window directly.

Below is an example script which writes the current date to a file, and echo's HTML code back to thebrowser. The HTML code gets an image from a URL and displays it in the widget.

```
#!/bin/sh

date >> /tmp/testecho '<table>'

echo '<tr><td> This is my custom script running </td></tr>'
echo '<tr><td>'

echo '<img src="http://www.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 all 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).

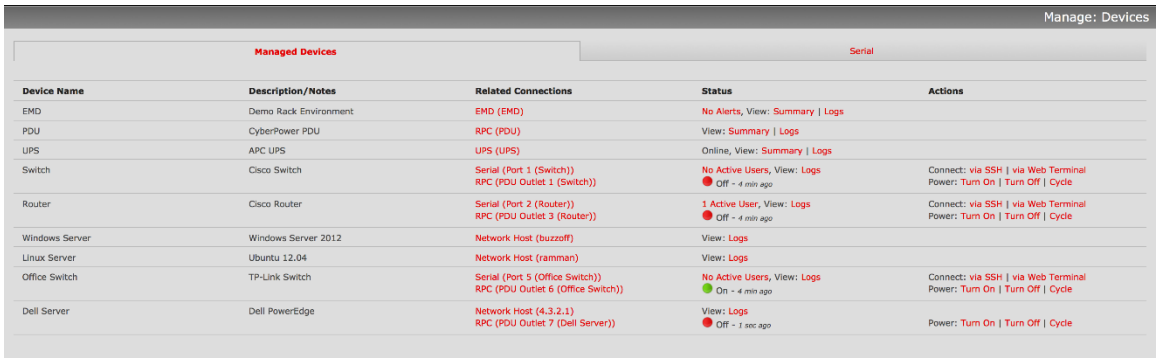
All other Management Console menu items are only available to administrators.

12.1 Device Management

See also, 3.4 Network Host.

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.

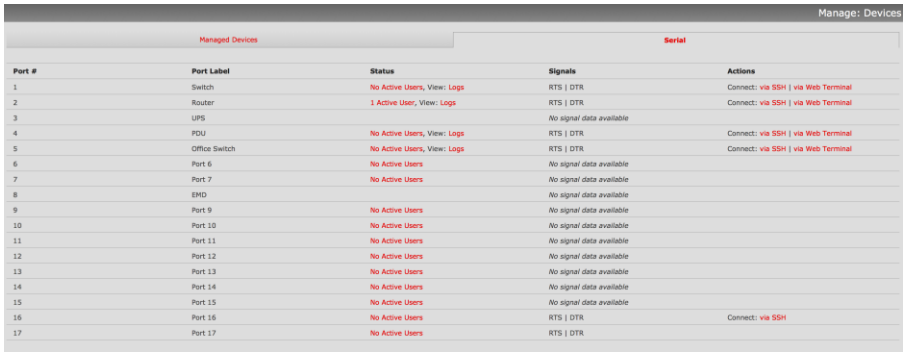
Admin-group users are presented with a list of all configured managed devices and their constituent connections, **user-group** users only see the **Managed Devices** for each **Related Connection** where theyhave been permitted access.



The **Status** column displays the current status for each Related Connection with links to detailed status.The links in the **Actions** column are used to control the managed device.

Administrators will see all configured managed devices. Non-admin users will see the managed devicesthey or their group have been given access privileges for.

Select the **Serial** tab for an ungrouped view of permitted serial port connections for the current user.



The **Signals** column displays the current state of the serial pins.

> **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 (e.g. an SSH client like SecureCRT).

12.2 Port Logs

Users can view and download logs of data transferred to and from connected devices.

Select **Manage > Port Logs** and the serial Port # to be displayed.

This will display logs stored locally on the console server memory or USB flash.

12.3 Terminal Connection

The Web Terminal service is available for accessing the console server command line and devices attached tothe console server serial ports, directly from a web browser:

The Web Terminal service uses AJAX to enable the web browser to connect to the console serverusing HTTP or HTTPS, as a terminal - without the need for additional client installation on the user's PC.

Web browser access is available to users who are a member of the admin or users' groups.

12.3.1 Web Terminal

The AJAX based Web Terminal service may be used to access the console server command line orattached 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 isbeing used to browse to the Opengear Management Console, i.e. if you are browsing using an https:/ / URL (this is the default), the Web Terminal connects using HTTPS.

Administrators can communicate with the console server command line from their browser:

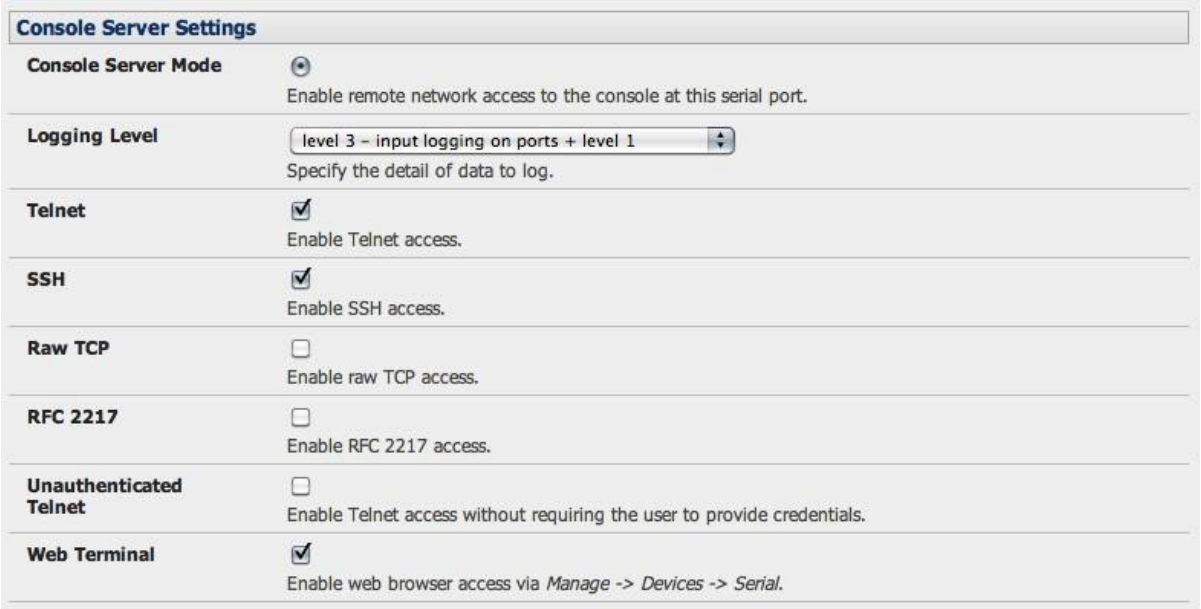
Select **Manage > Terminal** to display the Web Terminal from which you can log in to the console servercommand line.

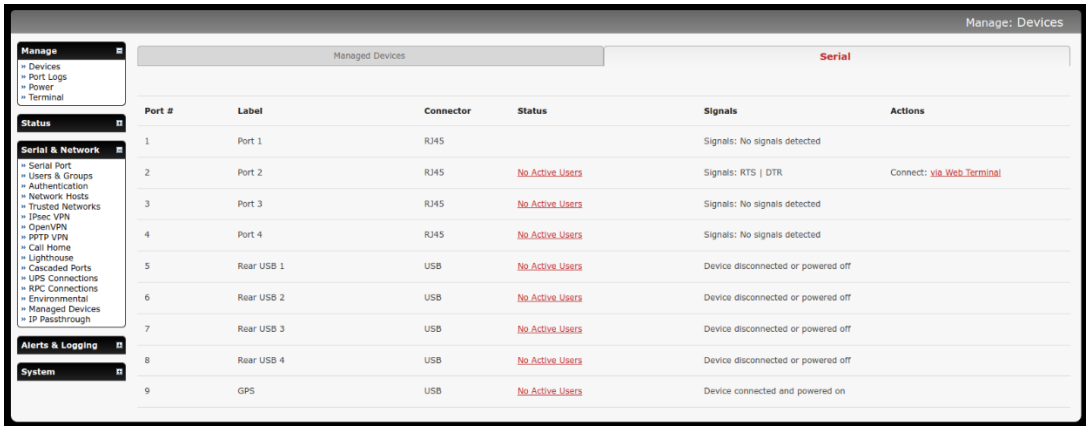
Web Terminal to Serial Device

To enable the Web Terminal service for each serial port you want to access:

1. Select **Serial & Network > Serial Port** and click **Edit**. Ensure the serial port is in Console serverMode.

2. Check **Web Terminal** and click **Apply**.





12.3.2 Console server access

Users can communicate with the console server command line and devices attached to the console server serial ports by using a Web terminal and browser.

12.4 Power Management

Users can access and manage the connected power devices. Select **Manage > Power**. This enables theuser to power Off/On/Cycle any power outlet on any PDU the user has been given access privileges to.

13. APPENDIX A: Hardware Specification

Feature	Value
Dimensions	ACM7004, ACM7004-2-L(V/A/R/MA/MV/MCR/MCT): 5 1/8 x 4 3/4 x 1 3/8 in (13 x 12 x 3.5 cm) IM7216/32/48: 17 x 10 x 1.75 in (44 x 25.4 x 4.5 cm) CM7116/32/48: 17 x 6.9 x 1.75 in (44 x 17 x 4.5 cm)
Weight	ACM7004, ACM7004-2-L(V/A/R/MA/MV/MCR/MCT): 0.6kg (1.3 lbs) IM7216/32/48: 4.5 kg (10 lbs) CM7116/32/48: 4 kg (9 lbs)
Ambient operating temperature	5°C to 50°C (41°F to 122°F) Higher for -I models
Non-operating storage temp	-30°C to +60°C (-20°F to +140°F)
Humidity	5% to 90%
Power	IM7200, CM7100: DAC have dual socket 100-240V AC DDC models dual +/- 36V to 72V DC Power consumption of IM7216-24E – 40W CM7100: SAC models – single socket universal 100-240V AC ACM7000: 110-240V AC to 12V DC external power adapter
Power Consumption	All less than 30W
CPU	IM7200: 1GHz ARM SoC (Marvell 88F6283) CM7100: 800MHz ARM SoC (Marvell 88F6W11) ACM7000: 800MHz ARM SoC (Marvell 88F6W11) Others: Micrel KS8695P controller
Memory	ACM7004, ACM7004-2-L(V/A/R/MA/MV/MCR/MCT): 254MB SDRAM, 256MB + 4GB Flash IM7216/32/48: 256MB SDRAM, 64MB + 16 GB Flash CM7116/32/48: 256MB SDRAM, 32MB + 4GB Flash
USB ports	ACM7004, ACM7004-2-L(V/A/R/MA/MV/MCR/MCT): 4 external USB2.0 IM7216/32/48: 2 external USB3.0 CM7116/32/48: 2 external USB2.0
Serial Connectors	ACM7004, ACM7004-2-L(V/A/R/MA/MV/MCR/MCT): 4 RJ-45 RS-232 serial ports IM7216-2: 16 RJ-45 RS-232 serial ports ** IM7232-2: 32 RJ-45 RS-232 serial ports ** IM7248-2: 48 RJ-45 RS-232 serial ports** CM7116-2: 16 RJ-45 RS-232 serial ports ** CM7132-2: 32 RJ-45 RS-232 serial ports ** CM7148-2: 48 RJ-45 RS-232 serial ports ** * models also have 1 DB-9 RS-232 console / modem serial port ** models also have 1 RJ45 console port
Serial Baud Rates	RJ45 ports - 50 to 230,400bps DB9 port - 2400 to 115,200 bps
Ethernet Connectors	IM7216/32/48: Two 10/100/1000 GbE copper or SFP fiber ports ACM7004, ACM7004-2-L(V/A/R/MA/MV/MCR/MCT): Two 10/100/1000 GbE ports

Feature	Value
	CM7116/32/48: Two 10/100/1000 GbE ports IM7216/32/48: Two 10/100/1000 GbE ports

Cellular Modem Frequency

Resilience Gateway ACM7000-L	Cellular Modem	LTE	UMTS/HSDPA HSUPA/HSPA	CDMA	GSM	EGSM	DCS	PCS
ACM700x-x-LMR	Sierra MC7304	2100 MHz 1800 MHz 2600 MHz 900 MHz (Band 1, 3, 8, 20) 800 MHz (Band 7)	2100 MHz 1900 MHz 850 MHz 900 MHz (Band 1, 2, 5, 8)		850 MHz	900 MHz	1800 MHz	1900 MHz
ACM700x-x-LMP	Sierra MC7430	2100 MHz 1800 MHz 850 MHz 2600 MHz 900 MHz 850 MHz 1500 MHz 700 MHz 2600 MHz 1900 MHz 2300 MHz 2500 MHz	2100 MHz 850 MHz 800 MHz 900 MHz 1700 MHz TD-SCDMA 1880 – 1920 MHz					
ACM700x-x-LMA ACM700x-x-LMV ACM700x-x-LMCR ACM700x-x-LMCT	Sierra MC7354	1900 MHz 1700/2100 MHz 850 MHz 700 MHz (LTE Band 2, 4, 5, 13, 17, 25)	2100 MHz 1900 MHz AWS 1700/2100 MHz 850 MHz 900 MHz	Cellular – 800 MHz PCS – 1900 MHz Secondary – 800 MHz				
Infrastructure Manager IM7200	**Cellular Modem**	**LTE**	**UMTS/HSDPA HSUPA/HSPA**	**CDMA**	**GSM**	**EGSM**	**DCS**	**PCS**
IM72xx-2-LR	Sierra MC7304	2100 MHz 1800 MHz 2600 MHz 900 MHz (Band 1, 3, 8, 20) 800 MHz (Band 7)	2100 MHz 1900 MHz 850 MHz 900 MHz (Band 1, 2, 5, 8)		850 MHz	900 MHz	1800 MHz	1900 MHz
IM72xx-2-LR	Sierra MC7455 (mPCIE) - NA and EU	2100 MHz 1900 MHz 1800 MHz 1700 MHz 850 MHz 2600 MHz 900 MHz 700 MHz (lower) 700 MHz (upper) 800 MHz 1900 MHz 850 MHz (ext) 700 MHz (SDL supplemental down-link) 2300 MHz 2500 MHz (TDD Time Division Duplex)	2100 MHz 1900 MHz 1800 MHz 1700 MHz 850MHz 900 MHz					
IM72xx-2-LMP	Sierra MC7430	2100 MHz 1800 MHz	2100 MHz 850 MHz					

		850 MHz 2600 MHz 900 MHz 850 MHz 1500 MHz 700 MHz 2600 MHz 1900 MHz 2300 MHz 2500 MHz	800 MHz 900 MHz 1700 MHz TD-SCDMA 1880 – 1920 MHz					
IM72xx-2-LMA IM72xx-2-LMV IM72xx-2-LMCB IM72xx-2-LMCR IM72xx-2-LMCT	Sierra MC7354	1900 MHz 1700/2100 MHz 850 MHz 700 MHz (LTE Band 2, 4, 5, 13, 17, 25)	2100 MHz 1900 MHz AWS 1700/2100 MHz 850 MHz 900 MHz	Cellular – 800 MHz PCS – 1900 MHz Secondary – 800 MHz				

Band	Frequency (Tx)	Frequency (Rx)
Band 1	1920-1980 MHz	2110-2170 MHz
Band 5	824-849 MHz	869-894 MHz
Band 6	830-840 MHz	875-885 MHz
Band 8	880-915 MHz	925-960 MHz
Band 9	1749.9-1784.9 MHz	1844.9-1879.9 MHz
Band 19	830-845 MHz	875-890 MHz

14. APPENDIX B: Safety & Certifications

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 fireor 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 recommendedyou use a surge suppressor or UPS to protect the equipment from transients.

FCC Warning Statement

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

WEEE Statement

The symbol on the product or its packaging indicates that this product must not be disposed of with yourother 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 contactyour local authority, or where you purchased your product.

Mexico Certification for IM7232-2-DAC-LMV

IFETEL number: **RTIOPIM19-0374**

La operación de este equipo está sujeta a las siguientes dos condiciones: (1) es posible que esteequipo o dispositivo no cause interferencia perjudicial y (2) este equipo o dispositivo debe aceptar cualquier interferencia, incluyendo la que pueda causar su operación no deseada.

15. APPENDIX C: Connectivity, TCP Ports & Serial I/O

Pin-out standards exist for both DB9 and DB25 connectors. There are not pin-out standards for serial connectivity using RJ45 connectors. Most console servers and serially managed servers / router / switches / power devices have adopted their own unique pin-out, so custom connectors and cables maybe required to interconnect your console server.

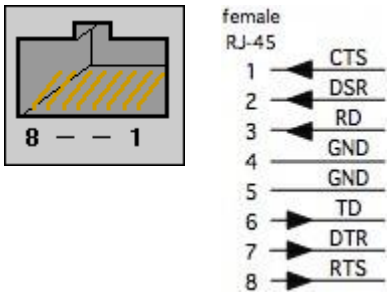
Serial Port Pinout

Opengear's console servers come with 1 to 48 serial connectors (notated *SERIAL* or *SERIAL PORTS*) forthe RS232 serial ports:

- The RJ45 serial ports are located on the rear panel of the rack mount IM7200 and CM7100
- The CM7100 and ACM7000 models have Cisco Straight serial pinouts on its RJ45 connectors
- The IM7200 has software selectable Cisco Straight or Cisco Rolled RJ45

Cisco Straight RJ45 pinout (option -X2)

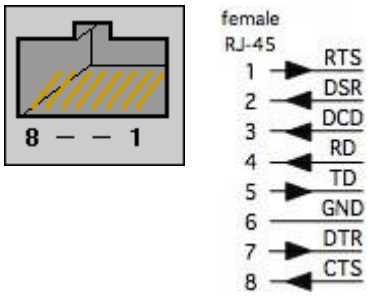
Straight through RJ-45 cable to equipment such as Cisco, Juniper, SUN, and more...



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	NA
5	GND	Signal Ground	NA
6	TXD	Transmit Data	Output
7	DTR	Data Terminal Ready	Output
8	RTS	Request To Send	Output

Opengear Classic (X0) RJ45 pinout

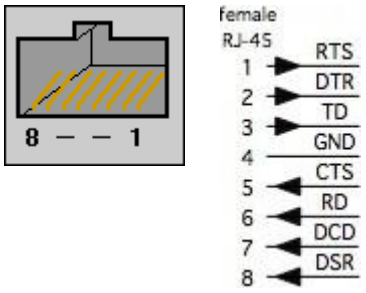
This is the same RJ45 pinout as the Avocent /Equinox brand console server:



PIN	SIGNAL	DEFINITION	DIRECTION
1	RTS	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	NA
7	DTR	Data Terminal Ready	Output
8	CTS	Clear To Send	Input

Cisco Rolled 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	NA
5	CTS	Clear To Send	Input
6	RXD	Receive Data	Input
7	DCD	Data Carrier Detect	Input
8	DSR	Data Set Ready	Input

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 withstandard UTP Cat 5 cable.

Each Opengear console server is supplied with UTP Cat 5 cables.

RS232 Standard Pinouts

The RS232 pinout standards for the DB9 (and DB25) connectors are tabled below:

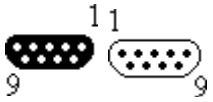
DB25	SIGNAL	DB9	DEFINITION
1			Protective Ground
2	TXD	3	Transmitted Data
3	RXD	2	Received Data
4	RTS	7	Request To Send
5	CTS	8	Clear To Send
6	DSR	6	Data Set Ready
7	GND	5	Signal Ground
8	CD	1	Received Line Signal Detector
9			Reserved for data set testing
10			Reserved for data set testing
11			Unassigned
12	SCF		Secondary Rcvd Line Signal Detector
13	SCB		Secondary Clear to Send
14	SBA		Secondary Transmitted Data
15	DB		Transmission Signal Timing

DB25	SIGNAL	DB9	DEFINITION
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

FEMALE MALE

25 pin DB25

9 pin DB9



8 pin RJ45

Connectors included in console server

The ACM7000, CM7100 and IM7200 families have the Cisco pinout by default and ship with cross-over /straight RJ45-DB9 connectors:

Part # 319014

DB9F-RJ45S straight connector

WIRING TABLE

RJ-45		DB9 F
1 CTS	----------	8 CTS
2 DCD	----------	1 DCD
3 RXD	----------	2 RXD
4 N/C		
5 GND	----------	5 GND
6 TXD	----------	3 TXD
7 DTR	----------	4 DTR
8 RTS	----------	7 RTS

Part # 319015

DB9F-RJ45S cross-over connector

WIRING TABLE

RJ-45		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

Other available connectors and adapters

Opengear also supplies a range of cables and adapters that enables you to connect to popular serversand network appliances. More detailed information can be found online at http://www.opengear.com/cabling.html

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.

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 w Cisco pinout to Netscreen and Dell.
319004 DB9M to RJ45 straight DTE adapter - Console server OOB modem connection.

For console servers with Opengear Classic pinouts:

319000 DB9F to RJ45 straight Console server with Opengear classic pinout to IP Power and other serialdevice.

319001 DB9F to RJ45 crossover DCE adapter - Console server with Opengear classic pinout to X86 andother.

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 andother.

319004 DB9M to RJ45 straight DTE adapter - Console server with Opengear classic pinout to Netscreenand Dell; and OOB modem connection.

319005 DB25F to RJ45 crossover DCE adapter - Console server with Opengear classic pinout to Cisco7200 AUX.

440016 5ft Cat5 RJ-45 to RJ-45 cables.

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.

TCP/UDP Port Numbers

Port numbers are divided into three ranges: Well Known Ports (0 through 1023), Registered Ports (1024through 49151), and Dynamic and/or Private Ports (49152 through 65535).

Well Known Ports are assigned by IANA, and on most systems can only be used by system processes orprograms executed by privileged users. The table below lists 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, UCP
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	TCP

16. APPENDIX D: TERMINOLOGY

Term	Meaning
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 (support for WiFi was discontinued in April of 2019).
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.
CertificateAuthority	A Certificate Authority is a trusted third party, which certifies public keys belong to their claimed owners. 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 owneror 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.
MS-CHAPv2	MS-CHAPv2 can be used for remote authentication over SSH and GUI based login. MS-CHAPv2 is the default for new configurations.
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	Domain Name System that allocates Internet domain names and translates

Term	Meaning
	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 random material (ciphertext) which cannot be read if intercepted. The proper decryption key is required to read the message.
Ethernet	A physical layer protocol based upon IEEE standards.
Firewall	A network gateway device that protects a private network from users on other networks. A firewall is installed to allow users on an intranet access tothe 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 peopleworldwide. The Internet uses the TCP/IP set of protocols.
Intranet	A private TCP/IP network within an enterprise.
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 serverplatform.
Key lifetimes	The length of time before keys are renegotiated.
LAN	Local Area Network.
LDAP	The Lightweight Directory Access Protocol (LDAP) is a protocol used to access information stored in an LDAP server. It is based on the X.500 standard but is simpler and more readily adapted to meet custom needs. The core LDAP specifications are defined in RFCs.
LED	Light-Emitting Diode.
MAC address	Every piece of Ethernet hardware has a unique number assigned to it called aMAC address. The MAC address is used by the local Internet router in order to direct console server traffic to it. It is a 48-bit number written as a series of 6 hexadecimal octets, *e.g.* 00:d0:cf:00:5b:da. Each console server has itsMAC address printed 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 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.
NTP	Network Time Protocol (NTP) used to synchronize clock times in a network of computers.

Term	Meaning
Out-of-Band Management	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 overthe 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 links betweentwo 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 toauthenticate 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 hubs andswitches 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 aSMTP 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 canview 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.

Term	Meaning
TCP/IP	Transmission Control Protocol/Internet Protocol. The basic protocol for Internet communication.
TCP/IP address	Internet addressing method that uses the form nnn.nnn.nnn.nnn.
Telnet	Terminal protocol that provides an easy-to-use method of creating terminal connections to a network.
UDP	User Datagram Protocol.
UTC	Coordinated Universal 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 fromone computer to another relaying the screen updates back in the other direction over a network.
VPN	Virtual Private Network (VPN) is 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) manages the association of workstation names and locations with IP addresses.

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