

User Guide

23.10



COPYRIGHT ©

Opengear Inc. 2023. All Rights Reserved.

Information in this document is subject to change without notice and does not represent a commitment on the part of Opengear. Opengear provides this document “as is,” without warranty of any kind, expressed or implied, including, but not limited to, the implied warranties of fitness or merchantability for a particular purpose.

Opengear may make improvements and/or changes in this manual or in the product (s) and/or the program(s) described in this manual at any time. This product could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes may be incorporated in new editions of the publication.

DOCUMENT REVISION HISTORY

Document Version Number	Revision Date	Description
23.04	Apr 23	<p>Added Port Tagging changes to Nodes, Ports and Groups and Roles</p> <p>Updated screens and messages for Port Logging</p> <p>Added Port-tags to CLI</p> <p>Updated screenshots for Subscriptions</p> <p>Added command line tools</p>
23.07	July 23	<p>Minor correction to SAML users access</p>
23.10	October 23	<p>Added verified AWS installation steps</p> <p>Added verified Azure installation steps</p> <p>Added Network Traffic Mirroring</p> <p>Removed Port tagging CLI</p> <p>Updated Authentication and authorization content.</p>

CONTENTS

Copyright ©	2
Document Revision History	3
Contents	5
About This User Guide	18
Lighthouse Overview	19
Lighthouse Architecture	19
The Lighthouse Virtual Machine Requirements	21
Lighthouse to Node interactions	22
Using Multiple Lighthouses	23
EULA and GPL	24
Installing Lighthouse	25
Installing Lighthouse VM on VMware	26
VMware vSphere 6.0 client on Windows	26
Requirements	26
Launch the vSphere Client and connect to a vSphere instance.	27
Import the Lighthouse VM Open Volume Format (.ovf) image	28
Launch Lighthouse	30
Access the Console of a Running But Headless Lighthouse Instance	30
VMware Workstation Player on Windows as Host	31
Import the Opengear Lighthouse VM file into VMware Workstation Player	32
VMware Workstation Pro on Windows as Host	32
Import the Lighthouse VM File Into VMware Workstation Pro	32

Installing Lighthouse VM on Hyper-V on Windows	34
Local deployment on Hyper-V	34
Remote Hyper-V Deployment With Pre-authenticated User	35
VirtualBox Deployments	36
VirtualBox on Windows as host	36
VirtualBox on macOS as host	38
VirtualBox on Ubuntu as Host	41
VirtualBox on Fedora Workstation as host	42
Installing Lighthouse VM on Linux Hosts	44
Virtual Machine Manager (KVM) on Ubuntu as host	44
Boxes on Fedora Workstation as host	45
Boxes on RHEL and Compatible Distributions	46
Installing in the Cloud	47
Installing in Azure	47
Set a password on Lighthouse via SSH	50
Installing in Amazon Web Services	51
Limitations	53
Launch a Lighthouse Instance on AWS	54
Set a password for the root user on Lighthouse	56
Final Steps	56
Adding Disk Space to Lighthouse	56
Adding a New Disk to AWS	57
Adding a New Disk - qemu specific instructions	57
Adding a New Disk - Azure	58
Adding a New Disk - Hyper-V	59
Adding a New Disk - VirtualBox	59
Increase the lh_data logical volume	60
First Boot of the Lighthouse VM	61

Setting up Lighthouse	64
Loading Lighthouse	64
To load Lighthouse	64
Lighthouse IP addresses	65
Logging into Lighthouse	66
Setting the Lighthouse hostname	68
Adding external IP addresses manually	69
The Lighthouse SSL Certificate	71
Set the Lighthouse Internal Clock	72
Setting up Networking Requirements	73
Examine or Modify the Lighthouse Sessions	74
Examine or Change the MTU of the Lighthouse VPN Tunnel	74
Network Connections	75
Edit a network interface	77
Configure SNMP Manager Settings	78
Examine or modify SNMP Service	80
Cellular Health Dashboard	82
Lighthouse MIBs	83
Examples of Lighthouse MIB queries using SNMP:	86
Setting up Multiple Instances of Lighthouse	87
Setting up a multiple instance	89
Enabling Alternate REST API Ports	91
Configuring Subnets for a Multiple Instance Lighthouse	92
Configuring the Subnets	92
Disconnecting a dependent instance	96
Promoting a dependent instance	97
Upgrading a multiple instance Lighthouse	98
Upgrading Dependent Multiple Instances of Lighthouse	98

Upgrading Lighthouse	99
Prepare to Upgrade Lighthouse	100
Upgrading the system from within Lighthouse	102
Upgrading the Lighthouse system via the local terminal	104
Troubleshooting the Upgrade Process	105
Upgrade NetOps Modules	108
Configuration Backup	110
Configuration restore	111
Subscribing to Lighthouse	113
Adding a new subscription to Lighthouse	116
To add a subscription	117
Assigning subscriptions to nodes	118
View Subscriptions in the Lighthouse UI	119
To assign nodes to subscriptions	119
To assign a subscription	120
To change a node's subscription	120
Shut Down or Restart Lighthouse	121
Finding the current Lighthouse instance version	122
Shut Down a Running Lighthouse Instance	124
Restarting a Running Lighthouse Instance	125
Returning a Lighthouse instance to factory settings	125
Managing Lighthouse Nodes	127
Monitor Nodes	127
Monitor Ports	128
Filtering pages displaying nodes	130
Filtering using the Free Text Search field	131
Filtering using Smart Groups	131

Filtering NODES using the Port Filter	133
ENROL Nodes	134
The Enrolled Nodes page	136
Enrollment Bundles	139
Assigning Subscriptions	140
Creating an Enrollment bundle	140
Structure of an Enrollment bundle	143
Enrolling Nodes	144
Enrollment via Node Web UI	145
Enrollment via Lighthouse Web UI	145
Enrolling nodes via OM, ACM, CM, and IM Web UI	147
Enrollment via USB drive	149
Backing up Nodes	150
Work with Nodes	152
Connect to the web-management interface of a node	152
Connecting to a node's serial ports	154
Find the Serial Ports	155
Access via HTML5 Web Terminal	158
Access a serial port via SSH	159
Example Console Gateway session	161
Selecting nodes using shell-based tools	161
Node organization and filtering	163
Filter Nodes	163
Creating Smart Groups	163
Editing a Smart Group	166
Creating Port Filters	167
Editing an existing Port Filter	169
Upgrade Nodes via the UI	171

Firmware Files	172
Upload a firmware file	172
Delete a firmware file	173
Create an upgrade task	174
Cancel an upgrade task	177
Copy a scheduled task	178
Delete an upgrade task	180
Retry an upgrade task	181
Node Upgrade Runtime Behaviour	182
Promoting a Secondary instance to Primary	182
Downgrading and Skipping Versions	182
Time Zones	183
Offline nodes	183
Node Connection interrupted	184
Unenrolling Nodes at Upgrade	184
Lighthouse Availability and Stability	184
Manage Ports	185
Filtering pages displaying ports	186
Filtering using the Free Text Search field	187
Filtering using the Smart Group Filtering drop-down menu	188
Filtering using the Port Filter drop-down menu	188
Filtering using the Port Tags	189
Create a new Port Tag	190
Edit A Port Tag	192
DELETE A Port Tag	193
Assign a Port Tag	195
 Configuring Lighthouse	 197
Create Templates	197

Creating new user and group templates	198
Modifying existing users and groups templates	200
Deleting users or groups from a template	201
Deleting users and groups templates	202
Create Authentication Templates	202
Creating new authentication templates	202
Modifying existing authentication templates	204
Deleting authentication templates	205
Create Script Templates	205
Creating new script templates	206
Modifying existing script templates	207
Deleting script templates	208
Use Templates	209
Apply Templates	209
Manually Activate NetOps modules via Template	212
Configuration & Technical support reports	213
Lighthouse CLI, Serial Port and REST API logging	216
Configuring Lighthouse for Network traffic Mirroring	224
Configuring Network traffic mirroring for Multiple Instances	226
Troubleshooting Network traffic mirroring	227
Managing Lighthouse Users	228
Work with Groups	229
About Groups	229
Creating New Groups and Roles	232
Create a new group	233
Available Roles:	234
Available Operations Permissions:	235

Modifying existing groups	237
Use an existing group as a template for a new group	238
Create a new Role	239
Work with Users	241
Creating new local users	246
Create New Local Users for Remote Authentication	248
Modify existing users	250
Expire user password	251
Setting Login Restrictions	252
Disabling a Lighthouse root user	254
Delete and Disable Users	254
SAML Config for SSO	255
Generic IdP Setup	257
Generic IdP SAML Attribute	260
Lighthouse Setup	261
Examples of Specific IdP Setups	262
Okta	262
Create an Application	262
Onelogin	265
Azure Active Directory	269
Configure AUTH0 for IdP	272
Create an Application (Enterprise applications)	272
Configure AUTH0 Metadata for IdP	275
Configure Lighthouses for AUTH0 for IdP	275
Configure AUTH0 for IdP	276
Limitations of SAML Configuration	277
IdP metadata certificate expiry	277
Making Changes to User Permissions	277

SAML SSO Usergroups	278
SAML SSO Users	278
Configuring AAA	278
LDAP Configuration	279
Radius Configuration	281
TACACS+ configuration	283
Setting password policy	286
Password fields in Lighthouse	287
Enabling Advanced Functionality	288
Introduction	288
About NetOps	289
NetOps Platform Security	289
Changing Docker IP Ranges	290
NetOps Module Management	292
Upgrade Modules from the UI	292
Upgrade Modules from the CLI	292
Update NetOps Modules Without Docker Access	293
Use a Pre-built Offline Installer (via GUI)	293
Use a Pre-built Offline Installer (via CLI)	294
Upgrade NetOps Modules	295
Activate a NetOps Module	297
Activate the NetOps Module on Lighthouse	298
'Always Activate' Mode on All Nodes (Automatic)	299
Activate NetOps on Selected Nodes (Automatic)	300
Activate the NetOps Module on Nodes (Manual)	301
Deactivate (remove) a NetOps Module	301
Automation Gateway	303

Differences Between IP Access and Automation Gateway	304
How to use Automation Gateway	305
PROCEDURE	305
Connect with REST/HTTP/HTTPS APIs	307
Automation Gateway Service Discovery	311
IP ACCESS	312
Connectivity	312
Enable IP Access in Lighthouse	315
Enable NetOps Automation	315
Activate the IP Access Module	316
Network Ports Used for IP Access	317
Generate a Certificate and Export Client Configuration	317
Connect the VPN Client	317
Password Authentication During VPN Connection	318
Advanced Options	319
Connecting to WAN Zone	320
Network Access Policies for Operations Manager	320
Understanding Access Policies	321
Setting up Network Access Policies	322
To set Access policies	322
Accessing Multiple VLANs or Ports	324
Group memberships	325
Firewall Zones	325
Multiple Layer 3 Network Connections	325
Troubleshooting IP Access	326
View the Docker logs	326
Using the Routing Table	328
SECURE PROVISIONING	329
Secure Provisioning Configuration Management	330

Stateless File Management	331
Stateful Device Management Gateway	331
How Secure Provisioning Works	332
Support for Secure Provisioning	333
Vendor Managed Devices Supported by Secure Provisioning	334
Local Network Services Provided by Nodes	335
Default Gateway	336
DNS Server	336
NTP Server	337
Syslog Server	337
Secure Provisioning Configuration	337
Device Resource Bundle	337
Node Inventory	338
Create Device Configuration	339
Activate the Secure Provisioning Module on Lighthouse	341
Install the Node	341
Configure a Per-node Module Activation Policy	342
Option A. Automatically Activate All Nodes Upon Enrollment	342
Option B. Automatically Activate Select Nodes Upon Enrollment	342
Option C. Manually Activate Nodes After Enrollment	343
Enroll the Node Into Lighthouse	343
Connect Target Device	344
PROCEDURE	345
UI-based WorkFlow	345
UI WorkFlow	345
Create Device Resource Bundle	346
Define Resource Distribution	349
Define a Static Node Inventory	349

DEfIne a Dynamic Node Inventory	350
Push Resources	351
CLI based WorkFlow	351
Create CoNFIguration YAML	352
DeFIne a Static Inventory:	355
Define a Dynamic Inventory:	356
How UI Fields Correspond to the YAML File (Example)	358
Upload Configuration and Resources	361
Option A. Secure Copy Method	361
Option B. git Method	362
Additional Resource Files and Device Type Files	363
Configure Device Resources via ZTP	364
Device Resource Bundle Matching	365
Resource Distribution	365
Baseline vs Final Device Configuration	365
Run a Script on a Newly Provisioned Device	366
Monitor the ZTP Progress of a Managed Device	367
WAN Gateway Services	368
Advanced Options	369
Using Variables in Configuration File Templates	369
Post-provisioning Scripts	372
Ordered Provisioning	373
Troubleshooting Secure Provisioning	375
Troubleshooting Commands	376
Command line tools	378
node-info	379
Example node-info output	380
node-upgrade	380

An example node-upgrade run	382
Results and Error Messages in node-upgrade	383
cron	384
sysflash	386
Support for mounting the hard disks with ogconfig-cli	388
Support for multiple instance Lighthouse with ogcon- fig-cli	389
CLI support for configuring Network traffic mirroring ..	389
Network Traffic Mirroring	390
Glossary	393

ABOUT THIS USER GUIDE

This user guide describes how to use Lighthouse and is current as of 2023.10.

When using a minor release, there may or may not be a specific version of the user guide for that release.

The current Lighthouse user guide, and other guides can always be found [here on the website](#).

Note: OPERATIONS MANAGER support may be partial for earlier releases.

Partial support may currently involve:

Mass node Enrollment using ZTP

Enrollment via USB drive

All template types are supported.

LIGHTHOUSE OVERVIEW

Lighthouse allows you to centrally access, manage, and monitor a network of Opengear console servers. Lighthouse is a virtual machine that can be hosted on various platforms like VMware or Hyper-V (on customer hardware) or on supported cloud providers (AWS or Azure).

Console servers connect to a central Lighthouse instance over an OpenVPN tunnel, and are accessed, managed, and monitored via services transported over the VPN tunnel. The console server is referred to as the node.

LIGHTHOUSE ARCHITECTURE

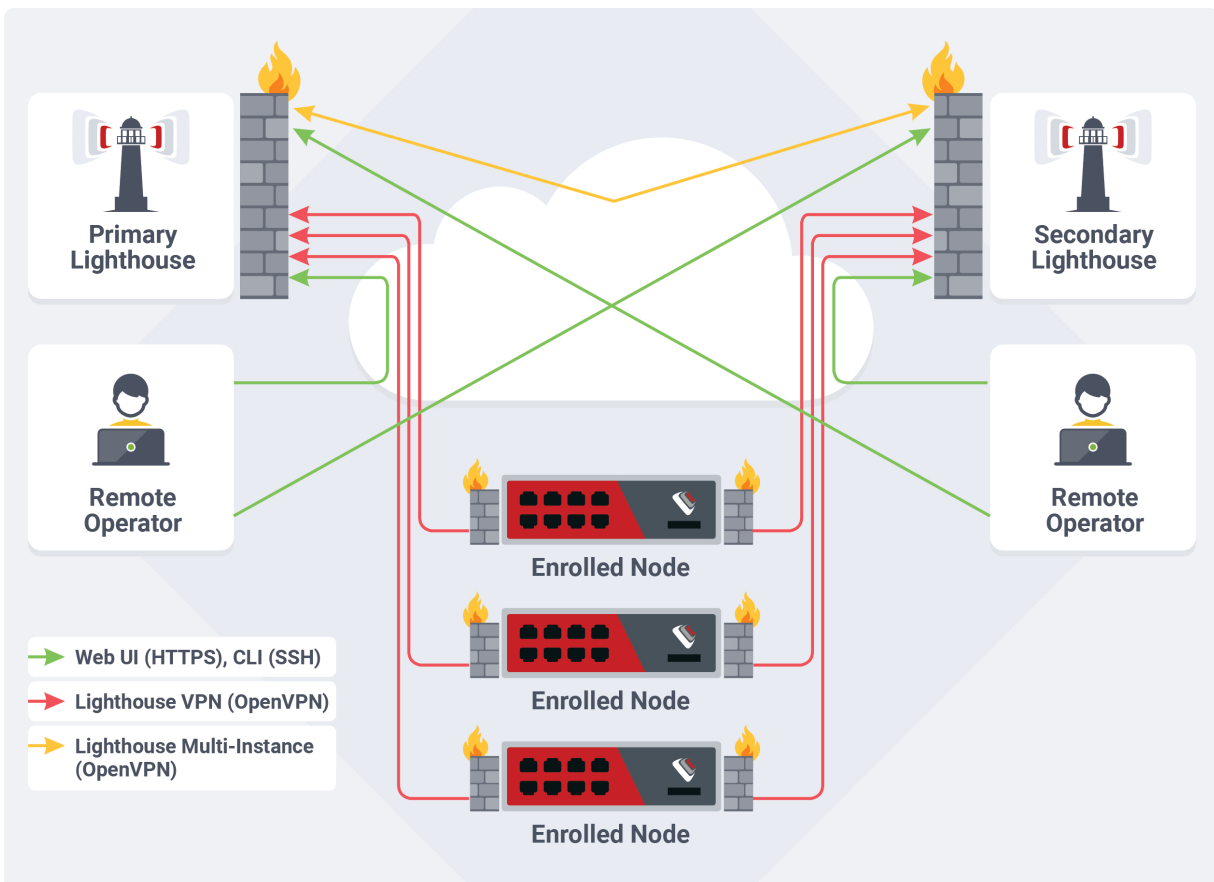
Lighthouse is an API-driven platform with an HTML5 interface that provides secure access to remote networks regardless of how devices are connected or how a user interacts with the system.

In combination with select Opengear Appliances, Lighthouse can push and manage Docker containers to each remote location to provide additional functionality and automation.

- An enterprise user connected to an IP network with a route to an enrolled Opengear device can access any other enrolled Opengear device (via IP).
- Devices attached to Opengear nodes can use IP routed connectivity to other devices attached to other Opengear nodes.
- Network automation and configuration tools deployed on centrally located servers can use IP routed connectivity to devices and systems attached to

Opengear nodes. For example vCenter is the configuration tool and it is used to provision eSXI server instances attached to Opengear nodes.

Nodes connect to a central Lighthouse instance over an OpenVPN tunnel, and are accessed, managed, and monitored via services transported over the VPN tunnel.



Note: This diagram depicts High Availability. If there is no dependent Lighthouse, the setup remains the same but without the dependent elements.

THE LIGHTHOUSE VIRTUAL MACHINE REQUIREMENTS

Lighthouse deploys as an application running in a Linux-based virtual machine (VM). To run a Lighthouse VM, the host computer must be able to run a VM manager and at least one full 64-bit Linux-based virtual machine.

The Lighthouse binary is available in Open, VMware and Hyper-V specific Virtual Machine formats. VM managers such as Boxes, KVM and VirtualBox can make use of the open format. Lighthouse binaries are also available for cloud hosting services including Amazon's AWS, and Microsoft Azure.

NetOps Modules are released independently of Lighthouse software or Operations Manager firmware. These releases are shipped to Amazon's ECR Public Gallery, where they can be fetched by Lighthouse then deployed to all activated nodes by Lighthouse. NetOps modules can also be downloaded off the Opengear FTP site, and uploaded manually on Lighthouse.

To host Lighthouse, the VM needs to be configured to support:

- A minimum 50GB SCSI disk. Start with more if you think your network will expand. Additional space may be required depending on your feature usage on Lighthouse and the scale of the network.
- 1 x network interface card, preferably paravirtualised (virtio, vmxnet3), Realtek rtl8139, or Intel e1000 are also supported, bridged.
- VGA console for initial setup.

To dimension CPU and RAM resources, follow these guidelines:

Note: CPU and RAM utilization increase with the number of enrolled nodes, network utilisation and storage.

For small deployments (Up to 500 nodes), allocate at a minimum:

- 2 x 64-bit CPU cores.
- 8GB RAM.

For medium deployments (between 500 and 1000 nodes), allocate at the minimum:

- 4 x 64-bit CPU cores.
- 16GB RAM.

For large deployments (more than 1000), allocate allocate at the minimum:

- 4 x 64-bit CPU cores.
- 32GB RAM.

Note: In general it is recommended that you add more memory than you assume you need.

For large deployments, please contact us for guidance on the deployment options, including low and zero-touch Enrollment.

LIGHTHOUSE TO NODE INTERACTIONS

When a node is enrolled to Lighthouse, a Virtual Private Network (VPN) tunnel is established between Lighthouse and the node. This provides secure encrypted IP networking, which is resilient to changes in the underlying network (such as node failover to cellular).

Lighthouse interacts with the node over the VPN tunnel, mostly via the node's REST API and SSH. Nodes notify Lighthouse of changes to their configuration and status.

The node web UI is accessible directly through Lighthouse, and is proxied via the VPN; this allows secure user access to the node even if it is behind a firewall with no direct HTTPS access.

USING MULTIPLE LIGHTHOUSES

Lighthouse offers a form of high availability with the Multiple Instance feature. The Multiple Instance feature allows you to set up dependent instances of Lighthouse. The dependent Lighthouses automatically receive updates from the primary Lighthouse instance, and maintains connections to all of its remote nodes.

The dependent Lighthouse will also replicate various values from the primary Lighthouse to ensure in the event of a failover, all information is up to date.

Dependent instances are read-only. They may be used to view Lighthouse information specific to that instance, and to connect to its nodes via `pmshell`. Configuration changes must be performed on the primary Lighthouse instance, which will then update the information displayed on the dependent instance.

The multiple instance feature has the following limitations:

- If external network addresses on the primary or secondary Lighthouses are updated after a dependent Lighthouse has been enrolled, it may break replication.
- Only Opengear nodes with a version that supports multiple instance will connect to the dependent instance. Nodes that don't support multiple instances will behave normally on the primary lighthouse.

- Up to ten dependent instances can be enrolled
- Dependent Lighthouse instances are read-only. Ensure that you re-configure instance specific settings such as hostname, external endpoints, and time zone on a dependent instance before adding the dependent instance to the primary Lighthouse in a normal way through UI.
- Only dependent Lighthouse instances with zero nodes can be enrolled to the primary Lighthouse.
- Removing a dependent Lighthouse instance will initiate a factory reset of the removed Lighthouse.

Note: Dependent Lighthouse user interfaces are read-only.

EULA AND GPL

The current Opengear end-user license agreement and the GPL can be found at <http://opengear.com/eula>.

INSTALLING LIGHTHOUSE

To install Lighthouse you require:

- A virtual machine (VM) that can support a 50GB disk at the minimum and
- The correct image file.

Lighthouse Virtual Machines Availability

Lighthouse VM is available in several formats on our secure ftp sites, from where you can download and verify the checksums and install the appropriate files. Ensure you use the correct upgrade file for your upgrade.

- **lighthouse-23.10.0-ovf.zip** - An Open Volume Format file inside a PKZip archive. This is for use with virtual machine managers such as KVM and Virtual Box.
- **lighthouse-23.10.0-vmx.zip** - A VMware configuration file inside a PKZip archive. This is for use with virtual machine managers from VMware.
- **lighthouse-23.10.0.ova** - An Open Virtual Appliance file. This is for use with virtual machine managers such as VM and Virtual Box as well as for use with virtual machine managers from VMware.
- **lighthouse-23.10.0-hyperv.zip** - A Hyper-V configuration file with Powershell script inside a PKZip archive. This is for use in Microsoft Hyper-V deployment.
- **lighthouse-23.10.0.azure.zip** - A Microsoft Azure file, for deploying on Azure.
- **lighthouse-aws-bootstrap.sh**, and the **lighthouse-23.10.0.aws.raw.tar** image
- A shell script for deploying on AWS.
- **lighthouse-23.10.0.lh_upg** - An upgrade file.

- **lighthouse-23.10.0.aws.lh_upg** - Upgrade on AWS.
- **lighthouse-23.10.0.azure.zip** - Upgrade on Azure.

There are also SHASUMS files to verify the downloaded files.

Note:The latest format for the files is as follows:

lighthouse-<year>.<month>.<release/patchnumber>

INSTALLING LIGHTHOUSE VM ON VMWARE

This section describes how to install Lighthouse VMs on VMware hosts including:

- VMware vSphere 6.0 client on Windows
- VMware Workstation Player on Windows
- VMware Workstation Pro on Windows

VMWARE VSPHERE 6.0 CLIENT ON WINDOWS

This procedure was tested using the VMware Sphere Client 6.0 running on Windows 7 Enterprise SP 1.

REQUIREMENTS

Ensure the following preconditions are met before you start installation:

- VMware vSphere 6.0 is installed and running on available hardware.
- Access to a Windows computer on which the VMware vSphere 6.0 client is installed.

- The installed client application must be able to connect to and manage the VMware vSphere 6.0 instance.
- Finally, a copy of the Lighthouse binary in Open Volume Format is required, the .ovf file, either copied to the Windows computer running the VMware vSphere 6.0 client or available via a URL.

LAUNCH THE VSPHERE CLIENT AND CONNECT TO A VSPHERE INSTANCE.

1. Launch the VMware vSphere Client. The simplest way is to use the **Start Menu** shortcut added during installation.

Start > All Programs > VMware > VMware vSphere Client

The VMware vSphere Client opens a login window.



2. Select the IP address or name of the VMware vSphere instance where Lighthouse will be installed from the IP address/Name drop-down list.
3. Enter the User name and Password required to gain management privileges to the selected VMware vSphere instance.
4. Click **Login** or press **Return**.
5. The login window displays progress text in the bottom left corner:
Connecting
Loading inventory
Loading main form
Displaying main form

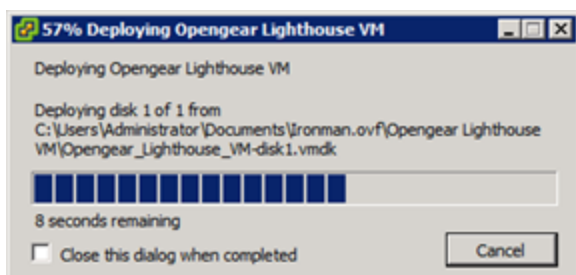
The vSphere main form window opens.

IMPORT THE LIGHTHOUSE VM OPEN VOLUME FORMAT (.OVF) IMAGE

To import the Lighthouse VM:

1. From the vSphere Client menu bar, choose **File > Deploy OVF Template**.
The **Deploy OVF Template** window displays, with the first stage, **Source**, pre-selected.
2. If the file **Opengear Lighthouse VM.ovf** is on a remote computer via a URL, enter the URL in the **Deploy from a file or URL** field. Otherwise, click **Browse**. An Open dialog displays.
 - a. Navigate to the directory containing the file **Opengear Lighthouse VM.ovf**.
 - b. Select **Opengear Lighthouse VM.ovf** and click **Open**.

3. The **Deploy OVF Template** window opens again, with the **Opengear Lighthouse VM.ovf** file listed in the **Deploy** from a file or URL combo-box. Click **Next**.
4. The **OVF Template Details** stage displays, showing basic information about the Lighthouse VM encapsulated by the **.ovf file**. Click **Next**.
5. The **Name and Location** screen displays with the **Name** field pre-populated and pre-selected. The default name is **Opengear Lighthouse VM**. To change this, enter a new name. Click **Next**.
6. The **Disk Format** screen displays which data-store the Lighthouse VM's virtual disk uses, how much free space the virtual disk has available and which provisioning scheme is being used. Click **Next**.
7. The **Network Mapping** screen shows which destination or inventory network the Lighthouse VM's virtual network is mapped to. Click **Next**.
8. The **Ready to Complete** screen displays, listing the basic properties of the about-to-be-deployed virtual machine. To be able to power-up the new virtual machine after deployment, select the **Power on after deployment** checkbox. Click **Finish**.
9. The **Deploying Opengear Lighthouse VM** progress dialog displays.



10. Once deployment has finished the **Deployment Completed Successfully** alert displays. Click **Close**.
The new virtual machine is now deployed and displays in the inventory list.

LAUNCH LIGHTHOUSE

The vSphere Client provides several ways of launching a Virtual Machine hosted on a vSphere instance. Begin by selecting the **Lighthouse VM** from the vSphere Client's inventory list. The selected VM can then be launched by doing one of the following:

- Select **Inventory > Virtual Machine > Power > Power On**.
- Press **Ctrl-B**.
- Click the **Power On** the virtual machine link in the **Basic Tasks** section of the **Getting Started** tab. This option requires the **Getting Started** tab be front-most. If it is not already the front-most tab, make it active by clicking it.
- Select **Inventory > Virtual Machine > Open Console** and then:
 - Click **Power On** in the console tool bar, or
 - Choose **VM > Power > Power On** from the console menu bar, or
 - Press **Ctrl-B**.

Note: Only the fourth option above results in the running virtual machine being accessible from within the vSphere Client. The first three boot the Lighthouse VM and run it as a headless system, that is, with no display on a monitor. However, you can access Lighthouse via the web UI or SSH.

ACCESS THE CONSOLE OF A RUNNING BUT HEADLESS LIGHTHOUSE INSTANCE

If direct interaction with a running but headless *OpenGear Lighthouse VM* is required, open a console window.

Select the running Opengear Lighthouse VM in the vSphere Client's inventory list, then do one of the following:

- Select **Inventory > Virtual Machine > Open Console** or
- Right-click and select **Open Console** from the context menu that displays.

VMWARE WORKSTATION PLAYER ON WINDOWS AS HOST

Follow these steps when VMware Workstation Player is installed on the host Windows machine. VMware-ready virtual machine files are stored in **C:\Users\%USERNAME%\Virtual Machines**. This is the location selected by default by VMware Workstation Player. If another location is preferred, adjust this procedure as required.

Prepare the Lighthouse VM file for import into VMware Workstation Player:

1. Move the lighthouse-23.10.0-vmx.zip archive to **C:\Users\%USERNAME%\Virtual Machines**.
2. Right-click the archive and select **Extract All** from the contextual menu.
3. A **Select a Destination and Extract Files** dialog opens. By default, the location is the same folder as the archive is in: **C:\Users\%USERNAME%\Virtual Machines**. Leave this as the destination folder.
4. Uncheck the **Show Extracted Files When Complete** checkbox and then click **Extract**.
5. A folder called **lighthouse** is created inside **C:\Users\%USERNAME%\Virtual Machines**.

IMPORT THE OPENGEAR LIGHTHOUSE VM FILE INTO VMWARE WORKSTATION PLAYER

1. Launch VMware Workstation Player.
2. Click **Open a Virtual Machine**.
3. Navigate to **C:\Users\%USERNAME%\Virtual Machines\lighthouse**.
VMware Workstation Player points to **Libraries > Documents** and includes **C:\Users\%USERNAME%\My Documents**.
Assuming this is the case, double-click **Virtual Machines** and then double-click **Lighthouse**.
4. If only one file, **Lighthouse**, is visible, double-click on it to add the Lighthouse virtual machine to the VMware Workstation 12 Player virtual machines list. If more than one file displays, double-click **Lighthouse.vmx**.
5. The Lighthouse virtual machine is added to the VMware Workstation 12 Player virtual machines list.
6. With **Opengear Lighthouse VM** selected in the VMware Workstation 12 Player virtual machine list, click **Play Virtual Machine** to boot Lighthouse.

VMWARE WORKSTATION PRO ON WINDOWS AS HOST

This procedure assumes VMware Workstation Pro is already installed on the host Windows machine and that VMware-ready virtual machine files are stored in **C:\Users\%USERNAME%\Virtual Machines**. If another location is preferred, adjust the steps as needed.

IMPORT THE LIGHTHOUSE VM FILE INTO VMWARE WORKSTATION PRO

Step 1. Preparation:

This step prepares the Lighthouse VM File for Import Into VMware Workstation Pro.

1. Move the **lighthouse-23.10.0.zip** archive to **C:\Users\%USERNAME%\Virtual Machines**.
2. Right-click the **lighthouse-23.10.0-vmx.zip** archive and select **Extract All** from the contextual menu.
3. A **Select a Destination and Extract Files** dialog opens. The location is the same folder as the PKZip archive is in: **C:\Users\%USERNAME%\Virtual Machines**. Leave this as the destination folder.
4. Uncheck the **Show Extracted Files When Complete** checkbox and then click **Extract**.
5. A folder called lighthouse is created inside **C:\Users\%USERNAME%\Virtual Machines**.

Step 2. Import Lighthouse VM File:

1. Click **Open a Virtual Machine**.
2. Navigate to **C:\Users\%USERNAME%\Virtual Machines\lighthouse**.
3. VMware Workstation Pro points to **Libraries > Documents** and this library includes **C:\Users\%USERNAME%\My Documents**. Double-click **Virtual Machines** and then double-click **Lighthouse**.
4. If only one file, Lighthouse, displays, double-click the file to add the Lighthouse virtual machine to the VMware Workstation Pro virtual machines list. If more than one file displays, double-click **Lighthouse.vmx**.
5. The Lighthouse virtual machine is added to the VMware Workstation Pro virtual machines list.

6. With the **Opengear Lighthouse VM** selected in the **My Computer** listing and the subsequent **Opengear Lighthouse VM** tab open, click **Power** on this virtual machine to boot Lighthouse.

INSTALLING LIGHTHOUSE VM ON HYPER-V ON WINDOWS

This section describes how to install Lighthouse VMs on Hyper-V on Windows:

- Hyper-V running on Windows 10 or Windows Server 2016
- VirtualBox deployments

LOCAL DEPLOYMENT ON HYPER-V

This procedure assumes Hyper-V is already installed on a Windows 10/Windows Server 2016 host machine and the required Zip archive, **lighthouse-23.10.0-hyperv.zip** is in **C:\Users\%USERNAME%\Downloads**.

1. Unzip **lighthouse-23.10.0-hyperv.zip**.
2. Navigate to the extracted folder. Make sure **lighthouse.vhd** and **lighthouse_virtual_machine_registration.ps1** are in the folder.
3. Right-click and choose **Run with Powershell** to execute the Powershell script.
4. Leave the host name empty when prompted to deploy Lighthouse to local machine.
5. Launch **Hyper-V Manager**. Lighthouse should be registered as a new VM image under Virtual Machine.
6. Select **Lighthouse** from the list and click **Start** in the **Action Panel** to boot

Opengear Lighthouse.

REMOTE HYPER-V DEPLOYMENT WITH PRE-AUTHENTICATED USER

In this scenario, the user who performs Lighthouse deployment does not have local access to Hyper-V installed on Windows 2016. However, user has access to a Windows 10 which can manage the Hyper-V server remotely.

This procedure assumes Hyper-V is installed on Windows Server 2016 (or later) host machine and the required Zip archive **lighthouse-23.10.0-hyperv.zip** is in **C:\Users\%USERNAME%\Downloads**. Windows 10 is already configured to manage Hyper-V on Windows Server 2016.

Note: Windows 10 and Windows Server 2016 must have the same user (same password) created. The user who performs the deployment must have permission to both execute the Powershell script and deploy the image on Hyper-V.

1. Login to Windows 10 with the user mentioned above.
2. Unzip **lighthouse-23.10.0-hyperv.zip**.
3. Navigate to the extracted folder. Make sure **lighthouse.vhd** and **lighthouse_virtual_machine_registration.ps1** are in the folder.
4. Right-click and choose **Run** with Powershell to execute the Powershell script.
5. Enter the fully qualified domain name for Windows Server 2016 when prompted to deploy Lighthouse to the remotely-managed Windows Server 2016 machine.

6. Launch Hyper-V Manager. Lighthouse should be registered as a new VM image under Virtual Machine for Windows Server 2016.
7. Select Lighthouse from the list and click **Start** in the **Action Panel** to boot Opengear Lighthouse.

VIRTUALBOX DEPLOYMENTS

Lighthouse can be installed on the following hosts:

- VirtualBox on Windows as host
- VirtualBox on macOS as host
- VirtualBox on Ubuntu as Host
- VirtualBox on Fedora Workstation as host

VIRTUALBOX ON WINDOWS AS HOST

Note:We recommend that VirtualBox users customize their instances and change their network cards to one other than e1000. We also suggest virtio for better performance.

This procedure assumes VirtualBox is already installed on the host machine and the required PKZip archive, **lighthouse-23.10.0-ovf.zip** is in

C:\Users\%USERNAME%\Downloads.

1. Unzip **lighthouse-ovf**. It may appear as **lighthouse-23.10.0-ovf.zip** depending on the Windows Explorer preference settings).
2. Right-click the **lighthouse-ovf** archive and select **Extract** all from the context menu.

3. The **Select a Destination** and **Extract Files** dialog opens. The destination is **C:\Users\%USERNAME%\Downloads\Lighthouse-ovf**.
4. Uncheck the **Show extracted files when complete** checkbox and edit the destination by removing **Lighthouse-ovf** from the path.
5. Click **Extract**.
6. A folder called **lighthouse-ovf** is created inside **C:\Users\%USERNAME%\Downloads**.
7. Launch VirtualBox.
8. The Oracle VM VirtualBox Manager window displays.
9. Choose **File > Import Appliance**.
10. The **Appliance to Import** dialog opens.
11. Click **Expert Mode**.
12. The **Appliance to import** dialog changes from **Guided Mode** to **Expert Mode**.
13. Click the icon of a folder with an upward pointing arrow superimposed. This icon is to the far right of the **Appliance to import field**.
14. The **Open File** dialog displays with **C:\Users\%USERNAME%\Documents** as the current folder.
15. Navigate to **C:\Users\%USERNAME%\Downloads\Lighthouse.ovf\Opengear Lighthouse VM**.
16. Select the file **Opengear Lighthouse VM** and click **Open**.
17. Double-click the text **vm** in the **Name** row and **Configuration** column to make it editable.
18. Type **Opengear Lighthouse VM** and press **Enter**.
19. Click **Import**.

20. A new virtual machine, called **Opengear Lighthouse VM** is added to the list of virtual machines available to **Virtual Box**.
21. Select **Opengear Lighthouse VM** from the list.
22. Select **Machine > Settings** or click the **Settings** icon in the **VirtualBox Manager** toolbar or press **Control+S**.
23. The **Opengear Lighthouse VM - Settings** dialog displays.
24. Click the **System** option in the list of options running down the left-hand side of the dialog.
25. The dialog shows the **System** options available as three tabs: **Motherboard**, **Processor**, and **Acceleration**. Depending on the underlying hardware platform, Acceleration may be greyed-out and unavailable. The Motherboard tab is preselected.
26. In the **Motherboard** tab, select the **Hardware Clock in UTC Time** checkbox.
27. Click **OK** or press **Return**
28. Select **Opengear Lighthouse VM** from the list and click **Start** in the Oracle VM VirtualBox Manager toolbar to boot Lighthouse. Double-clicking **Opengear Lighthouse VM** in the list also boots Lighthouse.

Note: Selecting the **Hardware Clock in UTC Time** checkbox is necessary because Lighthouse expects the hardware clock to be set to UTC, not local time. Unlike other Virtual Machine Managers, Virtual Box both exposes this option as a user-adjustable setting and does not set it to UTC by default.

VIRTUALBOX ON MACOS AS HOST

VirtualBox should already be installed on the host macOS machine and the required PKZip archive, **lighthouse-23.10.0-ovf.zip** is in **~/Downloads**.

1. Unzip lighthouse-23.10.0-ovf.zip.

This creates a folder **Lighthouse-ovf** in **~/Downloads** that contains the following files and folders:

```
Lighthouse-ovf
├── Opengear Lighthouse VM
│   ├── Opengear Lighthouse VM.ovf
│   └── Opengear_Lighthouse_VM-disk1.vmdk
```

2. Launch Virtual Box. The Oracle **VM VirtualBox Manager** window displays.
3. Select **File > Import Appliance** or press **Command+I**.
4. The **Appliance to Import** dialog sheet slides down from the Oracle VM VirtualBox Manager toolbar.
5. Click **Expert Mode**.
The **Appliance to Import** dialog sheet changes from **Guided Mode** to **Expert Mode**.
6. Click the icon of a folder with an upward pointing arrow superimposed. This icon is to the far-right of the **Appliance to Import** field.
7. The **Open File** dialog sheet slides down from the **Oracle VM VirtualBox Manager** toolbar. This sheet opens with **~/Documents** as the current folder.
8. Navigate to **~/Downloads/Lighthouse.ovf/Opengear Lighthouse VM/**.
9. Select **Opengear Lighthouse VM** and click **Open**. (Depending on the **Finder Preferences** settings, the file may present as **Opengear Lighthouse VM.ovf**.)
10. Double-click the text **vm** in the **Name** row and **Configuration** column to make it editable.
11. Type **Opengear Lighthouse VM** and press **Return**.

12. Click **Import**.
A new virtual machine, called Opendgear Lighthouse VM is added to the list of virtual machines.
13. Select **Opendgear Lighthouse VM** from the list.
14. Choose **Machine > Settings**. Or click the **Settings** icon in the **VirtualBox Manager** toolbar. The **Opendgear Lighthouse VM Settings** dialog displays.
15. Click the **System** option in the dialog's toolbar.
The dialog shows the System options available as three tabs: Motherboard, Processor, and Acceleration. (Depending on the underlying hardware platform, Acceleration may be greyed-out and unavailable). The Motherboard tab is preselected.
16. In the **Motherboard** tab, select the **Hardware Clock in UTC Time** checkbox.
17. Click **OK** or press **Return**.
18. **Select Opendgear Lighthouse VM** from the list and click **Start** in the **Oracle VM VirtualBox Manager** toolbar to boot Lighthouse. Double-clicking **Opendgear Lighthouse VM** in the list also boots Lighthouse.

Note: Selecting the Hardware Clock in UTC Time checkbox is necessary because Lighthouse expects the hardware clock to be set to UTC, not local time. Unlike other Virtual Machine Managers, Virtual Box both exposes this option as a user-adjustable setting and does not set it to UTC by default.

Note: By default, VirtualBox stores virtual machines in ~/VirtualBox VMs. If this is the first virtual machine setup by VirtualBox, it creates the VirtualBox VMs folder in the current user's home-directory and a folder — Opendgear Lighthouse

VM — inside the VirtualBox VMs folder. The Opengear Lighthouse VM folder contains the files and folders which make up Lighthouse when run under Virtual Box.

VIRTUALBOX ON UBUNTU AS HOST

Before beginning the procedure, make certain that VirtualBox and all required support files are installed on the host machine and the PKZip archive, **lighthouse-23.10.0-ovf.zip** is in **~/Downloads**.

1. Unzip **lighthouse-23.10.0-ovf.zip**. This creates a folder, **Lighthouse-ovf** in **~/Downloads** that contains the following files and folders:

```
Lighthouse-ovf
├── Opengear Lighthouse VM
│   ├── Opengear Lighthouse VM.ovf
│   └── Opengear_Lighthouse_VM-disk1.vmdk
```

2. Launch **Virtual Box**.
3. The **Oracle VM VirtualBox Manager** window displays.
4. Choose **File > Import Appliance**.
5. The **Appliance** to import dialog opens.
6. Click **Expert Mode**.
7. The **Appliance to Import** dialog changes from **Guided Mode** to **Expert Mode**.
8. Click the icon of a folder with an upward pointing arrow superimposed. This icon is positioned to the right of the **Appliance to Import** field.
9. A file-navigation dialog, **Choose a Virtual Appliance to Import**, opens with **~/Documents** as the current folder.

10. Navigate to **~/Downloads/Lighthouse.ovf/Opengear Lighthouse VM/**.
11. Select **Opengear Lighthouse VM.ovf** and click **Open**.
12. Double-click the text **vm** in the **Name** row and **Configuration** column to make it editable.
13. Type **Opengear Lighthouse VM** and press **Return**.
14. Click **Import**.
A new virtual machine, called **Opengear Lighthouse VM** is added to the list of virtual machines available to Virtual Box.
15. Select **Opengear Lighthouse VM** from the list and click **Start** in the **Oracle VM VirtualBox Manager** toolbar to boot Lighthouse. Double-clicking **Opengear Lighthouse VM** in the list also boots Lighthouse.

Note:VirtualBox stores virtual machines in **~/VirtualBox VMs**. If this is the first virtual machine setup by VirtualBox it creates the **VirtualBox VMs** folder in the current user's home-directory and a folder **Opengear Lighthouse VM** inside the **VirtualBox VMs** folder. Inside **Opengear Lighthouse VM** are the files and folders which make up Lighthouse when run under Virtual Box.

VIRTUALBOX ON FEDORA WORKSTATION AS HOST

Before beginning, make certain that VirtualBox and all required support files are already installed on the host machine and the PKZip archive, **lighthouse-23.10.0-ovf.zip** is in **~/Downloads**.

1. Unzip **lighthouse-23.10.0-ovf.zip**. This creates a folder **Lighthouse.ovf** in **~/Downloads** that contains the following files and folders:

```
Lighthouse.ovf
├── Opengear Lighthouse VM
│   ├── Opengear Lighthouse VM.ovf
│   └── Opengear_Lighthouse_VM-disk1.vmdk
```

2. Launch Virtual Box.
The **Oracle VM VirtualBox Manager** window displays.
3. Choose **File > Import Appliance** or press **Control-I**.
The **Appliance to Import** dialog opens.
4. Click **Expert Mode**.
The **Appliance to Import** dialog changes from **Guided Mode** to **Expert Mode**.
5. Click the icon of a folder with an upward pointing arrow superimposed. This icon is to the far right of the **Appliance to Import** field.
The **Open File** dialog opens with **~/Documents** as the current folder.
6. Navigate to **~/Downloads/Lighthouse.ovf/Opengear Lighthouse VM/**.
7. Select **Opengear Lighthouse VM** and click **Open**.
8. Double-click the text **vm** in the **Name** row and **Configuration** column to make it editable.
9. Type **Opengear Lighthouse VM** and press **Return**.
10. Click **Import**.
A new virtual machine, called **Opengear Lighthouse VM** is added to the list of virtual machines available to Virtual Box.

11. Select **Opengear Lighthouse VM** from the list and click **Start** in the **Oracle VM VirtualBox Manager** toolbar to boot Lighthouse. Double-clicking **Opengear Lighthouse VM** in the list also boots **Lighthouse**.

Note:VirtualBox stores virtual machines in **~/VirtualBox VMs**. If this is the first virtual machine setup by VirtualBox, it creates the **VirtualBox VMs** folder in the current user's home-directory and a folder **Opengear Lighthouse VM** inside the **VirtualBox VMs** folder. Inside **Opengear Lighthouse VM** are the files and folders which make up Lighthouse when run under Virtual Box.

INSTALLING LIGHTHOUSE VM ON LINUX HOSTS

This section describes how to install Lighthouse VMs on Linux hosts:

- Ubuntu
- Fedora Workstation
- RHEL

VIRTUAL MACHINE MANAGER (KVM) ON UBUNTU AS HOST

Virtual Machine Manager and all required support files should be installed on the host machine and the **.tar** archive, **lighthouse-23.10.0-raw.hdd.tar** is in **~/Downloads**.

1. Expand **lighthouse-23.10.0-raw.hdd.tar**. This extracts **lighthouse-23.10.0-raw.hdd** in **~/Downloads**.
2. Launch **Virtual Machine Manager**.

3. Click **New** at the top left of the Virtual Machine Manager window (or choose **File > New Virtual Machine**). The **Source Selection** window opens.
4. Click **Select** a file. A **Select a Device or ISO File** dialog slides into view.
5. Navigate to **~/Downloads/**.
6. Select the file **lighthouse-23.10.0-raw.hdd** and click **Open** in the top right-corner of the dialog. A **Review** window opens providing basic information about the virtual machine or box, as Boxes calls them, to be created.
7. Click **Create** in the top right corner of the **Review** window.
8. A new virtual machine instance, **Opengear_Lighthouse_VM-disk1**, is created and presented in the **Boxes** window.
9. To rename the virtual machine instance, right-click on the machine instance and choose **Properties** from the contextual menu that displays. Click anywhere in the **Name** field to select and edit the name. Click the **Close** box to save the changes.

BOXES ON FEDORA WORKSTATION AS HOST

Boxes and all required support files should be installed on the host machine and **lighthouse-23.10.0-ovf.zip** is in **~/Downloads**.

1. Unzip **lighthouse-23.10.0-ovf.zip**. This creates a folder **Lighthouse.ovf** in **~/Downloads** that contains the following files and folders:

```
Lighthouse.ovf
├── Opengear Lighthouse VM
│   ├── Opengear Lighthouse VM.ovf
│   └── Opengear_Lighthouse_VM-disk1.vmdk
```

2. Launch **Boxes**.
3. Click **New** in the Boxes window title bar. The **Source Selection** window opens.
4. Click **Select a File**. A **Select a Device or ISO File** dialog opens.
5. Navigate to **~/Downloads/Lighthouse.ovf/Opengear Lighthouse VM/**.
6. Select the file **Opengear_Lighthouse_VM-disk1.vmdk** and click **Open** in the top right-hand corner of the dialog. A **Review** window opens providing basic information about the virtual machine (or 'box', as Boxes calls them) to be created.
7. Click **Create** in the top right corner of the **Review** window.
8. A new virtual machine instance, **Opengear_Lighthouse_VM-disk1** is created and presented in the **Boxes** window.
9. To rename the virtual machine instance, right-click on the machine instance and choose **Properties** from the contextual menu that displays. Click anywhere in the **Name** field to select and edit the name. Click **Close** to save the changes.

BOXES ON RHEL AND COMPATIBLE DISTRIBUTIONS

CentOS should be installed, complete with the Gnome desktop environment as the host operating system. CentOS includes the full complement of KVM-centric virtualization tools including the GUI-based virtualization management tools **Boxes** and **virt-manager** and the shell-based virtualization management tool **virsh**.

This procedure assumes **Boxes** is used to setup and manage the Lighthouse VM and that the required PKZip archive, **lighthouse-23.10.0-ovf.zip** is in **~/Downloads**.

To install Lighthouse on CentOS:

1. Unzip **lighthouse-23.10.0-ovf.zip**.

This creates a folder **Lighthouse.ovf** in **~/Downloads** that contains the following files and folders:

```
Lighthouse.ovf
├── Opengear Lighthouse VM
│   ├── Opengear Lighthouse VM.ovf
│   └── Opengear_Lighthouse_VM-disk1.vmdk
```

2. Launch Boxes
3. Click **New** in the **Boxes** title bar.
4. Navigate to **~/Downloads/Lighthouse.ovf/Opengear Lighthouse VM/**
5. Select **Opengear Lighthouse VM** and click **Open**. A new virtual machine, called Opengear LighthouseVM is added to the list of virtual machines available to Boxes.

INSTALLING IN THE CLOUD

This section describes how to install Lighthouse on supported cloud environments:

- Azure
- AWS.

INSTALLING IN AZURE

To use the Microsoft Azure environment:

1. Login to the Microsoft Azure portal at <https://portal.azure.com>
2. Under **Azure Services**, click the **Storage Accounts** icon.

3. Create a new storage account with at least 50GB storage space.
4. Navigate to the newly created storage account, click **Containers** under **Data Storage** and create a new blob container.
5. Download a Lighthouse VHD image, the latest Lighthouse image can be found in a zip file at the following URL: https://ftp.opengear.com/download/lighthouse_software/current/lighthouse/azure.
6. Copy the Lighthouse VHD image into the Azure storage container. (Using AzCopy is recommended, as the VHD image is large and the upload can take a long time to complete through the Microsoft Azure portal.)
 - a. If you haven't already, install AzCopy following instructions provided by [Microsoft](#). [Click here to read the instructions on Microsoft's website](#)
 - b. Generate a SAS token to use in your AzCopy commands
 - i. While viewing the newly created storage container, click Shared access signature under Settings.
 - ii. Under Permissions, enable Read, Write and Create.
 - iii. Set valid start and end date.
 - iv. Click Generate SAS and connection string at the bottom of the page.
 - v. Copy the Blob SAS token and Blob SAS URL, as you will not be able to view these again.
 - c. Copy the Lighthouse VHD image into the Azure storage container using the following format, make sure to fill in the path to your local Lighthouse VHD image and your Blob SAS URL generated during the previous step: `./azcopy copy <path_to_local_image_file> "<blob_sas_url>"`

A SAS token can also be created using Azure CLI. [Click here to read the instructions on Microsoft's website.](#)

7. Create an image:
 - a. In the Azure Portal, under **Azure Services**, click the **Images** icon.
 - b. Click **Create** to create a new image, make sure that the location is the same as your storage account, the OS type is set to **Linux** and **VM generation** is set to Gen 1.
 - c. Click **Browse** on the **Storage blob** field and select the Lighthouse VHD file you uploaded during a previous step.
 - d. Click **Create** to create the image.
8. Go to the newly created image and click **Create VM**. Ensure the selected image is correct.
9. Choose the desired virtual machine instance size.
10. Enter the details for the Microsoft Azure admin user with either password OR SSH key authentication.

Note: If SSH key authentication is selected, the user will be created without a password and will be unable to access the UI.

11. Select the inbound ports enabled for the Lighthouse instance (SSH, HTTPS).
12. Navigate to the next page of configuration (Disks) and select the desired storage

option for the boot disk.

13. Go to the **Review** page and after validation passes, click **Create**.
14. Go to the **Virtual Machines** page, select the virtual machine and open the Serial Console. Lighthouse should now be deploying on Microsoft Azure.
15. To allow nodes to enroll in Lighthouse, you will need to add the following firewall rules on the **Networking** page under **Settings** on the virtual machine you deployed:
 - a. Add a rule to allow UDP connections from any source to port 1194 on the instance's internal network address (10.0.0.x).
 - b. Add a rule to allow UDP connections from any source to port 1195 on the instance's internal network address (10.0.0.x).
 - c. HTTPS and SSH should already be allowed from the initial setup. If not, add them.
 - d. Other ports may need to be opened, depending on feature usage. For example:
 - i. SNMP (UDP/161 or TCP/161) – SNMP Management
 - ii. OpenVPN (UDP/1195) – Lighthouse Multiple Instance VPN
 - iii. HTTPS (TCP/8443) – Alternate REST API port
16. Confirm that the Azure instance public IP address has been added to external endpoints in **Settings > System > Administration**.

SET A PASSWORD ON LIGHTHOUSE VIA SSH

If you are logged into Lighthouse via SSH keys, you will need to set a password to login via GUI. Use the `ogpasswd` utility to do this.

```
ogpasswd -u lh_admin -p MySecretPassword
```

Note:Your username must be the same as the Microsoft Azure admin user created in step 10

INSTALLING IN AMAZON WEB SERVICES

To use Lighthouse with Amazon Web Services (AWS), you will first need to create an Amazon Machine Image (AMI) containing Lighthouse in the AWS region that you want to deploy Lighthouse in. A temporary Linux “build-box” EC2 instance should be used to create a private Lighthouse AMI.

Note:This is a one-time procedure. The AMI can be used to create multiple instances of Lighthouse, and upgrades can be performed through the Lighthouse Web UI.

1. Create an account on AWS with an IAM user, a key pair and an access key.
 - The IAM user should have, at a minimum, permissions to create, attach, delete, and snapshot EBS volumes as well as create an Amazon Machine Image (AMI).
 - If you are using IAM Identity Center, you can use an IAM Identity Center user with the same permissions instead. Consult Amazon documentation for more information if required.
2. Create an AWS EC2 Linux instance, with the following settings:
 - Amazon Linux 2 or Amazon Linux 2023
 - `t2.small` instance type with default (8 GiB) root volume

- 50GB gp3 volume

Consult Amazon documentation for more information if required.

3. Create a Lighthouse AMI, using the `lighthouse-aws-bootstrap.sh` script (usage information can be displayed by using the `-h` option) on the EC2 instance created in the previous step. The steps are detailed below.

- Connect via SSH to your instance on AWS using the username `ec2-user` and the private key you created previously. All subsequent steps must be performed on the instance.

- Configure AWS using the following command:

```
aws configure
```

- Provide the access key and region details (other settings may be left unchanged). If you are using IAM Identity Center, you will need to instead configure using `aws configure sso`, and set the CLI Profile Name to be `default`.

- Download the `aws-bootstrap` script:

```
wget http://ftp.opengear.com/download/lighthouse_
software/current/lighthouse/aws/lighthouse-aws-
bootstrap.sh
```

- Run the `lighthouse-aws-bootstrap.sh` script as follows:

```
bash ./lighthouse-aws-bootstrap.sh -n Lighthouse -r
https://ftp.opengear.com/download/lighthouse_
software/current/lighthouse/aws/lighthouse-
23.10.0.aws.raw.tar
```

Note: `lighthouse-23.10.0.aws.raw.tar` is the sample file. You must download the latest file for your version of Lighthouse

- Wait while the Lighthouse AMI is created. This can take some time (up to 30 minutes).
- After the AMI has been created, terminate the Linux EC2 instance to avoid incurring additional costs.

Running the bootstrap script - Example

```
$ bash ./lighthouse-aws-bootstrap.sh -n Lighthouse -r \  
> http://ftp.opengear.com/download/lighthouse_  
software/current/lighthouse/aws/lighthouse-23.10.0.aws.raw.tar  
Downloading image...  
Image size is 54049899008 bytes (51 GiB)  
Creating volume...  
Attaching volume vol-09fb0b463f5a59eaf to EC2 instance...  
Cloning image onto volume...  
0+852971 records in  
0+852971 records out  
54049899008 bytes (54 GB, 50 GiB) copied, 845.072 s, 64.0 MB/s  
Creating snapshot of volume...  
Waiting for snapshot snap-0f83746856d985070 to complete...  
Creating AMI from snapshot snap-0f83746856d985070...  
Done!  
Cleaning up...
```

LIMITATIONS

AWS support is currently limited to:

- All standard Lighthouse operations
- Running on the AWS platform
- Providing aws-cli tools for interaction with AWS
- Loading the provided SSH key for the root user
- Running custom scripts on startup (see above)
- Providing a root password via userdata (see above)

At this time Lighthouse does not support:

- Using AWS's database services
- Using AWS's redis services
- Using any of AWS's scalability functionality

Note: If you want to deploy Lighthouse across different AWS regions an AMI will be needed in each region. [Amazon supports copying AMIs between regions and offers a walkthrough of the necessary steps to do this.](#)

LAUNCH A LIGHTHOUSE INSTANCE ON AWS

Once the Lighthouse AMI has been created, it will display in the Amazon Machine Images (AMIs) section of the EC2 Management Console.

To create a new Lighthouse EC2 instance, select the Lighthouse AMI then "Launch instance from AMI".

Instance Type

Lighthouse should run on a general purpose instance type, such as M5.

Note: If an instance type that supports "burstable" CPU such as T2 is used, please ensure that unlimited CPU is selected, to avoid operational problems caused by CPU throttling.

Key Pair

EC2 requires a key pair to be specified when launching instances.

Network Settings

A security group should be created. Lighthouse requires some ports to be open:

- SSH (TCP/22) – Secure Shell. Access should be limited to just your corporate network.
- HTTPS (TCP/443) – Lighthouse Web UI and REST API. This is used by both web browsers and nodes (eg, for call-home enrollment).
- OpenVPN (UDP/1194) – Lighthouse VPN. This is used to communicate with nodes once they are enrolled.
- Other ports may need to be opened, depending on feature usage. For example
 - SNMP (UDP/161) – SNMP Management
 - OpenVPN (UDP/1195) – Lighthouse Multiple Instance VPN
 - HTTPS (TCP/8443) – Alternate REST API port

Storage

By default, the root volume will be around 53 GiB. This may be sufficient, depending on your intended usage. It is easier to specify more storage now, but more can be added later.

Advanced Details

An initial root password must be set in the `UserData` section.

```
password=topSecretPassword123
```

If the user does not specify the root password in the Advanced Details section they can set the root password using the `ogpasswd` utility.

SET A PASSWORD FOR THE ROOT USER ON LIGHTHOUSE

If you are logged into Lighthouse via SSH keys, you will need to set root password to login via GUI. Use the "ogpasswd" utility to do this.

```
ogpasswd -u root -p MySecretPassword
```

FINAL STEPS

When done, the EC2 Linux instance can be shut down and removed or saved for creating future instances.

Note: The root password must be specified in the **Advanced Details**.

ADDING DISK SPACE TO LIGHTHOUSE

Additional physical volumes can be added to the volume group as required, and the logical volumes extended using `lvextend` and `resize2fs` to take advantage of the additional space.

Before you add disk space:

- Ensure you take a backup of Lighthouse
- In the case of a multiple instance Lighthouse installation, consider upgrading all instances, not merely the primary instance.

ADDING A NEW DISK TO AWS

Launch a Lighthouse instance as per our guidelines or your own deployment processes and note the instance ID.

To add a volume to an AWS Lighthouse without having to shut down the Lighthouse:

1. In the AWS web console, go to **Volumes** and create a new 50GB volume in the same availability zone as your LH instance.
2. Once the volume is created, select it and click the **Actions** button and select **Attach Volume**.
3. Enter the LH instance ID for the instance field and `/dev/xvdb` (or `/dev/xvdd`, `/dev/xvde` and so on) as the device and click **Attach**.

When you SSH into the LH you should be able to see the new volume as `/dev/xvdb` (or whatever device name you gave it).

ADDING A NEW DISK - QEMU SPECIFIC INSTRUCTIONS

Launch a qemu Lighthouse instance as per our guidelines or your own deployment.

To add a volume to the instance:

1. Shutdown the instance with the following command:

```
shutdown -h now
```

2. Create a new disk for the LH. You can use a different number for “count” which is in MiB.

```
dd if=/dev/zero of=/tmp/new_lh_disk.lh_hdd bs=1024k
count=256
qemu-img convert -p -f raw -O qcow2 /tmp/new_lh_disk.lh
/tmp/new_lh_disk.qcow2
```

3. Restart your qemu instance but make sure to add the new `qcow2` disk to the command.

Here is an example of what you should add to your qemu command when launching the instance:

```
-drive if=scsi,file=/tmp/new_lh_disk.qcow2
```

Note: This is just an example. You should specify the disk in a similar way to how you specified the primary Lighthouse disk. and you should make sure that the new disk is specified last, otherwise your disk will appear out of order when you boot the Lighthouse.

4. Once the LH boots you should have a new `/dev/sdX` device and the 'unused_disks' command should report that disk when you log in.

ADDING A NEW DISK - AZURE

Launch the LVM Lighthouse instance as per our guidelines or your own deployment.

To add a volume to the instance, use the following link to attach a new disk to your Lighthouse VM. Stop before you reach the section, "Connect to the Linux VM to mount the new disk."

<https://docs.microsoft.com/en-us/azure/virtual-machines/linux/attach-disk-portal>

ADDING A NEW DISK - HYPER-V

1. Launch the LVM Lighthouse instance as per our guidelines or your own deployment. To add a volume to the instance:
2. Shutdown your Hyper-V Lighthouse instance.
3. Open your Hyper-V manager.
4. Navigate to the VM list and locate your Lighthouse VM.
5. Right click on the instance and click Settings.
6. Click on the SCSI controller.
7. Select Hard drive on the right and click Add.
8. Select Virtual hard disk and click New.
9. Follow the prompts and select the options that best suit your needs and environment.
10. Once you've created the disk, click Apply in the VM settings window.
11. Restart the Lighthouse.

ADDING A NEW DISK - VIRTUALBOX

Launch the LVM Lighthouse instance as per our guidelines from the `.ova` file or your own deployment. To add a volume to the instance:

1. Shutdown the Lighthouse instance.
2. In the VirtualBox UI, locate your Lighthouse instance and right-click it.
3. Select **Settings**.

4. Select **Storage** on the left.
5. Click the **Controller: SCSI** in the disk list.
6. You will see two small icons, both with a green '+' symbol. Hover your mouse over the one that says **Adds a hard disk** and click it.
7. Click the **Create** icon.
8. Follow the prompts to create a new disk image.
9. Select the new disk image and click the **Choose** button.
10. Click **Ok** to exit the VM settings window.
11. Restart Lighthouse.

INCREASE THE LH_DATA LOGICAL VOLUME

1. Add the new disk to the LH VM (platform dependent, see above).
2. Log into the shell on Lighthouse. you should see the new "unused" disk listed in the welcome message. This is the case for any non-system disks aren't currently being used by the LVM system.
3. Create a partition on the new disk:

```
fdisk /dev/sdb (or /dev/xvdb, or /dev/(sd|xvd)X
```

NOTE: Be sure specify the correct disk, it might be `/dev/xvdb` on AWS.
4. Type 'n' and ENTER to create a new partition.
5. Type 'p' and ENTER to create a primary partition.
6. Continue hitting ENTER to accept the defaults to use the whole disk.
7. Type 'w' and ENTER to write the changes and exit `fdisk`.

8. Add the new partition as a physical volume (assuming you are now using `/dev/sdb1`, note that `/dev/xvdb1` will now be mapped to `/dev/sdb1` so make sure you use `sdb1`).
`pvcreate /dev/sdb1`
9. Extend the volume group with the new physical volume.
`vgextend lhvg /dev/sdb1`
10. Assuming the new disk gives you at least 2GB of extra space, expand the `lh_data` logical volume.
`lvextend -L +2G /dev/mapper/lhvg-lh_data`
11. Update the file system of the `lh_data` disk to use the extra space.
`resize2fs /dev/mapper/lhvg-lh_data`
12. When you log into the shell, the disk should no longer be listed as "unused".

FIRST BOOT OF THE LIGHTHOUSE VM

Note: This section does not apply to Azure or AWS.

During boot, two screens open.

1. The first screen prompts to Select Lighthouse boot mode and displays four options:
 - Graphics console boot
 - Graphics console recovery mode
 - Serial console boot
 - Serial console recovery mode

Graphics console boot is preselected and should not be changed. After the first boot has completed a message displays:

```
Welcome to Lighthouse. This is software version:  
2023.10.0
```

2. The final step in the initial setup displays:

```
To complete initial setup, please set a new root password.  
Press ENTER to continue.
```

3. After pressing **Enter**, a prompt displays:

```
Enter new root password:
```

4. Enter a password and press Enter. Keep in mind that non-US-English keyboards are not supported in the graphics console.

Note: It is recommended that you set a temporary password at this point and change it to a very strong high-entropy password as soon as possible using the WebUI.

5. The confirm prompt displays:

```
Confirm given password
```

6. Re-enter the password and press **Enter**. Multiple configuration notices appear ending with a login prompt:

```
lighthouse login:
```

7. Enter root and press Enter. A password prompt displays:

```
Password:
```

8. Enter the newly-set password and press **Enter**. A standard bash shell prompt displays with the list of static, DHCP, and IPv6 addresses.

```
net1 192.168.0.1/24
net1:dhcp 192.168.1.186/24
net1 fe80::a00:27ff:fe39:daa3/64
root@lighthouse:~#
```

SETTING UP LIGHTHOUSE

This section describes how to set up Lighthouse to monitor and manage your network.

LOADING LIGHTHOUSE

This section describes the initial setup stages for a new Lighthouse VM, from login, to setting external addresses, to setting the clock.

TO LOAD LIGHTHOUSE

1. Open a new browser window or tab, then enter one of the following:

```
https://192.168.0.1/
```

```
https://[DHCP-supplied address]/
```

or an IPv6 address, for example:

```
https://[fe80::a00:27ff:fe39:daa3/64].
```

2. Press **Return**. The Lighthouse Login page loads. A warning message displays because of the default self- signed certificate. You can ignore this at first load, and later install your own valid certificate using **SETTINGS > SERVICES >HTTPS Certificate** to remove the warning message.

LIGHTHOUSE IP ADDRESSES

When the Lighthouse VM is booted and running, it can be reached at:

- The static address, **192.168.0.1**, or
- The address it is assigned by any DHCP server it finds. Type **ifconfig** command to see which IP address the VM has been allocated by DHCP.
- Static IP address on another subnet, requiring IP address, mask, gateway.

Only the first two options are available out-of-the-box. The static IP on another subnet has to be configured first.

If there is no DHCP, and Lighthouse is not reachable on the default address **192.168.0.1** then, the static IPv4 address can be changed from the console using the **ogsetnetwork.sh** command.

```
root@lighthouse:~# ogsetnetwork.sh --help
```

Usage:

```
ogsetnetwork.sh [Use options below to configure a static IP]
-a, --address Static IP address to set
-n, --netmask Netmask for IP address
-g, --gateway Network gateway address
-d, --dns1 Chosen DNS server #1
-D, --dns2 Chosen DNS #2
```

Example:

```
ogsetnetwork.sh -a 192.168.1.24 -n 255.255.255.0 -g 192.168.1.1
```

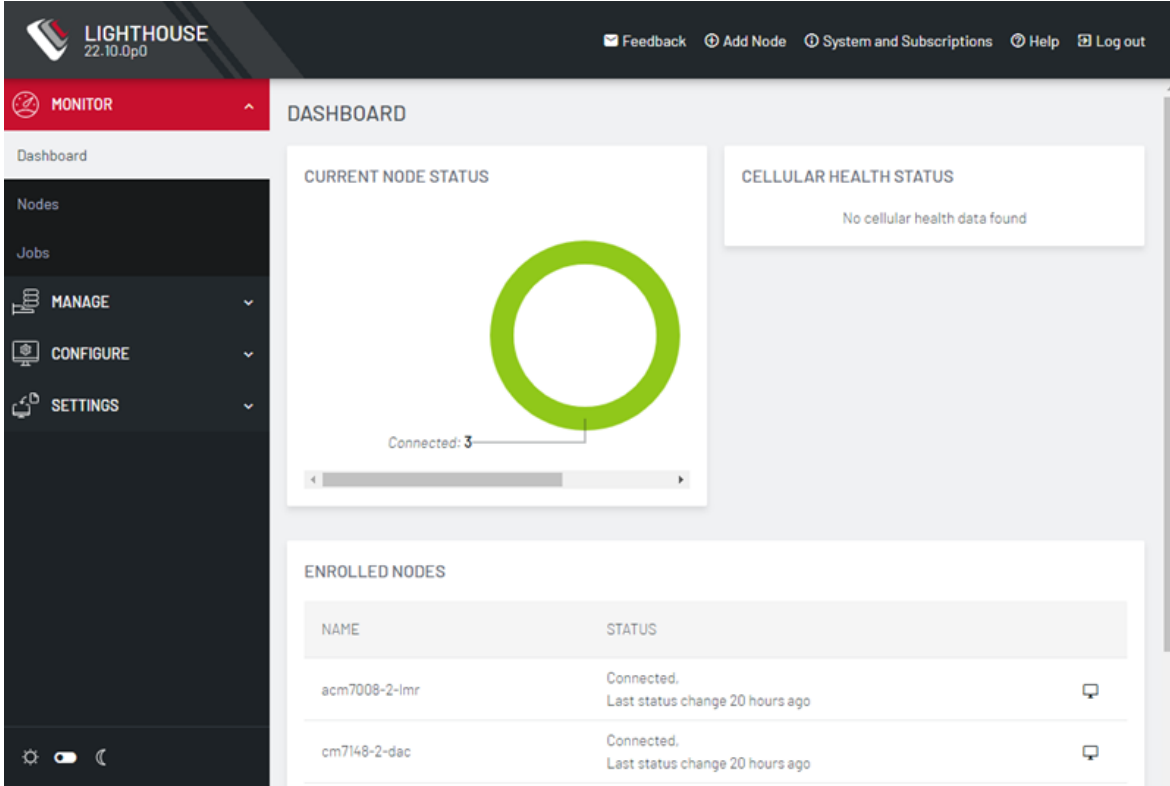
Tip: Type `ogset<tab>` and tab completion will give you the full command.

LOGGING INTO LIGHTHOUSE

To login to Lighthouse:

1. Enter a username in the **Username** field. The first time you log in, the username will be root.
2. Enter the password in the **Password** field. See "[First Boot of the Lighthouse VM](#)" on page 61 for more information.
3. Click **Log In** or press **Enter**. The Lighthouse Dashboard loads.

When you log in, the standard Lighthouse menus, options and panes display:



NAME	STATUS
acm7008-2-lmr	Connected. Last status change 20 hours ago
cm7148-2-dac	Connected. Last status change 20 hours ago

- The primary menu options - **MONITOR**, **MANAGE**, **CONFIGURE**, and **SETTINGS**
- A light/dark mode toggle on the bottom left of the interface. This control allows you to modify the appearance of the dashboard for low light situations.
- System menu options **Add Node**, **Help**, **System & Subscriptions**, and **Log Out** on the header.
- Various panes - some column headings have Arrow Icons next to them. Click to toggle between ascending and descending order.

Note: The elements that appear on the **Dashboard** page depend on the privileges granted to the currently logged in user. In this guide, screenshots represent what the root user sees.

For root users, the Dashboard displays the following panes; **Enrolled Nodes**, **Cellular Health Status**, and **Current Node Status**.

Click **Cellular Health** to go to **MANAGE > NODES > Node Web UI** page where you can view the **Cellular Health** column with information on each node.

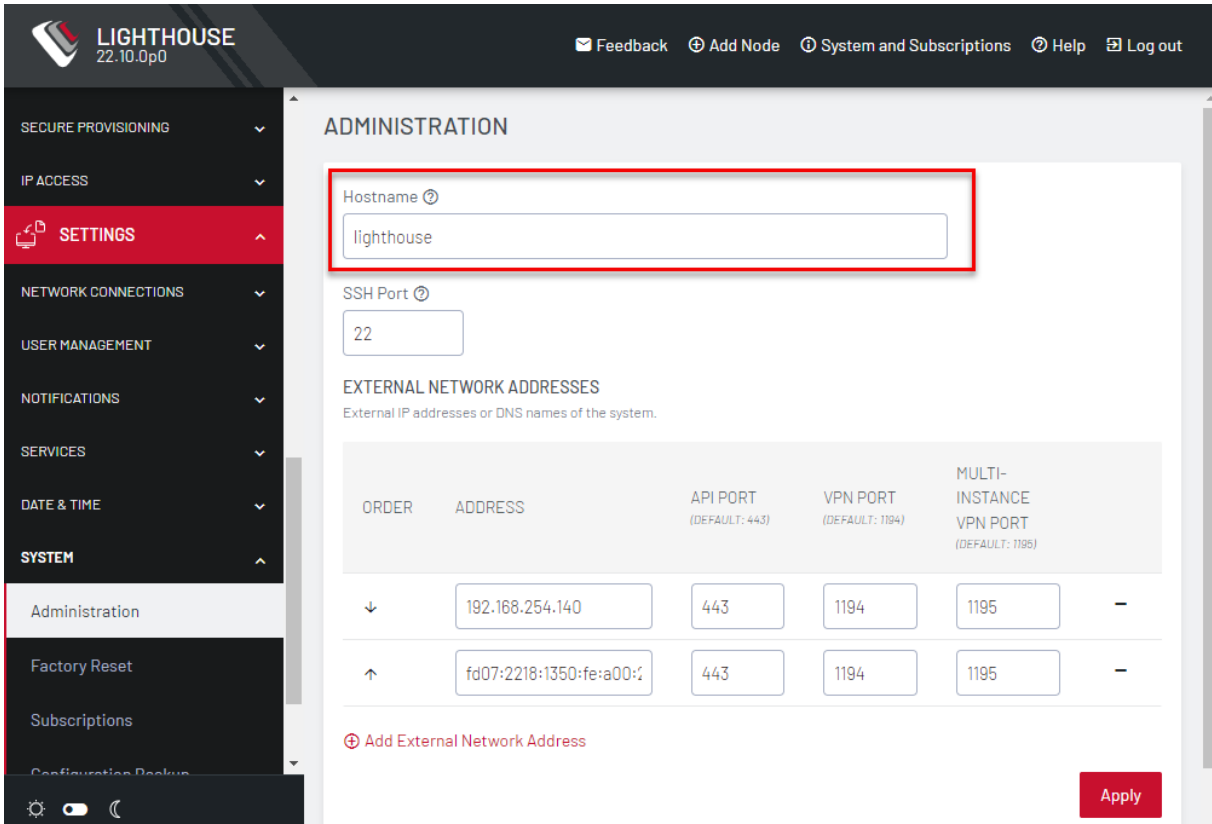
Note: The Cellular Health only displays if Cellular Health reporting is enabled.

Click **Current Node Status** to go to the appropriate page, that is, **Connected**, **Disconnected**, or **Pending** Node pages.

SETTING THE LIGHTHOUSE HOSTNAME

To set the hostname for a running Lighthouse instance:

1. Select **SETTINGS > SYSTEM > Administration**.
2. Edit the **Hostname** field as desired. Hostnames must follow the naming conventions
 - ASCII alphanumerical characters plus - and .
 - Maximum 64 characters



ADMINISTRATION

Hostname ⓘ
lighthouse

SSH Port ⓘ
22

EXTERNAL NETWORK ADDRESSES
External IP addresses or DNS names of the system.

ORDER	ADDRESS	API PORT (DEFAULT: 443)	VPN PORT (DEFAULT: 1194)	MULTI- INSTANCE VPN PORT (DEFAULT: 1195)	
↓	192.168.254.140	443	1194	1195	-
↑	fd07:2218:1350:fe:a00::	443	1194	1195	-

⊕ Add External Network Address

Apply

3. Click **Apply**.

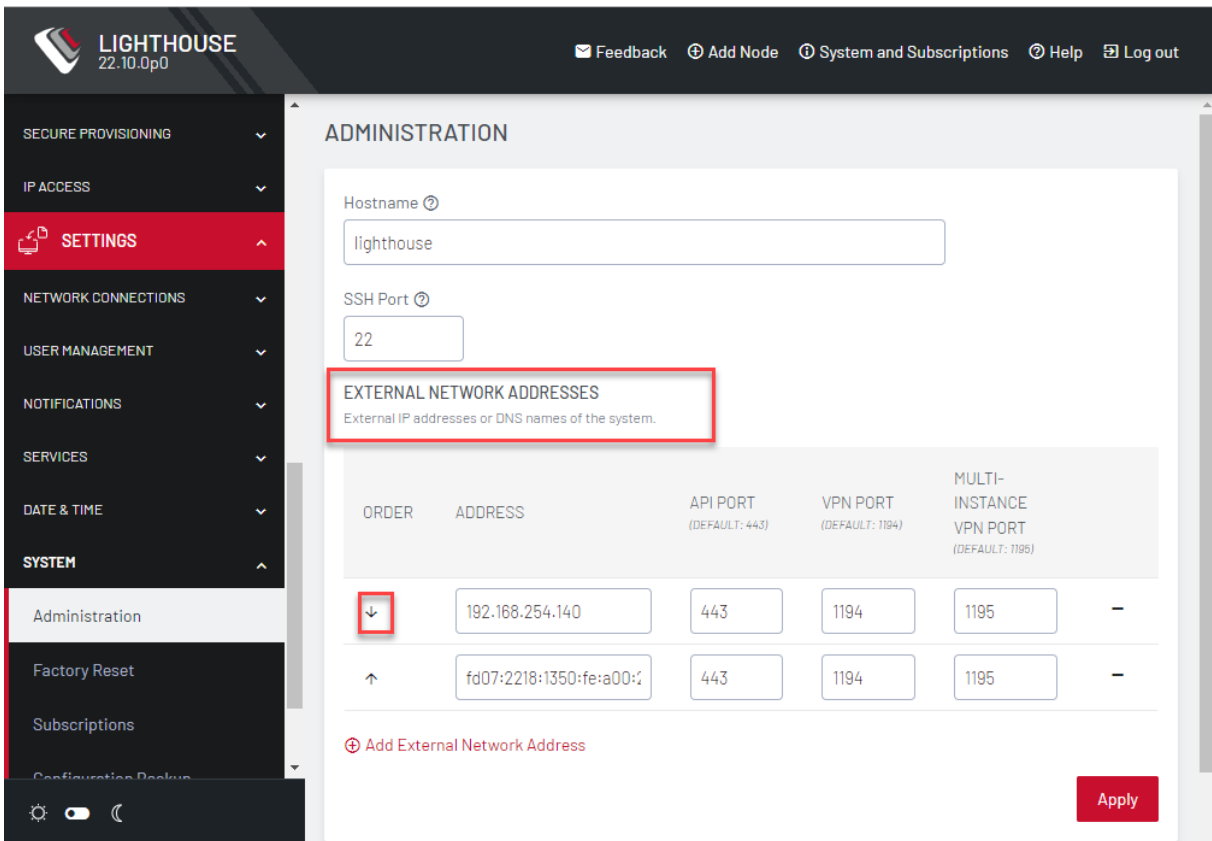
ADDING EXTERNAL IP ADDRESSES MANUALLY

Adding a Lighthouse instance's external IP address or addresses manually to a Lighthouse instance's configuration is an optional step. In general, these should not be changed except by a network support engineer. For more information on the network ports used by Lighthouse, see [this link on the network architecture](#).


Note: IP addresses can be IPv4, IPv6 or DNS names.


To add a single external address:

1. Select **SETTINGS > SYSTEM > Administration**.






ADMINISTRATION

Hostname 

SSH Port 

EXTERNAL NETWORK ADDRESSES
External IP addresses or DNS names of the system.

ORDER	ADDRESS	API PORT <small>(DEFAULT: 443)</small>	VPN PORT <small>(DEFAULT: 1194)</small>	MULTI- INSTANCE VPN PORT <small>(DEFAULT: 1195)</small>	
	<input type="text" value="192.168.254.140"/>	<input type="text" value="443"/>	<input type="text" value="1194"/>	<input type="text" value="1195"/>	-
	<input type="text" value="fd07:2218:1350:fe:a00::"/>	<input type="text" value="443"/>	<input type="text" value="1194"/>	<input type="text" value="1195"/>	-

 Add External Network Address

Apply

2. In the **Address** field of the **External Network Addresses** section, enter an IP address or DNS name.
3. Change the **API Port**, **VPN Port**, or **Multi-Instance VPN Port** if the ports used on the entered IP address are different from the default settings.
4. Click **Apply**.

To add further external addresses to a Lighthouse instance's configuration:

1. Click the **+ button**. A second row displays in the **External Network Addresses** section.

2. In the **Address** field, enter an IP address.
3. Change the **API Port**, **VPN Port**, or **Multi-Instance VPN Port** if the ports used on the entered IP address are different from the default settings.
4. Click **Apply**.

To change the order in which manually added IP addresses are sent to remote nodes:

1. Click the **up** and **down** arrows in the **Order** column to change the order in which the IP addresses are listed.
2. Click **Apply**.

If external IP addresses are manually added to a Lighthouse configuration, these addresses are sent to a remote node during enrollment. If no external IP address is manually added, default external IP addresses are used.

The external IP addresses are sent to a remote node during Enrollment in the order configured on the **SETTINGS > System > Administration** page.

THE LIGHTHOUSE SSL CERTIFICATE

Lighthouse ships with a private SSL Certificate that encrypts communications between it and the browser. Most browsers will display a warning message when first trying to access Lighthouse.

Note: If you plan to use the Lighthouse **multiple instance** feature, the certificate will be used on all instances. In this case, we recommend using a wildcard certificate.

To examine this certificate or generate a new **Certificate Signing Request**:

1. Select **SETTINGS > SERVICES > HTTPS Certificate**. The details of the **Current SSL Certificate** appear.
2. Below this listing is a **Certificate Signing Request** form, which can be used to generate a new SSL certificate.

SET THE LIGHTHOUSE INTERNAL CLOCK

Lighthouse and Node system times need to be in sync. Enrollment can fail if there is a significant difference between the Lighthouse and the node. It is recommended that you use an NTP server to automatically manage date and time.

If using multiple instances, configure the time zone for the secondary instances before adding them as secondary instance. The only way to change the time zone after adding a secondary instance is to use the CLI.

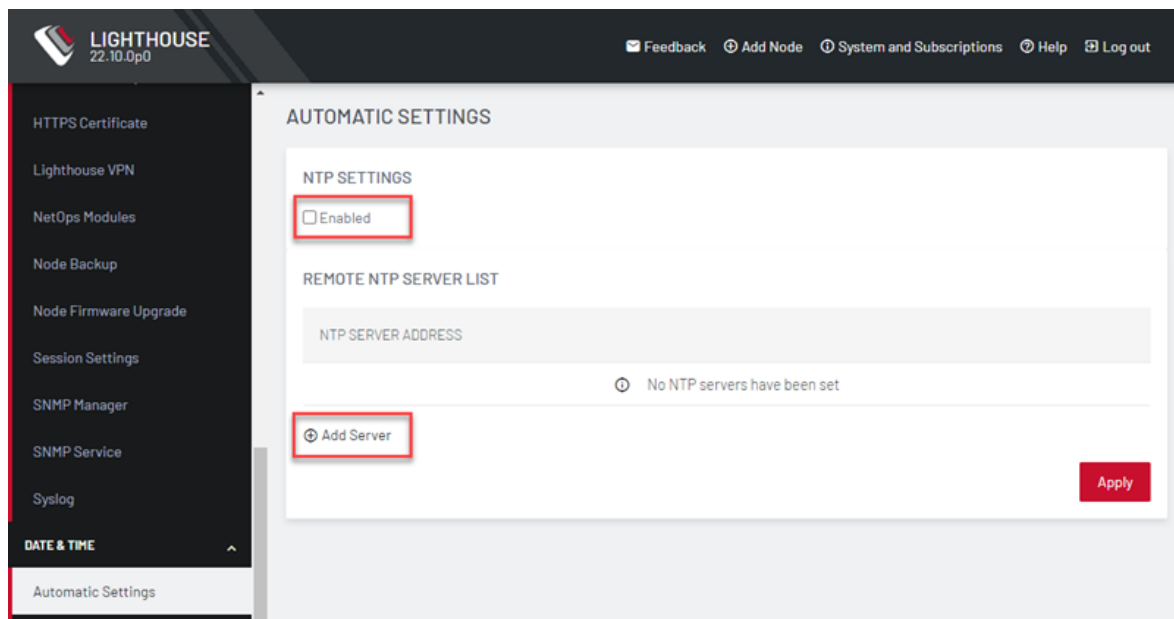
To set the time zone:

1. Select **SETTINGS > DATE & TIME > Time Zone**.
2. Select the Lighthouse instance's time-zone from the **Time Zone** drop-down list.
3. Click **Apply**.

Set time automatically

It is highly recommended that you use an NTP Server to automatically manage date and time:

1. Select **SETTINGS > DATE & TIME > Automatic Settings**.



2. Click the **Enabled** checkbox.
3. Click on **+ Add Server**.
4. Enter a working NTP Server address in the **NTP Server Address** field.
5. Click **Apply**.

SETTING UP NETWORKING REQUIREMENTS

This section outlines the basic steps to setup networking requirements for Lighthouse including:

- Lighthouse Session Settings
- MTU of the Lighthouse VPN tunnel
- Network connection

- SNMP Manager Settings
- SNMP Service
- Cellular Health Settings
- Lighthouse MIBs

EXAMINE OR MODIFY THE LIGHTHOUSE SESSIONS

To modify Web and CLI session settings select **SETTINGS > SERVICES > Session Settings**.

- **Web Session Timeout:** This value can be set from 1 to 1440 minutes.
- **CLI Session Timeout:** This value can be set from 1 to 1440 minutes or set it to 0 to disable the timeout. Changes take effect the next time a user logs in via the CLI.
- **Enable additional Enrollment-only REST API port:** This port defaults to 8443. Enabling this API allows users who are using NAT for the Lighthouse to expose an external port publicly only for nodes that are attempting to enroll to the Lighthouse, and not for the other functionality available from the REST API. After this option is disabled, all endpoints should be accessible as per normal usage.

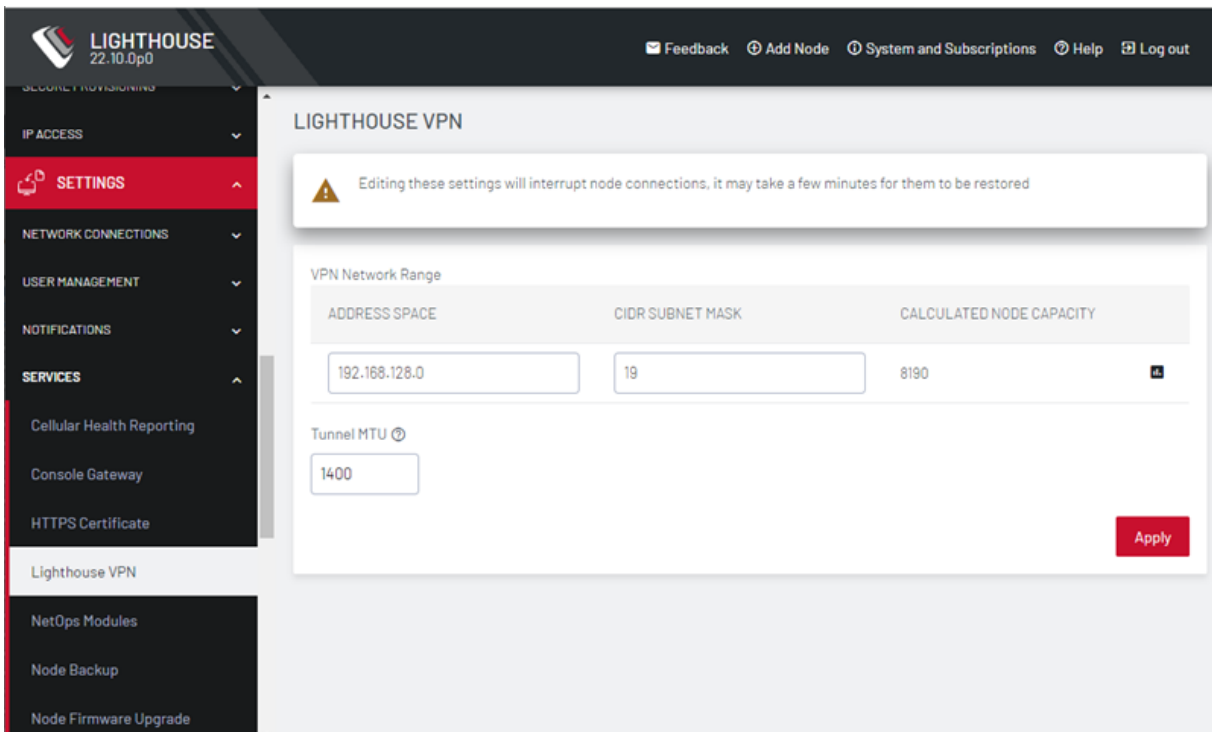
EXAMINE OR CHANGE THE MTU OF THE LIGHTHOUSE VPN TUNNEL

The **Maximum Transmission Unit (MTU)** setting can be configured for traffic through the Lighthouse VPN in an attempt to solve MTU path discovery problems.

The maximum transmission unit (MTU) is the size, in bytes, of the largest packet supported by a network layer protocol, including both headers and data.

To modify the MTU of the Lighthouse VPN tunnel select **SETTINGS > SERVICES > Lighthouse VPN**.

Allowed values are between 1280 and 1500.



The screenshot shows the Lighthouse Access Portal interface. The top navigation bar includes the Lighthouse logo, version 22.10.0p0, and links for Feedback, Add Node, System and Subscriptions, Help, and Log out. The left sidebar contains a menu with categories like SECURITY PROVISIONING, IP ACCESS, SETTINGS (highlighted in red), NETWORK CONNECTIONS, USER MANAGEMENT, NOTIFICATIONS, and SERVICES. Under SERVICES, options include Cellular Health Reporting, Console Gateway, HTTPS Certificate, Lighthouse VPN (selected), NetOps Modules, Node Backup, and Node Firmware Upgrade.

The main content area is titled 'LIGHTHOUSE VPN'. It features a warning message: 'Editing these settings will interrupt node connections, it may take a few minutes for them to be restored'. Below this is a 'VPN Network Range' section with a table:

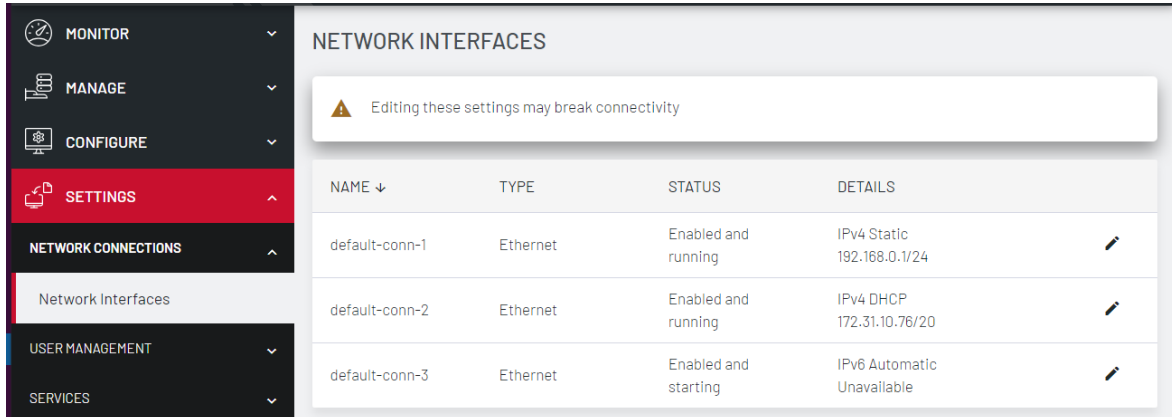
ADDRESS SPACE	CIDR SUBNET MASK	CALCULATED NODE CAPACITY
<input type="text" value="192.168.128.0"/>	<input type="text" value="19"/>	8190

Below the table is a 'Tunnel MTU' section with an input field containing the value '1400'. An 'Apply' button is located at the bottom right of the settings area.

NETWORK CONNECTIONS

To see the network connections available to Lighthouse:

1. Select **SETTINGS > NETWORK CONNECTIONS > Network Interfaces**.



MONITOR

MANAGE

CONFIGURE

SETTINGS

NETWORK CONNECTIONS

Network Interfaces

USER MANAGEMENT

SERVICES

NETWORK INTERFACES

⚠ Editing these settings may break connectivity

NAME ↓	TYPE	STATUS	DETAILS
default-conn-1	Ethernet	Enabled and running	IPv4 Static 192.168.0.1/24
default-conn-2	Ethernet	Enabled and running	IPv4 DHCP 172.31.10.76/20
default-conn-3	Ethernet	Enabled and starting	IPv6 Automatic Unavailable

2. The **Details** column displays connections of three types:

- Static interfaces
- DHCP IPv4 interfaces and by default,
- An automatic IPv6 connection.

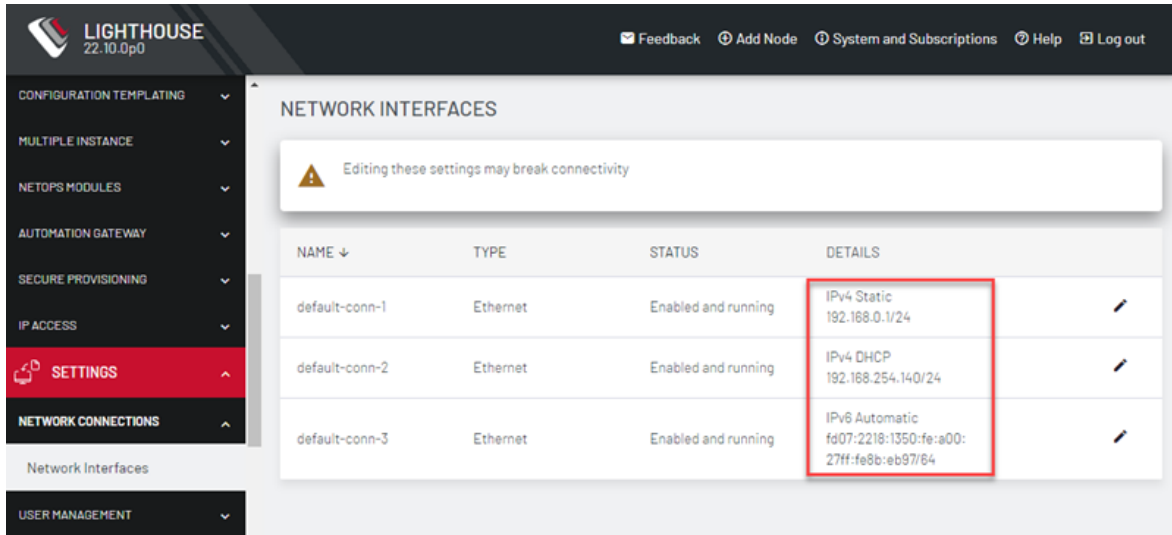
3. Click the Edit icon to view the status and change the connection details such as the following on the Static interfaces:

- IPv4 Address
- IPv4 network Mask
- Gateway
- Primary DNS Server
- Secondary DNS Server

Note:Editing the network settings may break connectivity.

EDIT A NETWORK INTERFACE

1. Select **SETTINGS > NETWORK CONNECTIONS > Network Interfaces**.
2. Click the **Edit** icon to the right of the network interface to be modified.
3. Make the desired changes.
4. Click **Apply**.



The screenshot displays the 'NETWORK INTERFACES' configuration page in the Lighthouse Access Portal. The page includes a warning message: 'Editing these settings may break connectivity'. Below this is a table listing three default network interfaces. The first interface, 'default-conn-1', is highlighted with a red box around its details, showing it is configured with IPv4 Static (192.168.0.1/24). The second interface, 'default-conn-2', is configured with IPv4 DHCP (192.168.254.140/24). The third interface, 'default-conn-3', is configured with IPv6 Automatic (fd07:2218:1350:fe:a00:27ff:fe8b:eb97/64). The left sidebar shows the 'SETTINGS' menu item highlighted in red, and the 'NETWORK CONNECTIONS' section is expanded to show 'Network Interfaces'.

NAME ↓	TYPE	STATUS	DETAILS
default-conn-1	Ethernet	Enabled and running	IPv4 Static 192.168.0.1/24
default-conn-2	Ethernet	Enabled and running	IPv4 DHCP 192.168.254.140/24
default-conn-3	Ethernet	Enabled and running	IPv6 Automatic fd07:2218:1350:fe:a00: 27ff:fe8b:eb97/64

Note: Do not change the **Connection Type** of default network interfaces. If a default interface is not required, edit the interface and uncheck the **Enabled** checkbox.

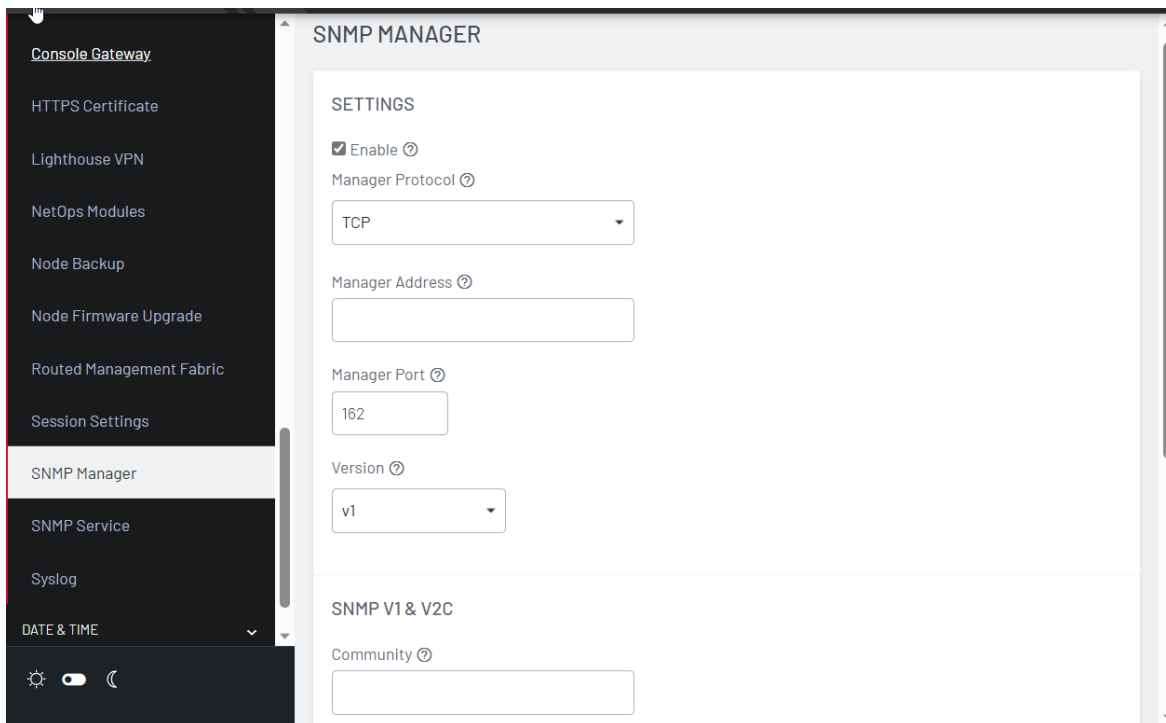
Instead, disable the interface which will not be used by unchecking the **Enabled** checkbox. If **default-static** and **default-DHCP** are changed to the same configuration method (that is, if both are set to **Static assignment** or both are set to **DHCP**) neither interface works.

CONFIGURE SNMP MANAGER SETTINGS

Administrative users can configure the **Simple Network Management Protocol** (SNMP) Manager settings. The SNMP Manager allows SNMP TRAP/INFORM messages to be sent from Lighthouse to a configured server any time a node connection status is changed.

To enable the SNMP Manager:

1. Select **SETTINGS > SERVICES > SNMP Manager**.



2. Under the **Settings** section, select the **Enable** checkbox.
3. In the **Manager Protocol**, select UDP, or UDP over IPv6, TCP, or TCP over IPv6.
4. Enter the **Manager Address** to receive SNMP messages.

5. Enter the **Manager Port**.
6. From the SNMP protocol **Version** select v1 or v2c or v3.

Depending on the selected SNMP **Version**, complete the following steps.

For **v1**, enter the **SNMP Community** to use for messages.

For **v2c**:

1. Select TRAP or INFORM as the **SNMP Message Type**.
2. Enter the **SNMP Community** to use for messages.

For **v3**:

1. Choose TRAP or INFORM as the **SNMP Message Type**.
2. Specify an optional **Engine ID** for sending an SNMP TRAP message. If left blank, the auto-generated Engine ID from the SNMP Service will be used. An Engine ID is not needed for an SNMP INFORM message.
3. Enter the SNMP v3 **Engine ID** and desired Configure SNMP Manager Settings.
4. Enter the **Username** to send the messages as, select the **Authentication Protocol**, either MD5 or SHA, and enter the SNMP user's **Authentication Password**.
5. Choose a **Privacy Protocol**, either DES or AES, and enter a **Privacy Password**.

For all three SNMP versions, trigger TRAP/INFORM notifications by checking either or both of the Node Connection Status and the Node Cellular Health Status checkboxes. Click Apply.

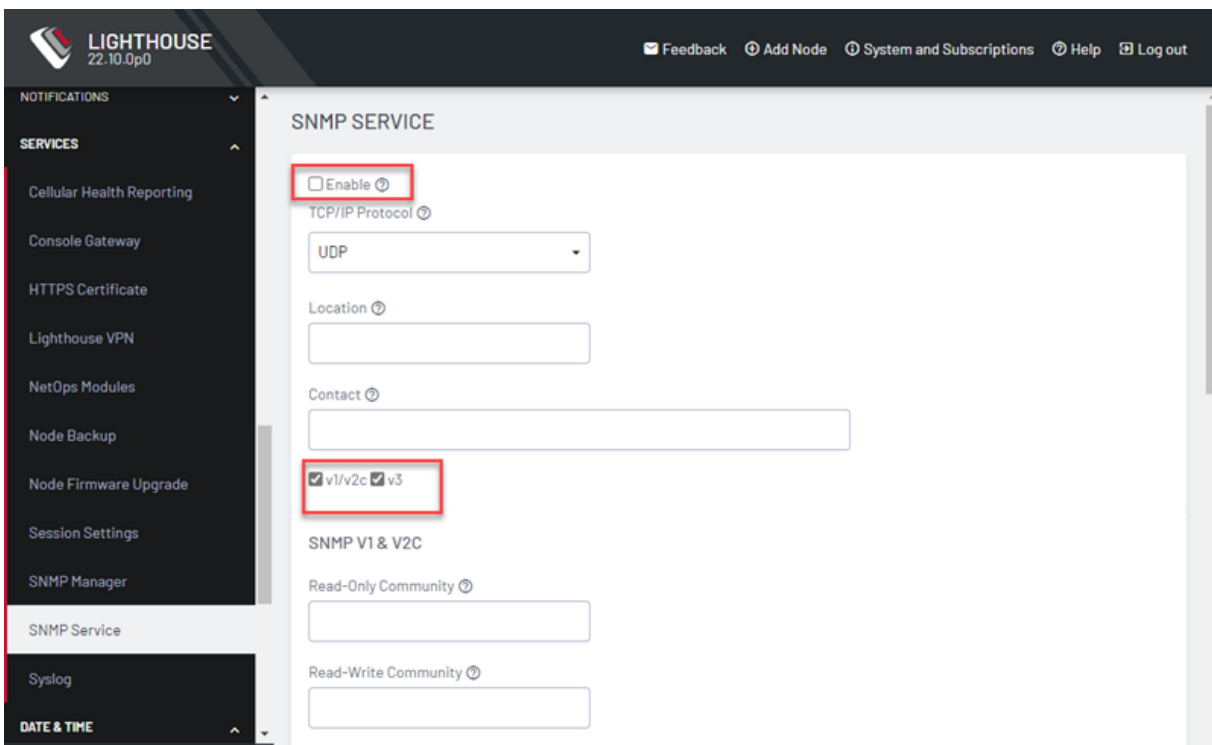
When a node connection status changes, a nodeStatusNotif notification is sent, populated with data about the node's connection status, address and name.

For information on Structure of notifications for Opengear nodes, refer to [OG-LIGHTHOUSE-MIB.mib](#).

EXAMINE OR MODIFY SNMP SERVICE

Administrative users can configure SNMP settings under **SETTINGS > SERVICES > SNMP Service**.

Lighthouse supports both v1/v2 and v3 SNMP versions, which can be running at the same time. The SNMP service is not enabled by default. The SNMP service starts after it has been configured correctly. If the user does not provide an **Engine ID**, an auto-generated ID displays. Lighthouse Health statistics (load/uptime/memory usage, etc.) can be retrieved.



The screenshot displays the Lighthouse web interface for configuring the SNMP Service. The left sidebar shows the navigation menu with 'SNMP Service' selected. The main content area is titled 'SNMP SERVICE' and contains the following configuration options:

- Enable
- TCP/IP Protocol: UDP
- Location: [Empty text field]
- Contact: [Empty text field]
- v1/v2c v3
- SNMP V1 & V2C:
 - Read-Only Community: [Empty text field]
 - Read-Write Community: [Empty text field]

To enable SNMP Service:

1. Select the **Enable** checkbox.
2. Choose from the **v1/v2c** and **v3** checkboxes.
3. Fill in the appropriate information for the SNMP versions.
4. Click **Apply**.

CELLULAR HEALTH SETTINGS

Administrative users can control the cellular health reporting settings under **SETTINGS > SERVICES > Cellular Health Reporting**.



When cell health checks are enabled, the network carrier, IMEI, IMSI and ICCID of the downstream SIM being utilized are part of the information that is displayed in Lighthouse for managed nodes

If a managed node has the modem disabled/off, an appropriate status is shown in Lighthouse for the node.

- Check the **Enable** box to enable Cellular Health monitoring.
- If required, adjust the signal quality ranges corresponding to **Good**, **Bad**, and **Moderate**. This will change the Cellular Health information displayed in various node lists and on the **Dashboard**.




- Adjust how frequently Lighthouse will check the signal quality.
- Finally, you can run a periodic **Cellular Connectivity Test** which will make sure the cellular can actually connect. This will use cellular data.

CELLULAR HEALTH DASHBOARD

The current health status of enrolled nodes can be viewed from the Cellular Health Dashboard: **MONITOR > Dashboard**. Click on a segment of interest to open the **Node Web UI** page which displays Node health information:

DASHBOARD
CURRENT NODE STATUS

ENROLLED NODES

NAME	STATUS	
acm7008-2-l	Disconnected, Last status change 1 week ago	
om1208-8e-l	Disconnected, Last status change 1 month ago	
im7216-2-dac-lr	Connected, Last status change 21 minutes ago	
im7216-0013c800e3fa	Connected, Last status change 10 minutes ago	
acm7008-2-lmp	Connected, Last status change 9 minutes ago	

CELLULAR HEALTH STATUS


LIGHTHOUSE MIBS

Lighthouse **management information bases** (MIBs) can be found in **</usr/share/snmp/mibs/>**.

Lighthouse can be configured to expose managed node information such as node name, node model number, node port label, license status, etc. via SNMP. The MIBs turn the SNMP data into text, that is more readable to human readers.

Some generic information about Lighthouse version and nodes count can be found at:

```
ogLhVersion
ogLhNodes
    ogLhNodesTotal
    ogLhNodesPending
    ogLhNodesConnected
    ogLhNodesDisconnected
    ogLhNodesTable with detailed information about nodes.
```

Available information for an enrolled Opengear node

ogLhNodesTable:

```
ogLhNodeIndex
ogLhNodeName
ogLhNodeModel
ogLhNodeProductType
ogLhNodeVpnAddress
ogLhNodeSerialNumber
ogLhNodeUptime
ogLhNodeConnStatus
```

ogLhNodePortsTable:

```
ogLhPortIndex
ogLhPortLabel
ogLhPortID
```

ogLhNodeInterfacesTable:

```
ogLhNodeInterfaceIndex
ogLhNodeInterfaceName
ogLhNodeInterfaceAddress
```

Available information for an enrolled third-party node

ogLhThirdPartyNodesTable:

- ogLhThirdPartyNodeIndex
- ogLhThirdPartyNodeSSHPort
- ogLhThirdPartyNodeName
- ogLhThirdPartyNodeModel
- ogLhThirdPartyNodeProductType
- ogLhThirdPartyNodeAddress
- ogLhThirdPartyNodeSerialNumber
- ogLhThirdPartyNodeUptime
- ogLhThirdPartyNodeConnStatus

ogLhThirdPartyNodePortsTable:

- ohLhThirdPartyPortIndex
- ogLhThirdPartyPortLabel
- ogLhThirdPartyPortConnectionMethod
- ogLhThirdPartyPortMode
- ogLhThirdPartyRemotePort
- ogLhThirdPartyPortLineID

To query licensing information:

ogLhLicenseStatus:

- ogLhLicInstalled
- ogLhLicSupported
- ogLhLicExpiry
- ogLhLicStatus
- ogLhLicFeatureName

To query enrolled node cellular health information:

ogLhNodeCellularHealth

SNMP commands such as `snmpwalk` or `snmpget` retrieve Lighthouse specific information.

Setup: SNMP is configured with version 1 and public is community string

Lighthouse public IP address is 192.168.1.1

All MIBs, including Lighthouse MIB are available in **`/usr/share/snmp/mibs`**

EXAMPLES OF LIGHTHOUSE MIB QUERIES USING SNMP:

Walk through the entire **ogLighthouseMib** using name:

```
snmpwalk -m ALL -v1 -c public 192.168.1.1 ogLighthouseMib
snmpwalk -m ALL -M /usr/share/snmp/mibs -v1 -c public 192.168.1.1
ogLighthouseMib
```

Walk through the entire **ogLighthouseMib** using the OID directly:

```
snmpwalk -m ALL -M /usr/share/snmp/mibs -v1 -c public 192.168.1.1
1.3.6.1.4.1.25049.18.1
```

Get the total nodes enrolled in Lighthouse:

```
snmpget -m ALL -v1 -c public 192.168.1.1 ogLhNodesTotal.0
snmpwalk -m ALL -v1 -c public 192.168.1.1 ogLhNodesTotal
```

Get serial number with enrolled node having VPN address 192.168.128.2:

```
snmpwalk -m ALL -v1 -c public 192.168.1.1
ogLhNodeSerialNumber.192.168.128.2
snmpget -m ALL -v1 -c public 192.168.1.1
ogLhNodeSerialNumber.192.168.128.2
```

Get cellular health for all enrolled nodes:

```
snmpwalk -m ALL -c public -v 1 192.168.124.143 ogLhNodeCellularHealth
OG-LIGHTHOUSE-MIB::ogLhNodeCellularHealth.192.168.128.2 = INTEGER:
good(4)
OG-LIGHTHOUSE-MIB::ogLhNodeCellularHealth.192.168.128.3 = INTEGER:
```

```
good(4)
```

```
OG-LIGHTHOUSE-MIB::ogLhNodeCellularHealth.192.168.128.4 = INTEGER:
```

```
bad(2)
```

```
OG-LIGHTHOUSE-MIB::ogLhNodeCellularHealth.192.168.128.5 = INTEGER:
```

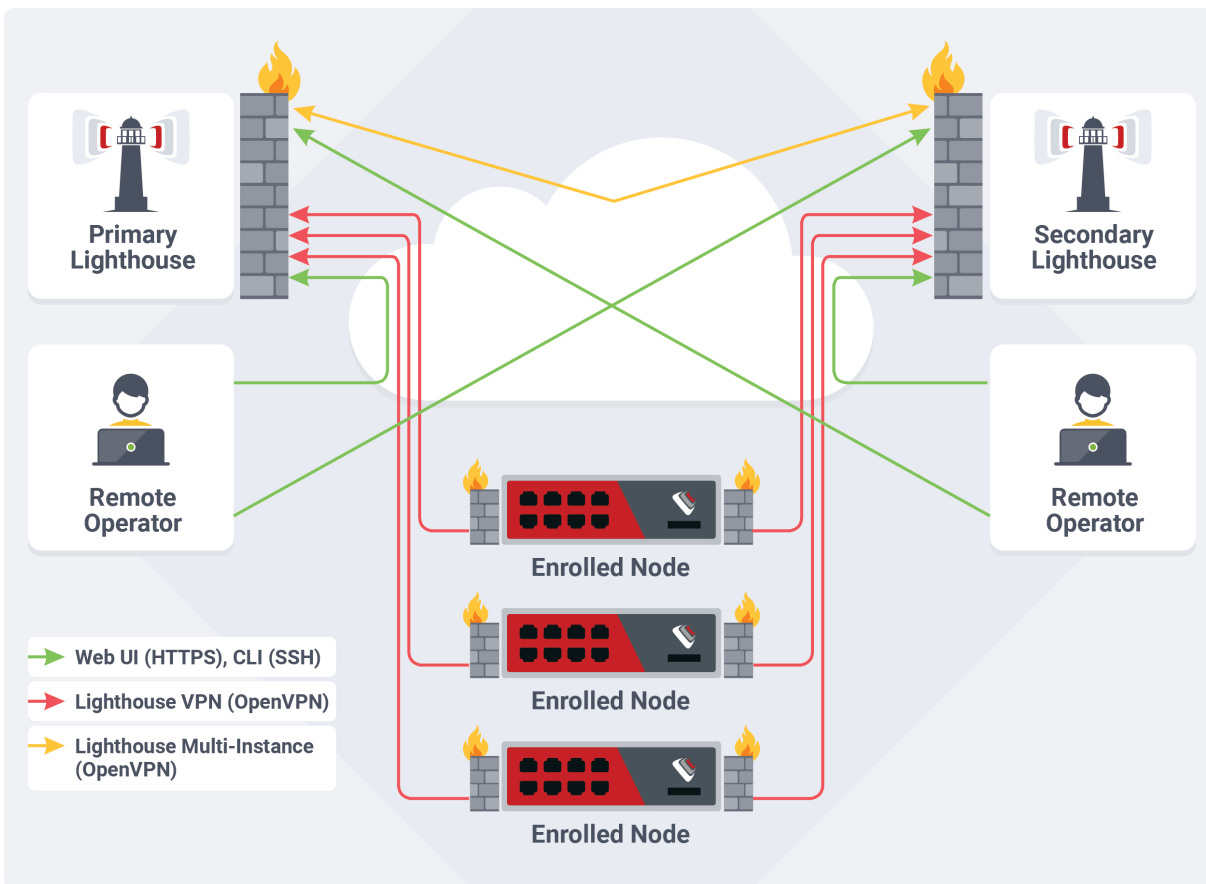
```
unknown(0)
```

```
OG-LIGHTHOUSE-MIB::ogLhNodeCellularHealth.192.168.128.6 = INTEGER:
```

```
bad(2)
```

SETTING UP MULTIPLE INSTANCES OF LIGHTHOUSE

This chapter discusses the licensing, setup, configuration, promoting and disconnecting of secondary instances, and upgrading of a multiple instance Lighthouse.



The multiple instance functionality allows you to set up secondary or dependent instances of Lighthouse that automatically receive updates from a primary Lighthouse instance and maintains connections to all its remote nodes.

Secondary instances are read-only. They may be used to view Lighthouse information specific to that instance using `ogconfig-cli`, and to connect via `pmsHELL`.

Configuration changes must be performed on the primary instance, which will then update the information displayed on the secondary instance. For more details, see [Lighthouse Architecture in "Lighthouse Overview" on page 19](#)

SETTING UP A MULTIPLE INSTANCE

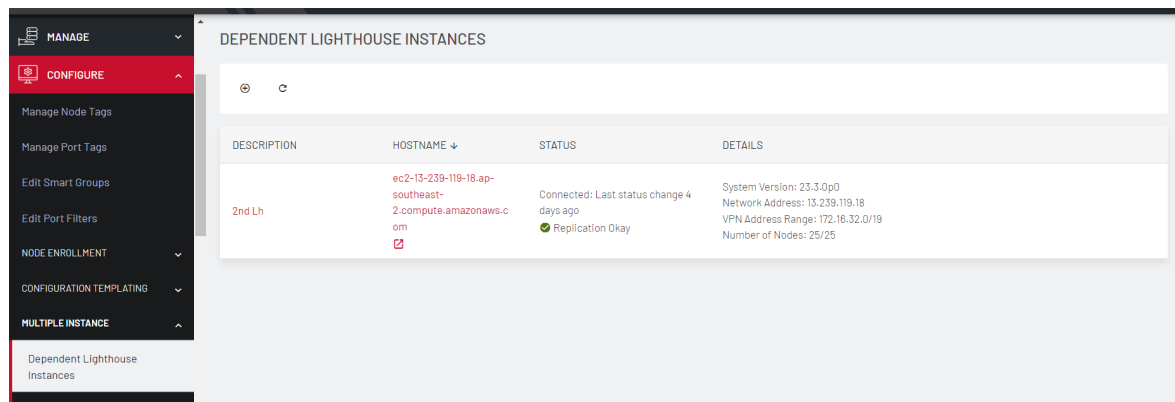
Lighthouse supports up to 10 secondary instances for each primary Lighthouse instance. A secondary instance is also known as a dependent instance.

Before you attempt to set up a multiple instance:

- Start with what will be the primary instance and one or more Lighthouse instances to act as secondary. All instances must have the same version of Lighthouse.
- Configure the networking information for each instance (hostname, external endpoints, network addresses, REST API port).
- Configure the time settings of each instance.
- Ensure you have a subscription active on your primary Lighthouse.

To set up a multiple instance feature on the primary Lighthouse:

1. On the primary Lighthouse, click **Configure > MULTIPLE INSTANCE > Dependent Lighthouse Instances**.



2. **Click Add.** Enter the following details of a Lighthouse instance to enroll it as a secondary instance:

Description

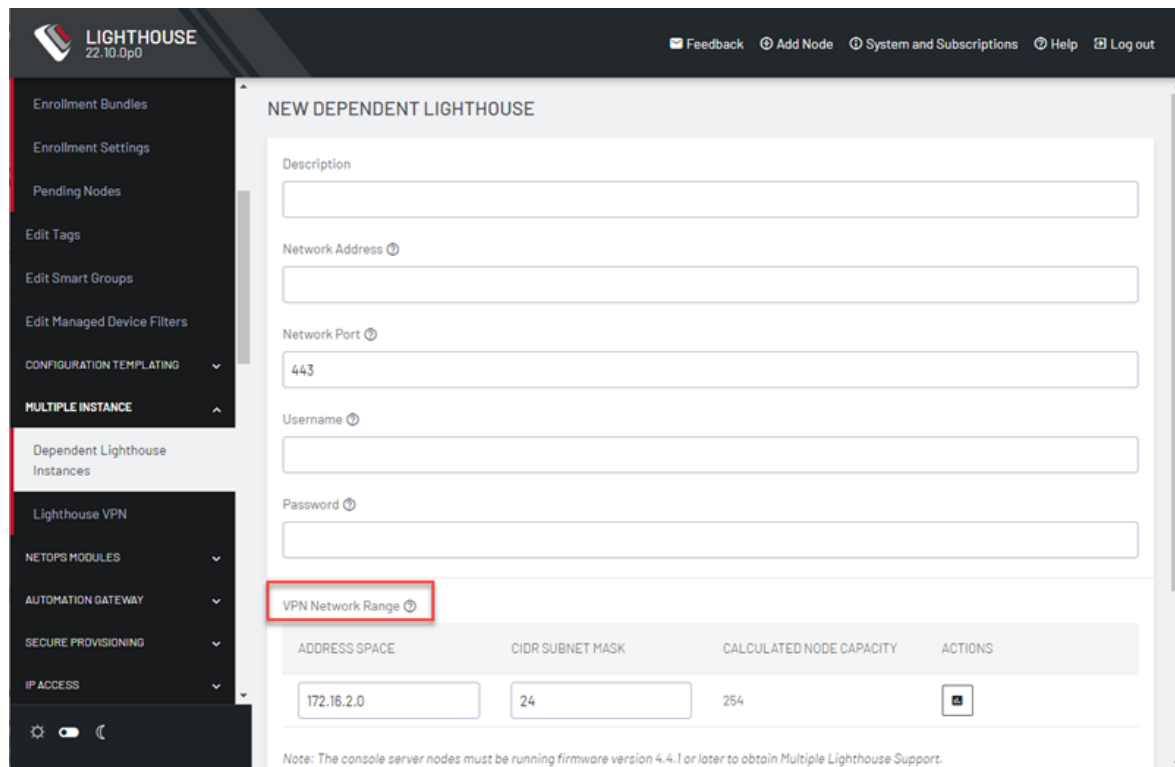
Network address

Network port

Username

Password

In the **VPN Network Range** enter a valid, unused network subnet to use as the dependent lhvpn address range. See ["Configuring Subnets for a Multiple Instance Lighthouse"](#) on page 92.



LIGHTHOUSE 22.10.0p0

Feedback Add Node System and Subscriptions Help Log out

Enrollment Bundles
Enrollment Settings
Pending Nodes
Edit Tags
Edit Smart Groups
Edit Managed Device Filters
CONFIGURATION TEMPLATING
MULTIPLE INSTANCE
Dependent Lighthouse Instances
Lighthouse VPN
NETOPS MODULES
AUTOMATION GATEWAY
SECURE PROVISIONING
IP ACCESS

NEW DEPENDENT LIGHTHOUSE

Description

Network Address

Network Port 443

Username

Password

VPN Network Range

ADDRESS SPACE	CIDR SUBNET MASK	CALCULATED NODE CAPACITY	ACTIONS
172.16.2.0	24	254	+

Note: The console server nodes must be running firmware version 4.4.1 or later to obtain Multiple Lighthouse Support.

Note: The secondary Lighthouse instance must be able to reach the primary instance on UDP Port 1195.

- 3.
4. Click **Apply**.
5. Dependent Lighthouse Enrollment displays status as it moves from **Pending > Registered > Enrolled**.
6. When the VPN connection is established between primary and secondary Lighthouse, this page will display **Connected** with the time since the last status change and **Disconnected** when the connection is lost. Any errors in the Enrollment process will display in the status column.

ENABLING ALTERNATE REST API PORTS

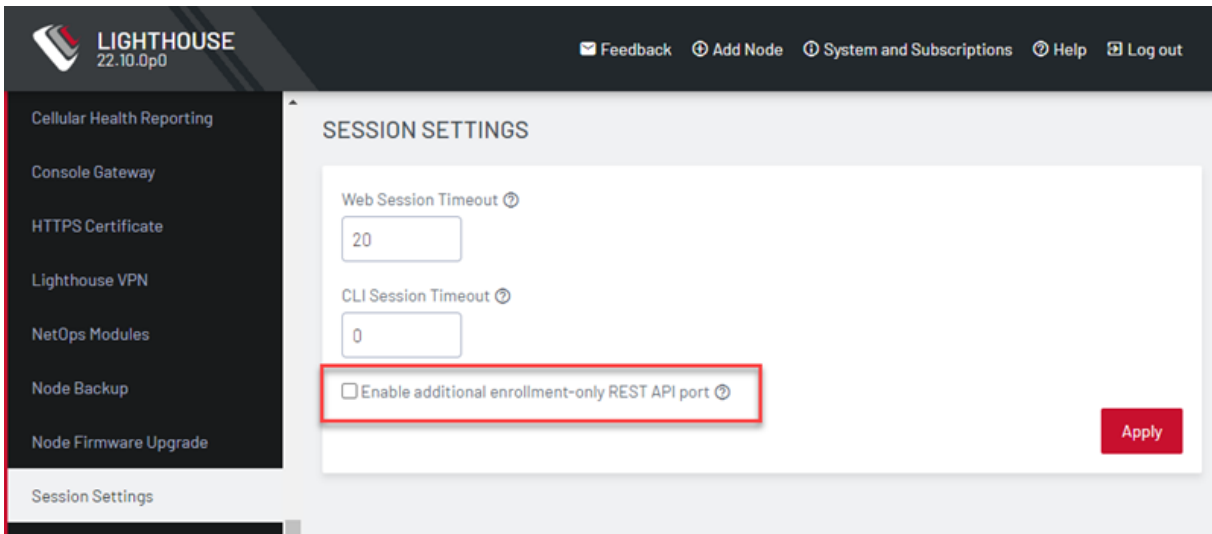
If you are planning to use the alternate REST API ports, you will need to make sure this option is enabled on both the primary and dependent Lighthouse servers, prior to Enrollment of the dependent(s). Lighthouse will prevent the Enrollment of a dependent Lighthouse instance if there is a mismatch in these settings. If this occurs, the message "Lighthouse is using Alternate API port" will be displayed on the Dependent Lighthouse Instances page.

To fix the issue, either

- Enable the Alternate REST API port on both Lighthouse servers, or
- Disable the Alternate REST API port on both Lighthouse servers, then delete the failed Lighthouse Enrollment and try again.

The Alternate REST API Port is configured as follows:

1. Select **Settings > Services > Session Settings**. The page displays:



2. Select **Enable additional enrollment-only REST API port**.

Note:The alternate REST API Port for enrollment is 8443

CONFIGURING SUBNETS FOR A MULTIPLE INSTANCE LIGHTHOUSE

A Lighthouse with multiple instance support requires multiple separate subnets for Lighthouse VPN connections:

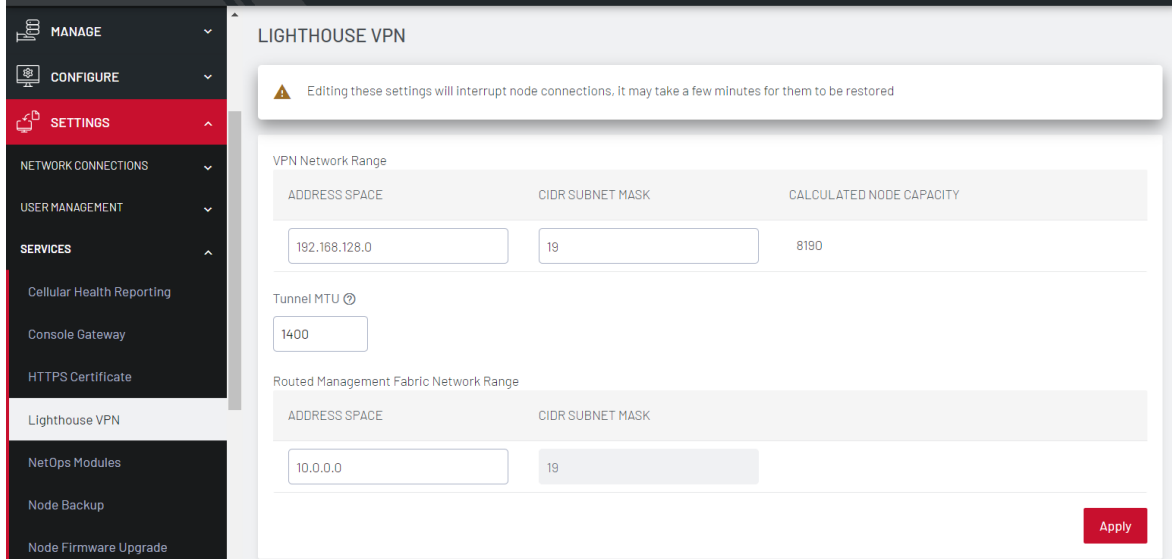
- Between each instance and its nodes
- Between the primary and dependent Lighthouses.

Note:Each subnet must not overlap any subnet in use by another Lighthouse instance.

CONFIGURING THE SUBNETS

To configure the subnet between the primary Lighthouse and its nodes:

1. Select **SETTINGS > SERVICES > Lighthouse VPN** on the primary Lighthouse.



LIGHTHOUSE VPN

⚠ Editing these settings will interrupt node connections. It may take a few minutes for them to be restored

VPN Network Range

ADDRESS SPACE	CIDR SUBNET MASK	CALCULATED NODE CAPACITY
<input type="text" value="192.168.128.0"/>	<input type="text" value="19"/>	8190

Tunnel MTU ⓘ

Routed Management Fabric Network Range

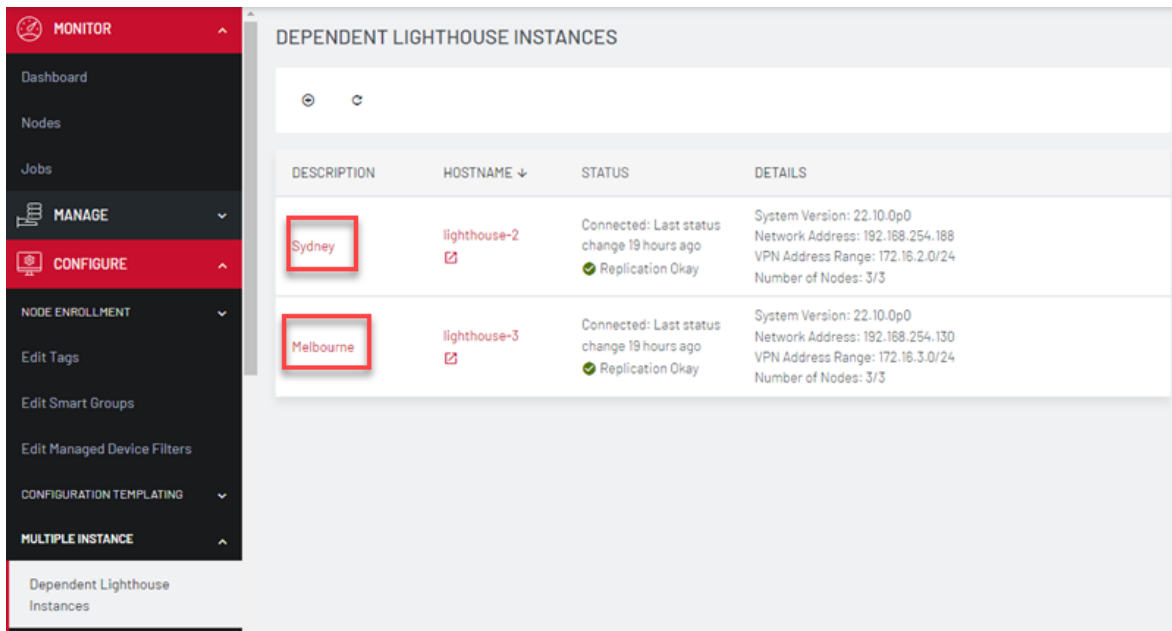
ADDRESS SPACE	CIDR SUBNET MASK
<input type="text" value="10.0.0.0"/>	<input type="text" value="19"/>

2. Enter the **Address Space** and **CIDR Subnet Mask**. The **Calculated Node capacity** displays the addressable nodes based on the network.

Note: A secondary Lighthouse is read-only and cannot be modified. The **SETTINGS > SERVICES > Lighthouse VPN** page displays the subnet used by this Lighthouse instance, but it cannot be modified directly.

3. To configure the subnet between each secondary Lighthouse and its nodes select **CONFIGURE > MULTIPLE INSTANCE > Dependent Lighthouse Instances**.

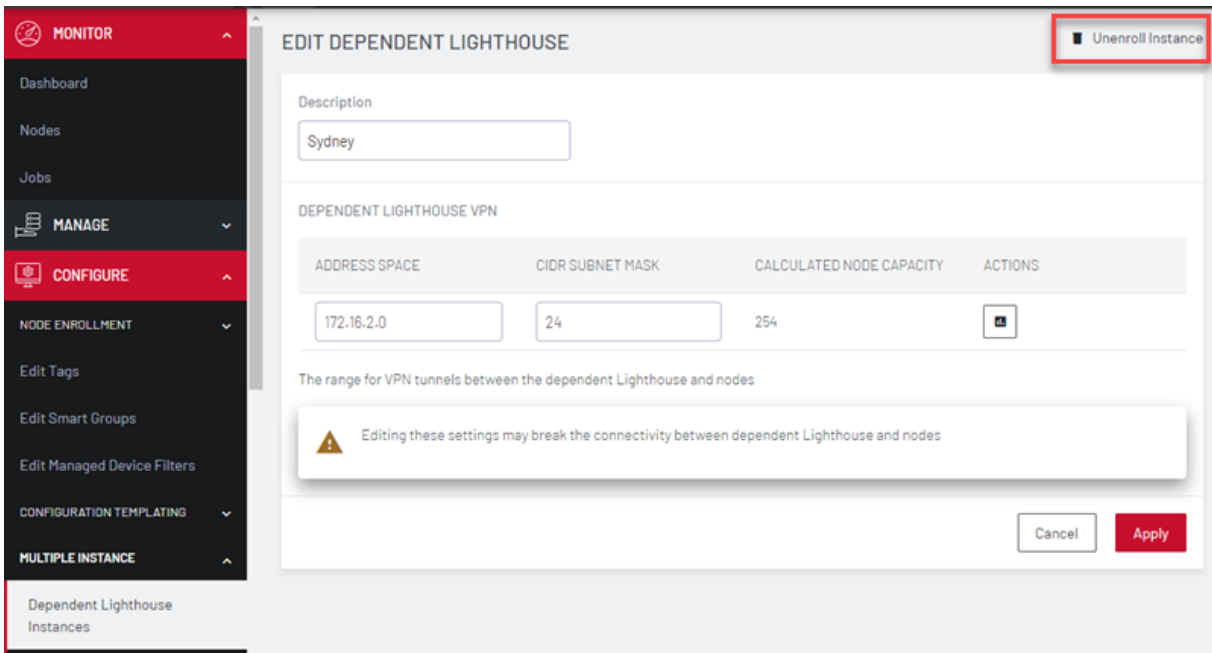
- The **Dependent Instances** page displays. Click on the name of the dependent Lighthouse to be modified.



DEPENDENT LIGHTHOUSE INSTANCES

DESCRIPTION	HOSTNAME ↓	STATUS	DETAILS
Sydney	lighthouse-2	Connected: Last status change 19 hours ago ● Replication Okay	System Version: 22.10.0p0 Network Address: 192.168.254.188 VPN Address Range: 172.16.2.0/24 Number of Nodes: 3/3
Melbourne	lighthouse-3	Connected: Last status change 19 hours ago ● Replication Okay	System Version: 22.10.0p0 Network Address: 192.168.254.130 VPN Address Range: 172.16.3.0/24 Number of Nodes: 3/3

- The Edit Dependent Lighthouse page displays.



EDIT DEPENDENT LIGHTHOUSE Unenroll Instance

Description: Sydney

DEPENDENT LIGHTHOUSE VPN

ADDRESS SPACE	CIDR SUBNET MASK	CALCULATED NODE CAPACITY	ACTIONS
172.16.2.0	24	254	[Icon]

The range for VPN tunnels between the dependent Lighthouse and nodes

⚠ Editing these settings may break the connectivity between dependent Lighthouse and nodes

Cancel Apply

Other information that is specific to dependent Lighthouse should be configured before enrolling but can be modified on the primary Lighthouse via `ogconfig-cli`.

Instance specific information includes:

Hostname

Time zone

Networking

External interfaces

The instance specific information is available on both the primary and secondary Lighthouses but it is read-only on the secondary Lighthouse.

Configurations of all Lighthouse instances are stored in `lighthouse_configurations`.

These can be viewed via `ogconfig-cli`. The primary instance will have a value of `Primary` for its role, and dependent instances have the value `Secondary`.

The following is an example of the `ogconfig-cli` session:

```
6. root@lighthouse:~# ogconfig-cliogcfg> print lighthouse_con-
  configurations[0].rolelighthouse_configurations[0].role (string):
  'Primary'ogcfg> print lighthouse_configurations[1].rolelight-
  house_configurations[0].role (string): 'Secondary'
```

Alternatively, the command `/usr/bin/is_secondary` will output `n` for a primary Lighthouse or `y` for a secondary.

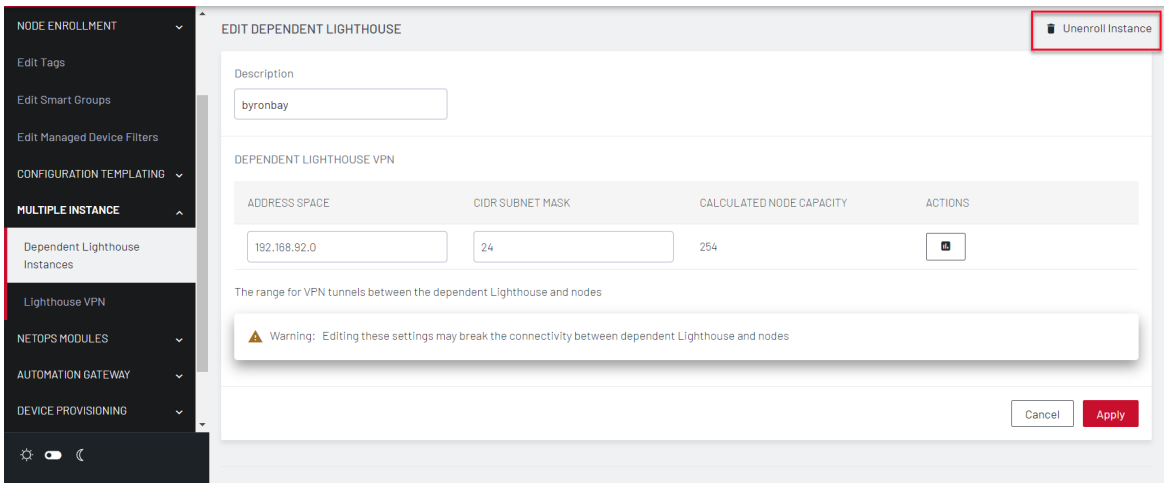
7. You can modify the configuration of secondary lighthouses from the primary Lighthouse. For example, to update the hostname of the secondary Lighthouse, run the following commands on the primary Lighthouse:


```
ogconfig-cli  
set lighthouse_configurations[1].hostname new_name  
push
```

DISCONNECTING A DEPENDENT INSTANCE

To disconnect dependent Lighthouse instances from the primary Lighthouse:

1. Click **CONFIGURE > MULTIPLE INSTANCE > Dependent Lighthouse Instances**, and click the instance name.
2. The dependent Lighthouse displays. Click the **Unenrol Instance** icon in the top right of the page.



ADDRESS SPACE	CIDR SUBNET MASK	CALCULATED NODE CAPACITY	ACTIONS
192.168.92.0	24	254	

3. Click **Yes** in the message that asks you to confirm.
4. You must manually remove the connection to the dependent Lighthouse from each connected node. Click the **Delete link** in the Console Server.

PROMOTING A DEPENDENT INSTANCE

When a primary Lighthouse is no longer reachable, a dependent Lighthouse instance can be promoted to primary. The new primary can then be used to set up a dependent Lighthouse if required.

Note: This should only be performed if the primary Lighthouse has no chance of returning, the procedure is not reversible and will break all node connections with the previous primary instance. The previous primary instance must be factory reset before it can be used again.

To promote a dependent instance to primary, login as root on the secondary instance via console or ssh and run

```
promote-secondary-lighthouse
```

Remove all dead connections from node side using the node's web UI. The Promotion tool deletes connection between primary and dependent instance but does not touch node connections.

The new primary can then be used to enroll a dependent Lighthouse if required.

Note: If the previous primary becomes accessible again, it will not be able to connect to its enrolled nodes or the previous secondary Lighthouses.

- All scheduled firmware upgrades are cancelled in the event of a dependent Lighthouse promotion, and will need to be rescheduled.
- Firmware files are not replicated among the multiple instance cluster and must be re-uploaded to the new primary after promotion.

UPGRADING A MULTIPLE INSTANCE LIGHTHOUSE

Lighthouse must be upgraded in succession. For example, to upgrade to a version that is several releases newer than your current release, you will need to install all the major releases in between to install the newest one.

Before a multiple instance upgrade is attempted, compatibility and status checks are performed on primary/secondary instances to pre-empt possible failure points.

Secondary Lighthouse upgrades are performed in parallel (not in a queue) to speed up the overall process of rolling upgrades.

Where there are multiple instances of Lighthouse, when a system upgrade is being performed the status of dependent instances is flagged in the System Upgrade page.

When the primary Lighthouse is updated, any secondary Lighthouses will be updated in a rolling fashion after the primary has successfully booted. If any Lighthouse fails to successfully update along the way, the update will stop.

UPGRADING DEPENDENT MULTIPLE INSTANCES OF LIGHTHOUSE

To upgrade a Multiple Instance Lighthouse:

When the primary Lighthouse is upgraded any secondary Lighthouses will be upgraded in a rolling fashion after the primary has successfully booted. If any Lighthouse fails to successfully upgrade along the way, the upgrade will stop.

Click the **Dependent Lighthouses** link (red text) to view the upgrade process status for dependent Lighthouse nodes. Click **View Job Details** link to see details of the update progress and any problems.

MULTI_INSTANCE_DEPENDENT_UPGRADER

Pending

No nodes associated with this job.

```
2021-01-20T01:08:31 - Attempt #1 [temporary_failure]
Timed out waiting for lighthouse lighthouse_configurations-2 to reconnect
```

JOB INFO

Duration
13 minutes 11 seconds

Started
2021-01-20T00:58:03

Job ID
18

Owner/Origin
system

During a system upgrade, notification/status elements are flagged in the following scenarios:

- When an upgrade is attempted, a pass/fail notification on the instance.
- When an upgrade is attempted on a secondary instance, a pass/fail notification on the associated primary instance.

Information about the upgrade progress and status is visible in the Lighthouse **Jobs** page.

UPGRADING LIGHTHOUSE

Lighthouse can be upgraded using a `.lh_upg` image file. Note the following conditions:

- AWS requires `.aws.lh_upg` and Microsoft Azure requires `.azure.lh_upg`. All other platforms use the standard `.lh_upg` file.
- Incremental upgrades to Lighthouse using `lh_upg` files are only supported from 20.Q3.x and not earlier releases.

Note: Upgrades do not overwrite existing configurations or user files, however it is recommended that you perform a Configuration Backup before you upgrade a Lighthouse.

After the upgrade is complete, the Lighthouse instance reboots. It is unavailable during the reboot process.

About the Upgrade Process

Lighthouse performs the following high-level steps to upgrade to the new version

1. Validates the upgrade image, and takes a backup of the current root filesystem and snapshot of data volume
2. Reboots into the new root filesystem (from the upgrade image)
3. Performs data migrations and system re-configurations
4. Commits the changes on success, or reverts on failure
5. For Multiple Instance only, after a successful Primary upgrade: After a 10 minute delay, secondary instances are automatically upgraded in sequence.

Lighthouse uses LVM snapshots to manage storage during upgrade and data migration. If a failure occurs, the snapshot is used to revert the system to its previous state.

PREPARE TO UPGRADE LIGHTHOUSE

While upgrading Lighthouse is a simple process, the following tasks are best practices to ensure a successful upgrade.

- Read the release notes, in particular any known issues or special requirements for the new version

- Provide a sufficiently large maintenance window to start and complete the upgrade. Larger networks and more complex configurations will take more time. You can run `q-stat` to check the job queue status.
- Download the correct upgrade image.
The current release can be found here: [Opengear FTP](#)
Archived releases are available here: [Archives Opengear FTP](#)
- Verify the image integrity by checking against SHASUMS. For example, on Linux

```
$ sha1sum lighthouse-23.10.0.lh_upg
0f52c30a212566030a1742b6e3d5bf9316d89abd lighthouse-
23.10.0.lh_upg
```
- Before starting the upgrade, generate a Technical Support Report. This can assist Opengear support with diagnosing upgrade issues.
- Use the `df` command to display disk usage by filesystem.

```
root@lighthouse:~# df /mnt/data/
```
- Ensure that you have enough disk space in `/mnt/data`. If you have less than 20% disk space available, clean up unnecessary files, or add disk space (see ["Adding Disk Space to Lighthouse" on page 56](#)). If disk space is added to the primary instance, add additional space all secondary instances also.
- Take a Configuration Backup on the Primary Lighthouse. This can be used to restore the system in the event of failure during upgrade.
- Do not make any configuration changes during the upgrade process (includes secondary upgrades).
- Consider taking a Virtual Machine backup. If the Lighthouse storage has been increased (by adding additional physical volumes to LVM) then these must be included in the backup, and all storage volumes must be in sync.

- You can also consider running some technical checks before starting the upgrade to check job queues, memory, temporary filesystem (tmpfs), database integrity, and multiple instance status.

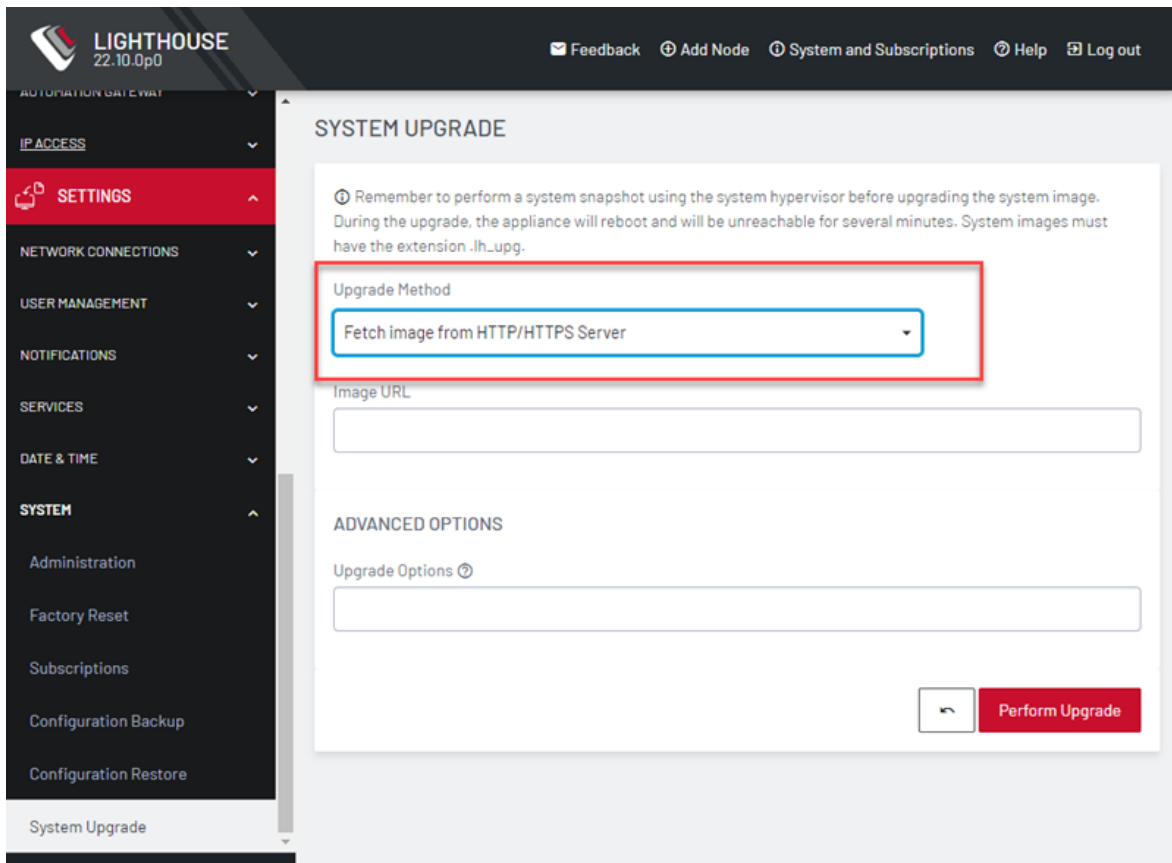
UPGRADING THE SYSTEM FROM WITHIN LIGHTHOUSE

Lighthouse must be upgraded in succession. For example, to upgrade to a version that is several releases newer than your current release, you will need to install all the major releases in between to install the newest one. If you are running a Multiple Instance Lighthouse cluster, the upgrade must be performed through the Primary Lighthouse instance. After the upgrade is complete, the Lighthouse instance reboots automatically. Lighthouse is unavailable during the reboot process.

To upgrade a Lighthouse instance's system using the Lighthouse UI:

1. Select **SETTINGS > SYSTEM > System Upgrade**.

2. Select the **Upgrade Method**, either **Fetch image from HTTP/HTTPS Server** or **Upload Image**.



LIGHTHOUSE 22.10.0p0

Feedback Add Node System and Subscriptions Help Log out

AUTOMATION GATEWAY

IP ACCESS

SETTINGS

NETWORK CONNECTIONS

USER MANAGEMENT

NOTIFICATIONS

SERVICES

DATE & TIME

SYSTEM

Administration

Factory Reset

Subscriptions

Configuration Backup

Configuration Restore

System Upgrade

SYSTEM UPGRADE

ⓘ Remember to perform a system snapshot using the system hypervisor before upgrading the system image. During the upgrade, the appliance will reboot and will be unreachable for several minutes. System images must have the extension .lh.upg.

Upgrade Method

Fetch image from HTTP/HTTPS Server

Image URL

ADVANCED OPTIONS

Upgrade Options ⓘ

Perform Upgrade

3. If upgrading via **Fetch image from HTTP/HTTPS Server**:
 - a. Enter the URL for the system image in the Image URL text-entry field.
 - b. Click Perform Upgrade.
4. Or if upgrading via **Upload Image**:
 - a. Click the **Choose file** button.
 - b. Navigate to the directory containing the appropriate upgrade image file.

- c. Select the upgrade image file and press **Return**.
- d. Click **Perform Upgrade**.

The **Advanced Options** section, which expands to present an **Upgrade Options** text-entry field, should only be used if a system upgrade is being performed as part of an Opendgear Support call.

Once the upgrade has started, the **System Upgrade** page displays feedback as to the state of the process.

A system upgrade attempt returns the error **System version was not higher than the current version** if the selected image file is not a more recent version than the installed version.

UPGRADING THE LIGHTHOUSE SYSTEM VIA THE LOCAL TERMINAL

Lighthouse includes a shell-based tool — `sysflash` — that allows a user with administrative privileges to upgrade the instance's system from the local terminal.

Note: Before using `sysflash`, we recommend that you check available disk space when manually uploading `.lh` upgrade files. We also suggest you use `/mnt/nvram` as the path.

To upgrade Lighthouse instance's system using the Lighthouse local terminal:

1. Select **MANAGE > LIGHTHOUSE > local terminal**.
2. At the `[hostname] login:` prompt, enter an administrator username and press **Return**.

3. At the `Password:` prompt, enter the administrator's password and press `Return`.
4. To use `sysflash` with a `.lh_upg` file available via an HTTP or HTTPS server:
At the local terminal bash shell prompt, enter a URL. It must be URL-encoded:

```
sysflash http[s]://%3A%2F%2Fdomain.tld%2Fpath%2Fto%2Ffirmware-  
upgrade- image.lh_upg
```
5. Press `Return`.

To use `sysflash` with a `.lh_upg` file available via the local file system:

1. At the local terminal bash shell prompt enter:

```
sysflash /path/to/system-upgrade-image.lh_upg.
```
2. Press `Return`.

Note: `sysflash` includes several flags that allow for variations in the standard system upgrade process. These flags should not be used unless directed to do so by Opengear Support.

List the flags by running either of the following at a local terminal bash shell prompt:

```
sysflash -h or
```

```
sysflash --help
```

For more information on `sysflash` See the Command line tools chapter.

TROUBLESHOOTING THE UPGRADE PROCESS

There are two main reason why an upgrade fails:

- Migration failures

Lighthouse will return to the pre-upgrade state. An example of such a failure is malformed data in the database, which does not conform to more stringent schema checks in the new version.

- System level failures

This would include environmental issues such as power loss during the upgrade. If such an issue prevented Lighthouse from rolling back to the previous state, Lighthouse may be left in an unusable state.

Recovering from a failed upgrade

If Lighthouse is in an unusable state (either as a result of upgrade problems, or any other catastrophic failure), you can

- Promote a Secondary Lighthouse

This requires multiple instances of Lighthouse. If the primary Lighthouse instance is unreachable, one of the existing secondary instances can be promoted to become the new primary Lighthouse instance.

The old primary Lighthouse instance should be replaced with a fresh installation of Lighthouse. This can then be enrolled as a secondary to the newly promoted primary Lighthouse.

- Restore a Configuration Backup

Deploy a Lighthouse instance with the version you are upgrading from. Restore the configuration backup taken before the failed upgrade.

- Manually retry via the CLI if a secondary upgrade fails.

Determine the reason for the upgrade failure and resolve the issue before retrying the upgrade. Assistance from Opengear technical support may be required.

TROUBLESHOOTING A FAILED SECONDARY LIGHTHOUSE UPGRADE

To retry the secondary upgrade, first list the secondaries and identify the IDs of the secondary lighthouses that need to be retried by running the `retry_secondary_upgrades list` command.

`retry_secondary_upgrades list` command will list all the secondary lighthouses and their current status, as in the example below:

```
root@lighthouse:~# retry_secondary_upgrades list
ID  UUID  Hostname  Firmware  Version  Fw  Status  Lighthouse  Status
2   lighthouse_configurations-2  lighthouse-2  22.11.2  not updated
UpgradeFailed
3   lighthouse_configurations-3  lighthouse-3  23.10.0  updated
Enrolled
4   lighthouse_configurations-4  lighthouse-4  22.11.2  not updated
UpgradeFailed
```

In the example above, the Lighthouses with IDs 2 and 4 have failed to upgrade (note that the “Enrolled” status is the desired status). To retrigger an upgrade for those lighthouses run the following command. Ensure that the lighthouse IDs are comma separated:

```
retry_secondary_upgrades trigger -l 2,4
```

The method above is the recommended way but there is a shortcut to retrigger all failed secondary upgrades by running the command below:

```
retry_secondary_upgrades trigger --failed
```

Note: Only one secondary will upgrade at a time.

You should be able to view the secondary upgrade progress in the primary Lighthouse UI as you would for a normal upgrade.

CONTACT SUPPORT

In the unlikely event that Lighthouse does not automatically recover, or your troubleshooting efforts fail, contact Opendgear support for advice. Provide the following:

- If your instance is usable, download a Technical Support Report (from the Help menu) and share it with our team.
- Share the configuration backup taken before the upgrade process .

UPGRADE NETOPS MODULES

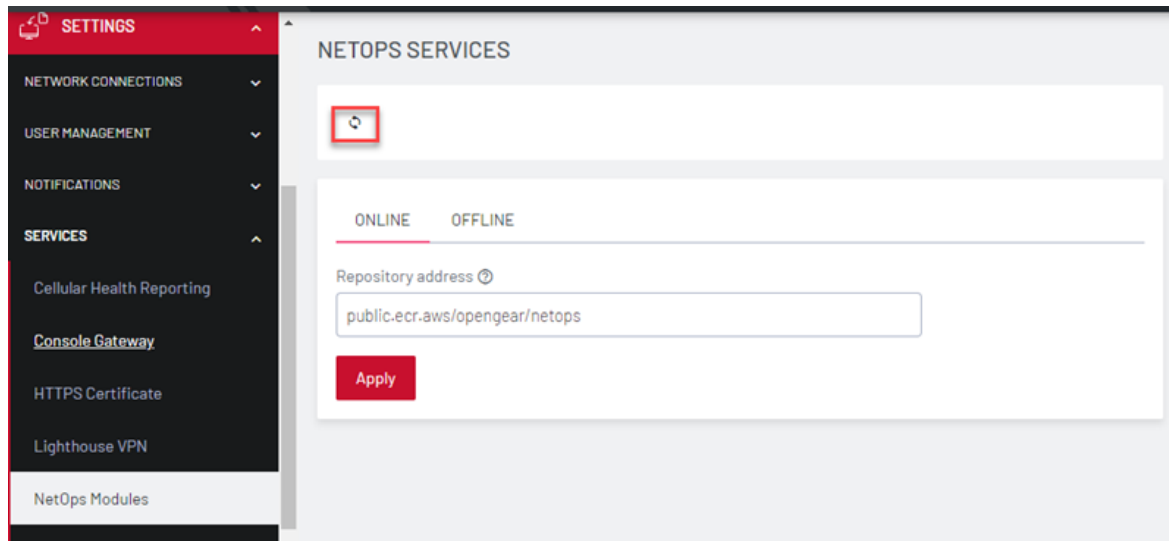
NetOps Modules are released independently of Lighthouse software or Operations Manager firmware.

NetOps releases are uploaded to Opendgear's file server, where they can be fetched by Lighthouse then deployed to all activated nodes by Lighthouse.

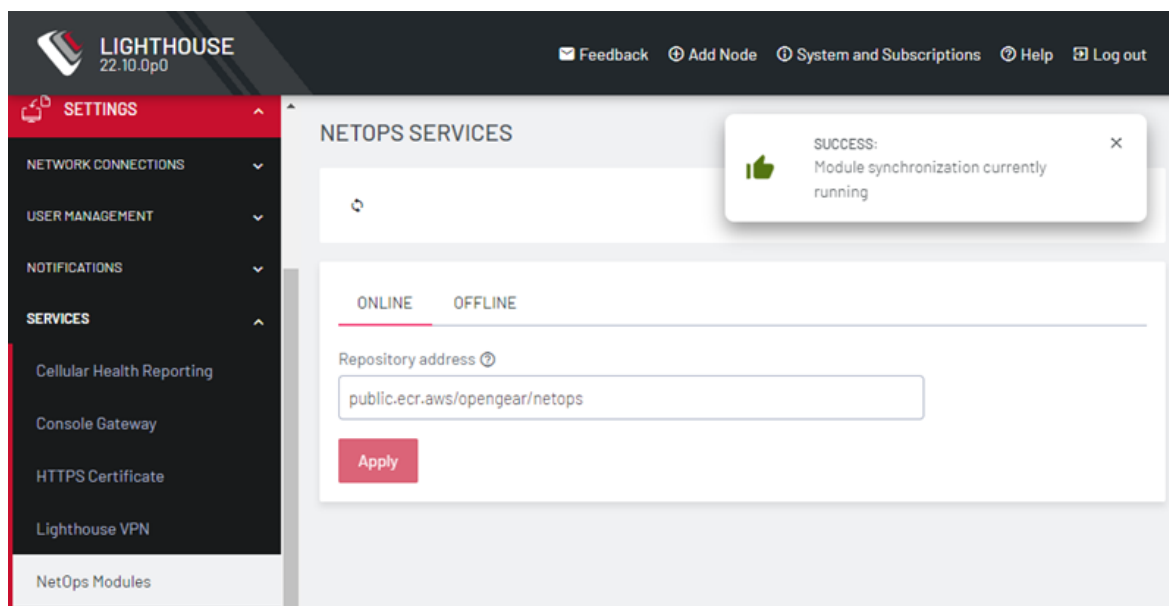
Node upgrades may be carried out through either the Lighthouse UI or the CLI.

PROCEDURE for Lighthouse UI

1. Log in to the Lighthouse web UI as a Lighthouse Administrator or the root user.
2. From the menu, select **SETTINGS > Services > NetOps Modules**. Select either Online or Offline.



3. Click the  **Synchronize** icon. A message displays with the status.



4. From the menu, select **CONFIGURE NODES > NetOps Modules > Manage Modules**.
5. Click the **Redeploy** icon.

PROCEDURE for Lighthouse CLI

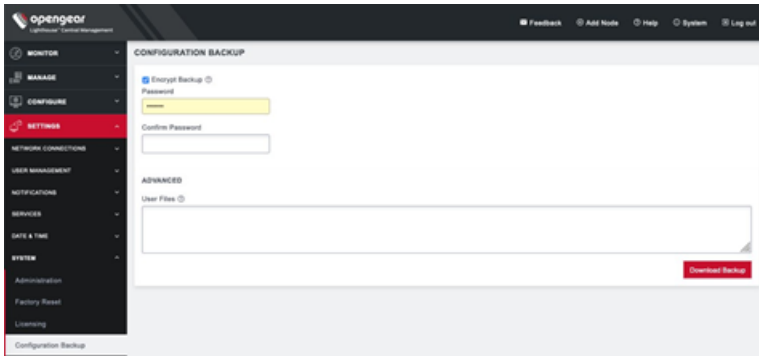
Replace **root** and **default** with a Lighthouse Administrator or root credentials, then run the following:

```
USERNAME=root
PASSWORD=default
/etc/scripts/netops_sync_handler
token=$(curl -k -L -d '{
"username":"'$USERNAME'", "password":"'$PASSWORD'"}'
"https://127.0.0.1/api/v3.0/sessions/" | python -c 'import sys, json;
print json.load(sys.stdin)["session"]')
curl -k -L -H "Content-Type: application/json" -H "Authorization:
Token $token"
"https://127.0.0.1/api/v3.0/netops/modules/dop/redeploy"
```

CONFIGURATION BACKUP

Before performing a factory reset or system upgrade, you may want to backup the current Lighthouse configuration. To do so:

1. Select **SETTINGS > SYSTEM > Configuration Backup**.

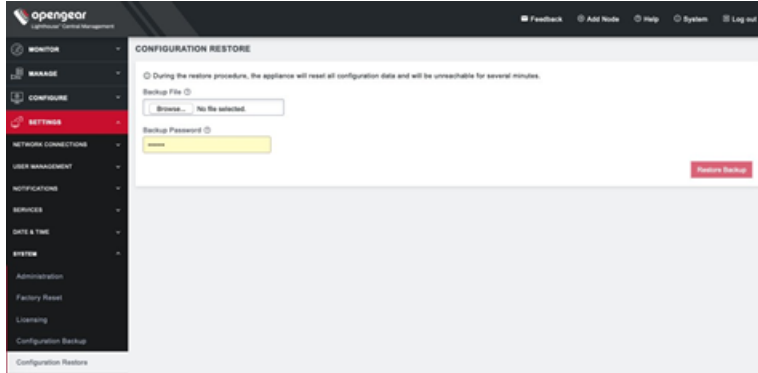


2. If desired, check **Encrypt backup**. Enter and confirm a password.
3. Under the **Advanced** section, specify the paths to any **User Files** you also wish to include in the backup.
4. Click **Download Backup** and save this file. The filename consists of a timestamp and `lh_bak` extension, for example: `lighthouse-20190710100325.lh_bak`

CONFIGURATION RESTORE

To restore the configuration and user files you backed up using **Configuration Restore**:

1. Select **SETTINGS > SYSTEM > Configuration Restore**.



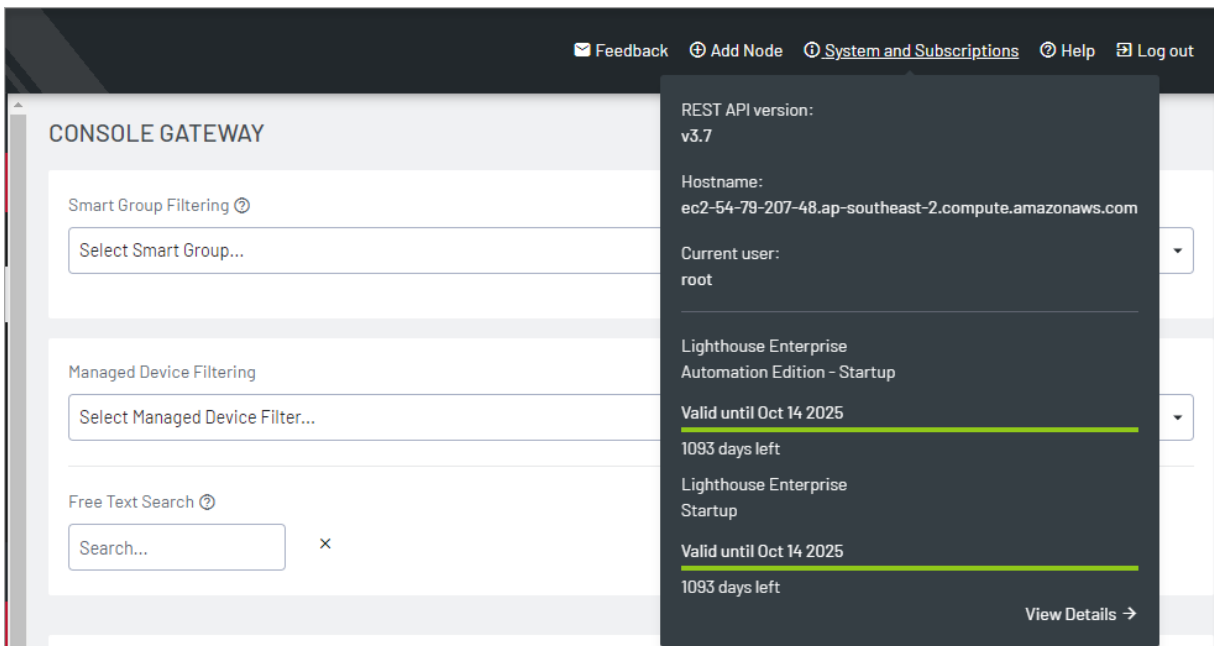
2. Locate the file you downloaded when you performed the Configuration Backup.
3. If you chose **Encrypt backup** when creating the backup, enter the **Backup Password**.
4. Click **Restore Backup**.
5. A **Configuration Restore Confirmation** dialog opens, click Yes.
6. Lighthouse will restore the backup and any included user files and restart.

CONSIDERATIONS IF USING MULTIPLE INSTANCES

- Before Lighthouse 23.04.1: Existing Secondary Lighthouse instances will not be synced with the primary, and will need to be deleted and re-enrolled again.
- Lighthouse 23.04.1 and later: The newly restored primary should re-establish contact with the existing secondary instances. The databases may be out of sync at first, but will be re-synced automatically.

SUBSCRIBING TO LIGHTHOUSE

Lighthouse has a flexible, simplified subscription model that allows you to add extended functionality if required. The **Systems and Subscriptions** option on the main menu provides information on your subscriptions including the type of subscriptions, the validity and the number of days before expiry.




Click **View Details**. The **Subscriptions** page displays.

Feedback Add Node System and Subscriptions Help Log out

SUBSCRIPTIONS

SUBSCRIPTIONS SUBSCRIPTION ASSIGNMENT

LIGHTHOUSE ENTERPRISE - START UP




Node assignments
9/10 available

Valid until Oct 14 2025
1093 days left

Update Subscription

LIGHTHOUSE ENTERPRISE: AUTOMATION EDITION - START UP



Node assignments
9/10 available

Valid until Oct 14 2025
1093 days left

Update Subscription

Show Details ▾

You can also click Show Details for more information about activation.

LIGHTHOUSE ENTERPRISE: AUTOMATION EDITION - GIGA



Node assignments
1000/1000 available

Valid until 2 Aug 2025

900 days left

⇌ Update Subscription

Hide Details ^

USING AUTOMATION EDITION FEATURES

To use these features you will first need to activate modules on compatible nodes.

There are 2 ways you can activate modules on nodes:

Enrollment Bundles will allow you to activate specific modules on all nodes that are enrolled with the bundle.

Configuration Templating will allow you to push Automation Edition module configuration to your applicable enrolled nodes.

The subscriptions available are:

- The Enterprise Edition Subscription provides base functionality to enroll, monitor, and manage nodes.
- The Enterprise Automation Edition provides base functionality plus the advanced NetOps features - Automation Gateway and Secure Provisioning.

You can apply the extra functionality to selected nodes only, giving you the flexibility to use different subscriptions for different nodes.

Subscription licensing is clearly displayed on the UI. Users can see the active subscriptions, the node count supported, assigned nodes, and time left on the subscription.

For more information on subscription tiers, see ["Enrollment Bundles" on page 139](#).

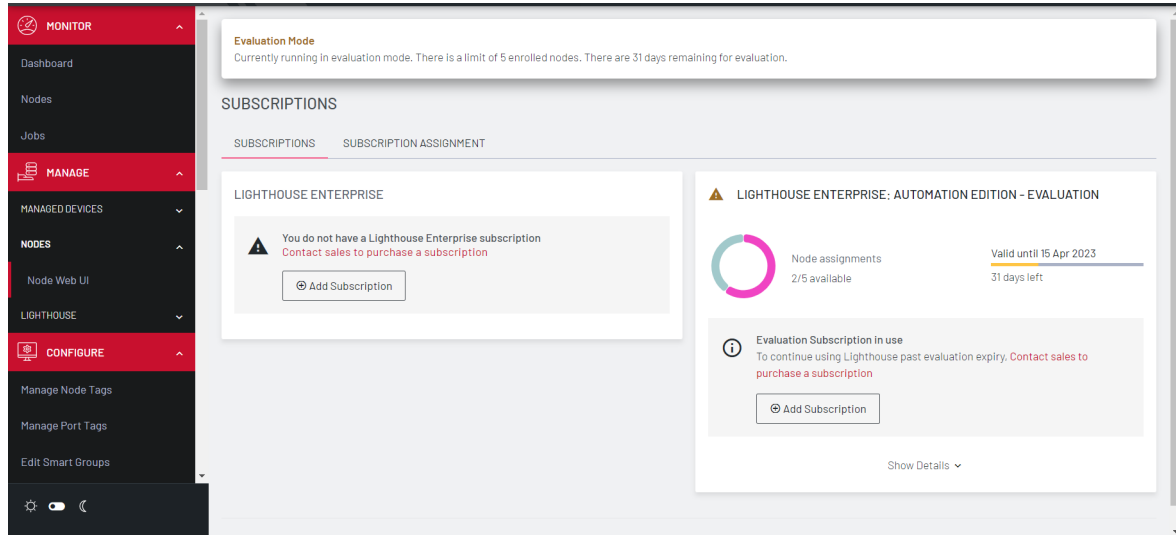
ADDING A NEW SUBSCRIPTION TO LIGHTHOUSE

Lighthouse has a flexible, simplified subscription model that allows you to add extended functionality if required.

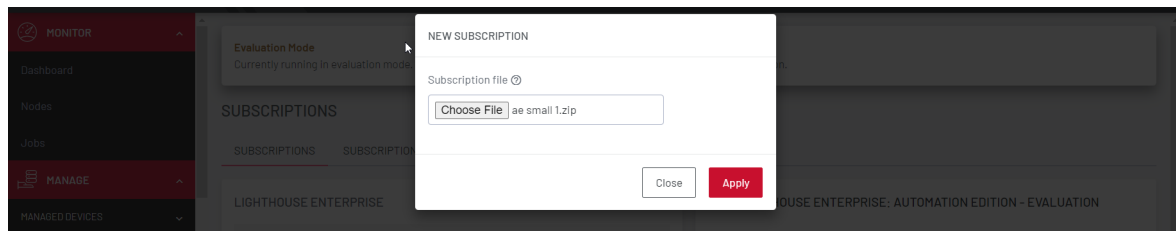
Note: Contact sales@opengear.com with a request for the type of subscription, including the number of nodes you wish to apply the subscription to. You will receive an encrypted .zip file named ***subscription.zip***.

TO ADD A SUBSCRIPTION

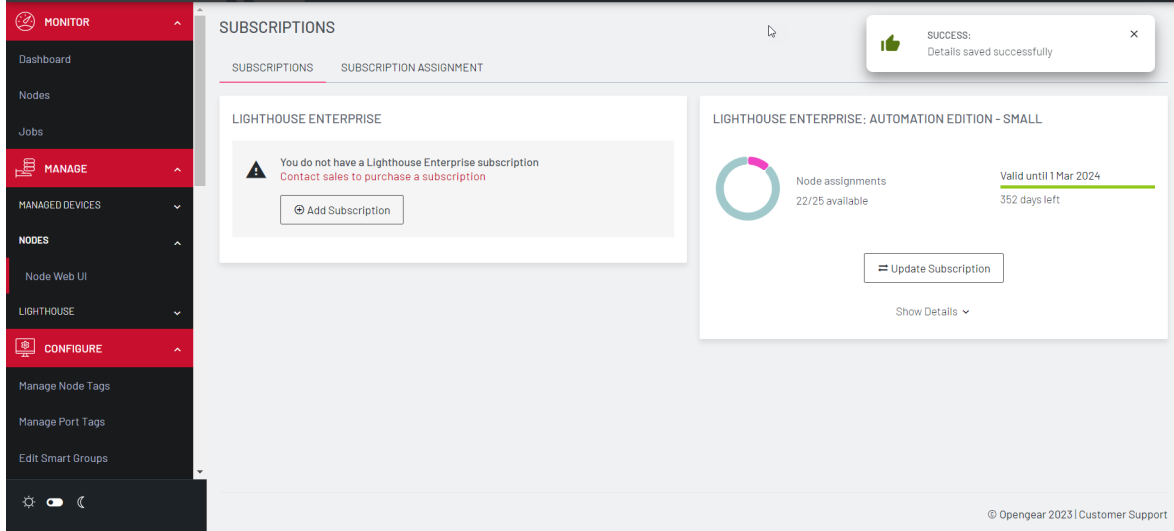
1. Select **Systems and Subscriptions**. A summary displays, click **View Details**. The **Subscriptions** page displays.



2. Click **Add Subscription**.
3. The **New Subscription** dialog displays. Click **Choose file** and select the required zip file and click **Apply**.



4. The success message displays, and the subscription displays.



ASSIGNING SUBSCRIPTIONS TO NODES

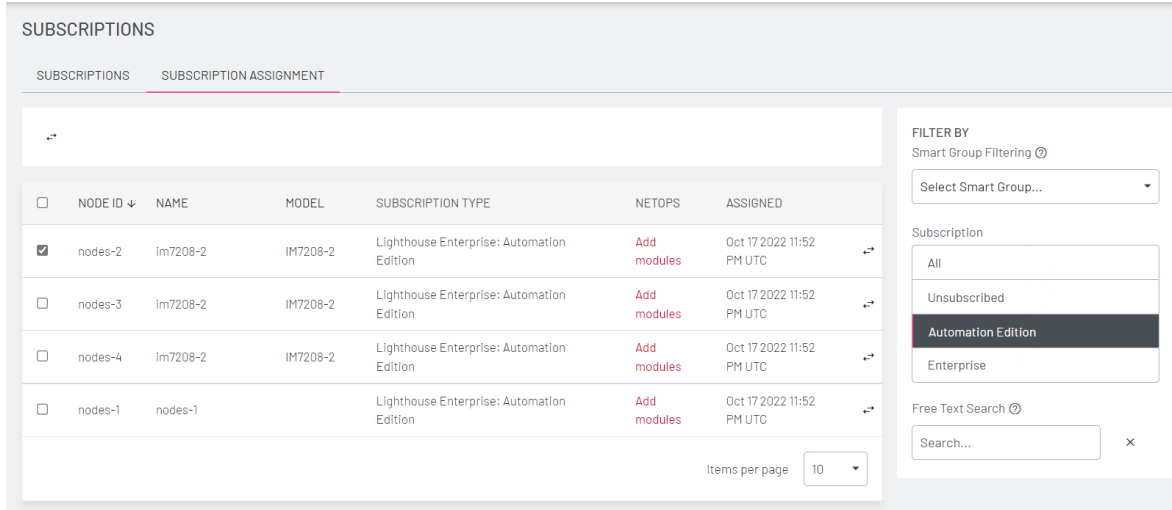
Lighthouse has a flexible, simplified subscription model that allows users to mix and match functionality where required. Users can reassign nodes to different subscriptions in order to optimize Automation Edition features on their network. For example, if the user:

- Previously had two license tiers, but only paid to renew one license tier
- Purchased an Automation Edition license for the first time, and wants the extra functionality on some of their nodes
- Wants to swap which nodes have access to the extra functionality available in an Automation Edition license

VIEW SUBSCRIPTIONS IN THE LIGHTHOUSE UI

To see subscriptions:

1. Select **SETTINGS > Systems > Subscriptions**.
2. The Subscriptions page displays. Select **Subscription Assignment**.



SUBSCRIPTIONS

SUBSCRIPTIONS SUBSCRIPTION ASSIGNMENT

<input type="checkbox"/>	NODE ID ↓	NAME	MODEL	SUBSCRIPTION TYPE	NETOPS	ASSIGNED	
<input checked="" type="checkbox"/>	nodes-2	im7208-2	IM7208-2	Lighthouse Enterprise: Automation Edition	Add modules	Oct 17 2022 11:52 PM UTC	↔
<input type="checkbox"/>	nodes-3	im7208-2	IM7208-2	Lighthouse Enterprise: Automation Edition	Add modules	Oct 17 2022 11:52 PM UTC	↔
<input type="checkbox"/>	nodes-4	im7208-2	IM7208-2	Lighthouse Enterprise: Automation Edition	Add modules	Oct 17 2022 11:52 PM UTC	↔
<input type="checkbox"/>	nodes-1	nodes-1		Lighthouse Enterprise: Automation Edition	Add modules	Oct 17 2022 11:52 PM UTC	↔

Items per page 10

FILTER BY
Smart Group Filtering ⓘ
Select Smart Group...
Subscription
All
Unsubscribed
Automation Edition
Enterprise
Free Text Search ⓘ
Search... x

The Subscriptions page displays details of the subscriptions and allows you to search using smart group filters, subscription, or free text searches.

The page also allows you to update, replace or add new subscriptions.

TO ASSIGN NODES TO SUBSCRIPTIONS

Select **SETTINGS > System > Subscriptions > Subscription Assignments**.

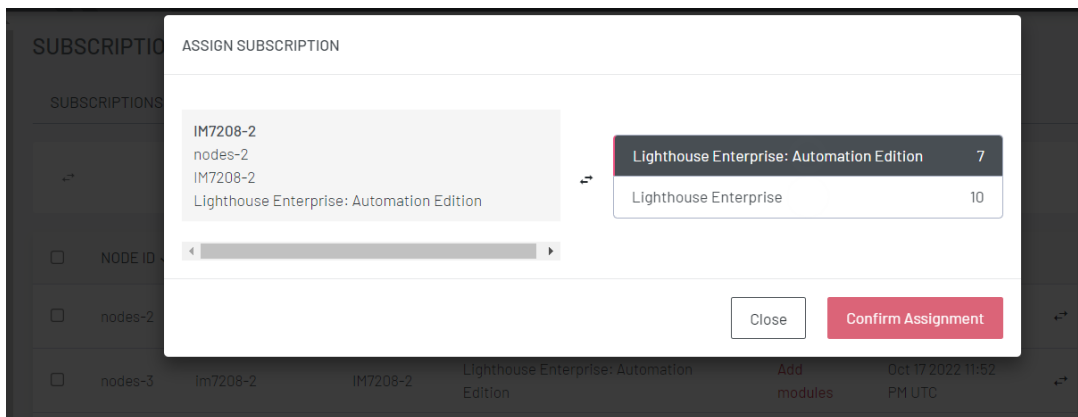
The **Subscriptions Assignments** page displays details of the nodes including:

- Node Id
- Node name
- Subscription Type

- Current NetOps module deployment to assigned nodes
- Date of Assignment

TO ASSIGN A SUBSCRIPTION

1. Select **SETTINGS > System > Subscriptions > Subscription Assignment**
2. Display the required nodes using the Filter pane, either by using the **Filters**, **Subscription**, or **Free text** options.
3. To assign a subscription to a node click the **↔ Assign** button. The **Assign Subscription** dialog displays.

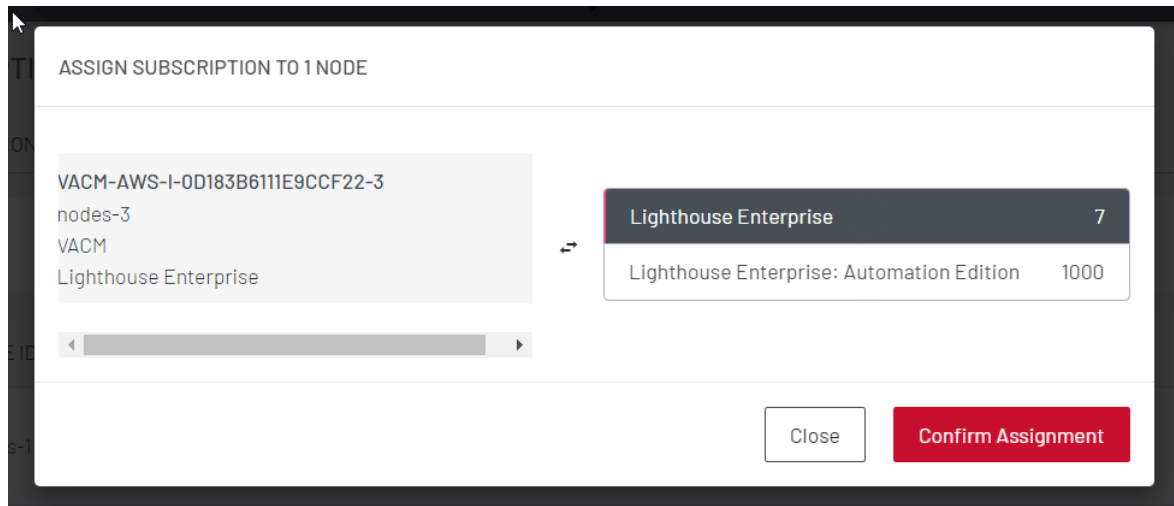


4. Select the required subscription from the leftmost panel using the **↔ Assign** button.
5. Click **Confirm Assignment**

TO CHANGE A NODE'S SUBSCRIPTION

1. Select **SETTINGS > Systems > Subscriptions > Subscription Assignment**
2. Display the required nodes using the Filter pane, either by using the **Labels** or **Free text** options.

3. To change subscription on a node click the **↔ Assign** button on the row. The **Assign Subscription** dialog displays.
4. Select the required subscription from the right panel.
5. Click **Confirm Assignment** to change the node's subscription. A message box displays indicating the effect of changing the subscription.



Note: Another way of removing a node from a subscription is to unenrol the node. The subscription will then become available to be assigned to another node.

SHUT DOWN OR RESTART LIGHTHOUSE

The following sections describe the process to shutdown or restart Lighthouse.

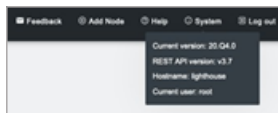
This includes finding instance version, returning to factory setting, and shutting down or restarting a running version of Lighthouse.

FINDING THE CURRENT LIGHTHOUSE INSTANCE VERSION

There are two ways to find the current Lighthouse version.

Using Lighthouse

1. Click **System & Subscriptions** on the Lighthouse banner.
2. The Details menu displays, listing the Lighthouse instance's:
 - Current version
 - REST API version
 - Hostname, and
 - Current user.



Via the local Lighthouse shell

1. Click **MANAGE > LIGHTHOUSE > Local Terminal**
2. At the `[hostname] login:` prompt, enter an administrator username and press **Return**.
3. At the `Password:` prompt, enter the administrator's password and press **Return**.
4. At the bash shell prompt, enter `cat /etc/version` and press **Return**.

The current Lighthouse instance's version is returned to STD OUT. For example:

```
root@lighthouse:~# cat /etc/version 2022.Q1.0
```

Note: The procedure above uses the Web UI to reach the Lighthouse Local Terminal. This is not the only way to reach the Lighthouse shell and `cat /etc/version` works in any circumstance where an administrator has access to the Lighthouse shell. For example, many of the Virtual Machine Manager applications that can run a Lighthouse instance offer virtual console access. If this is available and an administrator logs in to the Lighthouse shell via this console, the command string works as expected.

Via other information sources

Two other command strings can be useful when specifics about a particular Lighthouse instance are needed.

Both these commands can be run by an administrator with access to a running Lighthouse instance's bash shell.

First is `cat /etc/sw*`. This command concatenates the following four files to STD OUT:

```
/etc/sw_product
/etc/sw_variant
/etc/sw_vendor
/etc/sw_version
```

For example:

```
# cat /etc/sw*
lighthouse
```

```
release  
opengear  
2022.Q1.0
```

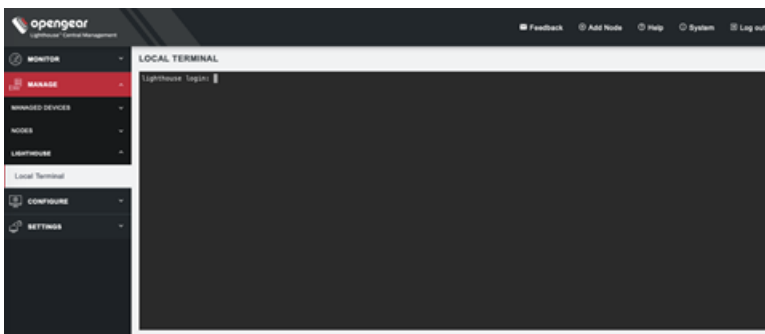
Second is `cat /etc/issue`. `/etc/issue` is a standard *nix text file which contains system information for presenting before the system's login prompt. On a Lighthouse instance, `/etc/issue` contains the vendor and Lighthouse product version.

```
# cat /etc/issue  
Opengear Lighthouse 2022.Q1.0 \n \l
```

SHUT DOWN A RUNNING LIGHTHOUSE INSTANCE

To shut down a running Lighthouse instance:

1. Select **MANAGE > LIGHTHOUSE > Local Terminal**



2. At the Local Terminal login prompt enter a username with administrative privileges (for example, root).

3. At the Password: prompt, enter that account's password. A Last login date and time for that account are returned to STD OUT and a shell prompt for the logged in user displays.
4. Enter the command `shutdown now` and press Return. The Lighthouse virtual machine shuts down.

RESTARTING A RUNNING LIGHTHOUSE INSTANCE

To restart a running Lighthouse instance, follow the first three steps of the "[Shut Down or Restart Lighthouse](#)" on page 121 instance procedure above. At the shell prompt, enter one of these commands and press Return:

```
reboot
```

or

```
shutdown -r now
```

The Lighthouse virtual machine shuts down and reboots.

RETURNING A LIGHTHOUSE INSTANCE TO FACTORY SETTINGS

At some stage, you may need to return to the factory settings. You can do this either through the UI or by running a shell script if you have root access.

Note: During this process, the current Lighthouse configuration will be overwritten and user files will be deleted. If you wish, you can create a backup of the configuration and any desired user files.

To return a Lighthouse to its factory settings using the Lighthouse UI:

1. Login to the Lighthouse as root. Other users, even those with full administrative privileges, do not have the permissions required to reset the Lighthouse VM to its factory settings.
2. Select **SETTINGS > SYSTEM > Factory Reset**.



3. Select the **Proceed with the factory** reset checkbox.
4. Click **Reset**.

MANAGING LIGHTHOUSE NODES

After Lighthouse has been installed and configured, enrol a small set of nodes, then create a set of tags and smart groups that allow nodes access to be filtered to the correct subset of users.

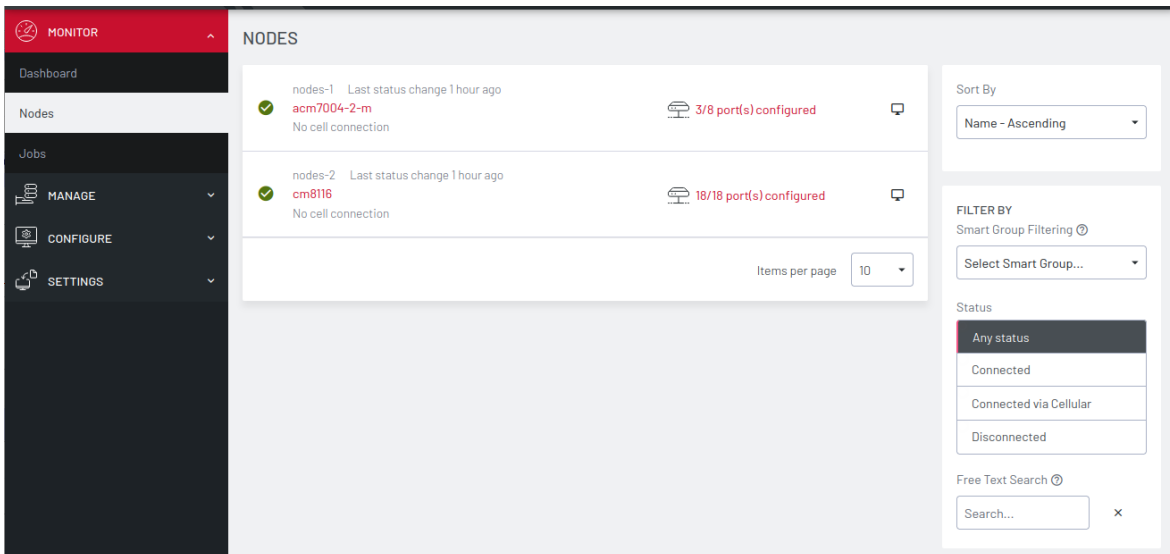
Once these nodes are installed, test access to the Node's Web UI and serial ports.

MONITOR NODES

Lighthouse allows you to view all nodes including connected, not connected, enrolled, and pending, as well as nodes using cellular.

MONITOR > Nodes displays the cellular health and number of ports. Click the icon on the right of connected nodes to access the Web UI of the node.

1. Select **MONITOR > Nodes**.

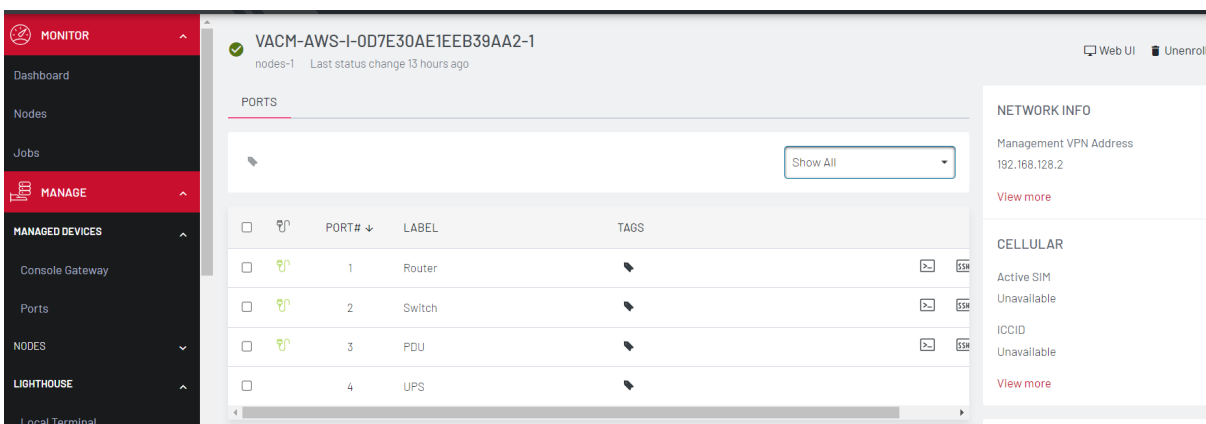


The screenshot shows the 'MONITOR > NODES' interface. On the left is a dark sidebar with navigation options: Dashboard, Nodes, Jobs, MANAGE, CONFIGURE, and SETTINGS. The main content area displays a table of nodes. Two nodes are listed: 'nodes-1' with ID 'acm7004-2-m' and 'nodes-2' with ID 'cm8116'. Both show '3/8 port(s) configured' and '18/18 port(s) configured' respectively, and both have 'No cell connection'. A 'Sort By' dropdown is set to 'Name - Ascending'. A 'FILTER BY' section includes 'Smart Group Filtering' and 'Status' options: 'Any status', 'Connected', 'Connected via Cellular', and 'Disconnected'. A 'Free Text Search' field is also present.

Node ID	Status	Ports Configured	Cellular Connection
nodes-1 acm7004-2-m	Connected	3/8 port(s) configured	No cell connection
nodes-2 cm8116	Connected	18/18 port(s) configured	No cell connection

2. Use the **SORT BY** menu to sort the display of nodes, by *Status Change*, *Name* or *Connected Devices*, in ascending or descending order, or newest or oldest.
3. Use the **FILTER BY** menu to display the nodes by a selected *Smart Group*.
4. Use the **Status** menu to display the nodes by *Any status*, *Connected*, *Connected via Cellular*, *Disconnected* or *Pending*.
5. Use the **Free Text Search** to search using a text string. You can also search by Port tags.
6. The **Monitor Nodes** page displays the result of the search on the page.

Click on any connected node to view the node details, list of configured ports and unconfigured ports.



The screenshot shows the 'MONITOR' section of the Lighthouse interface. The main content area displays details for a node with ID 'VACM-AWS-I-0D7E30AE1EEB39AA2-1'. Below the node name is a 'PORTS' section with a 'Show All' dropdown menu. A table lists the ports:

PORT#	LABEL	TAGS
1	Router	
2	Switch	
3	PDU	
4	UPS	

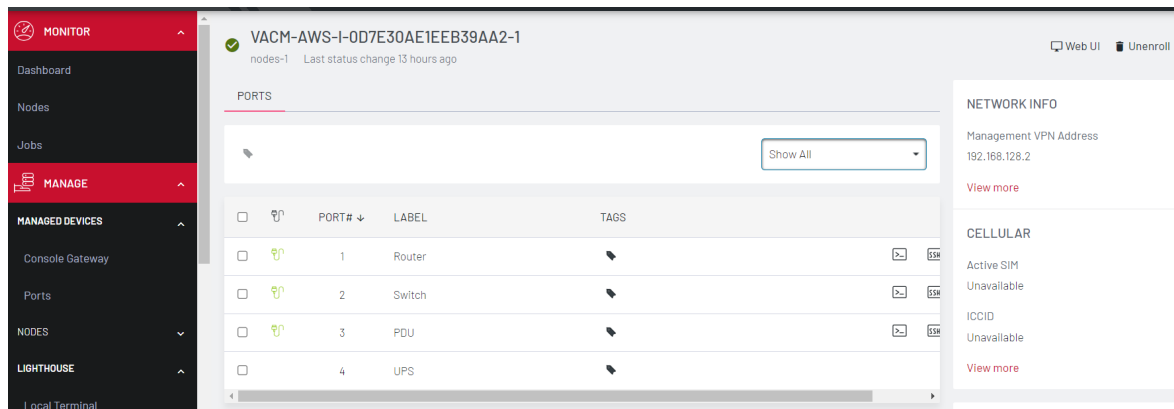
The right sidebar contains 'NETWORK INFO' (Management VPN Address: 192.168.128.2) and 'CELLULAR' (Active SIM: Unavailable, ICCID: Unavailable) sections.

From this detail page, you can access the web UI of the node, as well as the web terminal and SSH of each connected device.

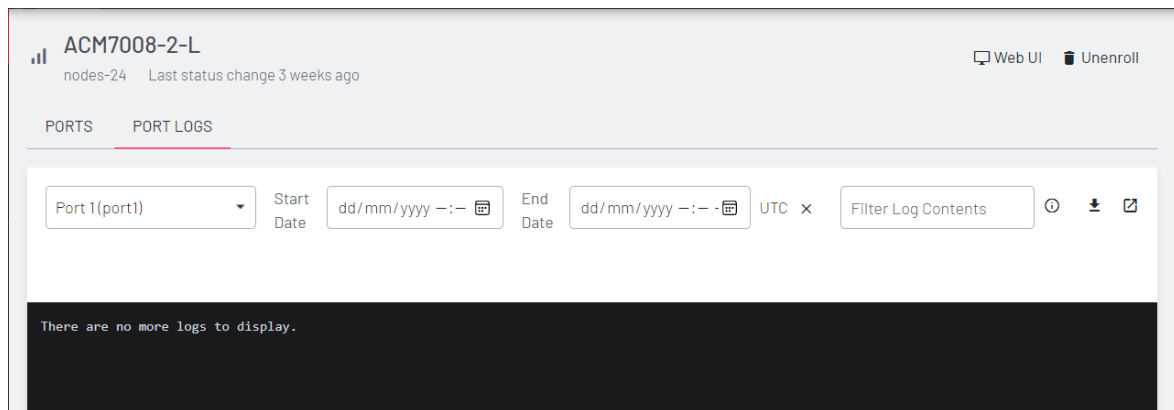
MONITOR PORTS

Lighthouse allows users with the appropriate permissions to view ports on a node to get a quick snapshot of the health of the nodes. For example, to trace a fault on a node, a network engineer will want to investigate the latest logs for a port.

1. Select **MONITOR > Nodes**. A list of nodes displays, each node displays the total number of **ports/configured ports**.
2. Click on the required node. The Node page displays node information including sortable lists of **Configured Ports** and **Unconfigured Ports**, **Network Info**, **Cellular details**, **Node tags** and **Node details**.



3. The drop down allows you to select to *Show All*, *Configured Ports*, or *Unconfigured Ports* on the node.
4. If the node has been configured to display logs, and you have the correct permissions you can select **Port Logs**.
5. The **Port Logs** page displays.



Select the **Port** from the list, and specify the date range (**Start Date** and **End**

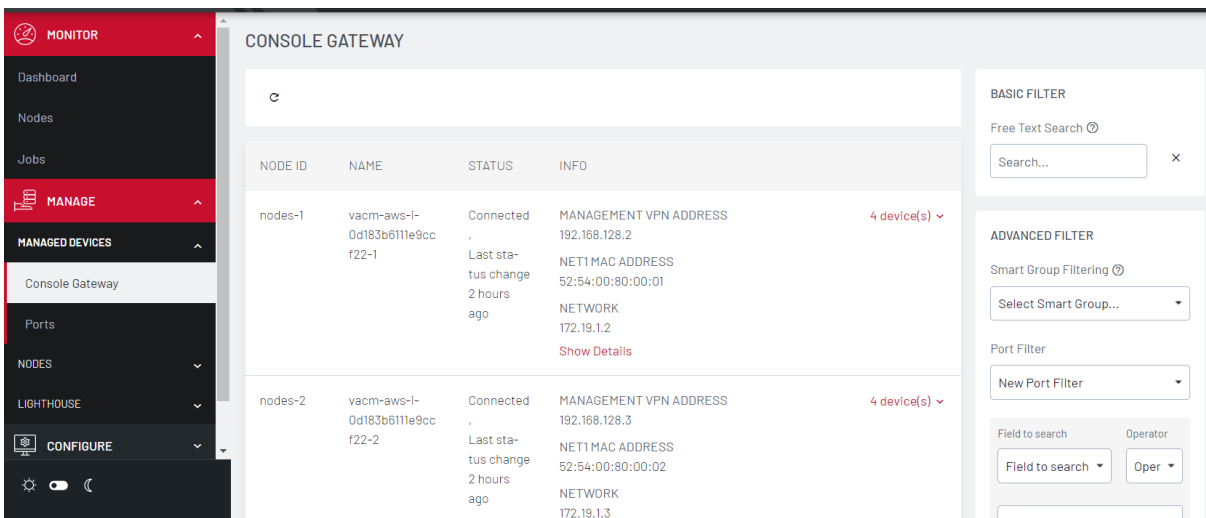
Date) to view the logs that display in the log window below. You can also access the web terminal and SSH of each connected device.

6. Alternatively, you can search for a log with a particular text, using the **Filter Log Contents** Logs matching the search parameter display in the log window.
7. You can also download the displayed logs, or open a new window to view the logs in more detail.

FILTERING PAGES DISPLAYING NODES

If you want to quickly find a particular node or set of nodes, you can drill down to specific nodes by using BASIC and ADVANCED filters. The filters can be used independently from each other or in combination to create customized displays based on ports, devices and permissions.

Select **MANAGE > MANAGED DEVICES > Console Gateway** to display all the nodes with all the devices/ports.



The screenshot shows the 'CONSOLE GATEWAY' management page. On the left is a navigation sidebar with 'MANAGE' selected. The main content area displays a table of nodes with columns for Node ID, Name, Status, and Info. Two nodes are visible, both with a status of 'Connected' and a 'Last status change' of '2 hours ago'. To the right of the table are filter panels for 'BASIC FILTER' and 'ADVANCED FILTER'.

NODE ID	NAME	STATUS	INFO
nodes-1	vacm-aws-i-0d183b6111e9ccf22-1	Connected Last status change 2 hours ago	MANAGEMENT VPN ADDRESS 192.168.128.2 NET1 MAC ADDRESS 52:54:00:80:00:01 NETWORK 172.19.1.2 Show Details
nodes-2	vacm-aws-i-0d183b6111e9ccf22-2	Connected Last status change 2 hours ago	MANAGEMENT VPN ADDRESS 192.168.128.3 NET1 MAC ADDRESS 52:54:00:80:00:02 NETWORK 172.19.1.3

FILTERING USING THE FREE TEXT SEARCH FIELD

The **Free Text Search** input field allows near real-time filtering of nodes and managed devices using the following criteria:

- Node name
- Firmware version
- Management VPN address
- MAC address
- Serial number and
- Port label
- Port tag

Enter your search term in the **Free Text Search** field and press **Enter**.

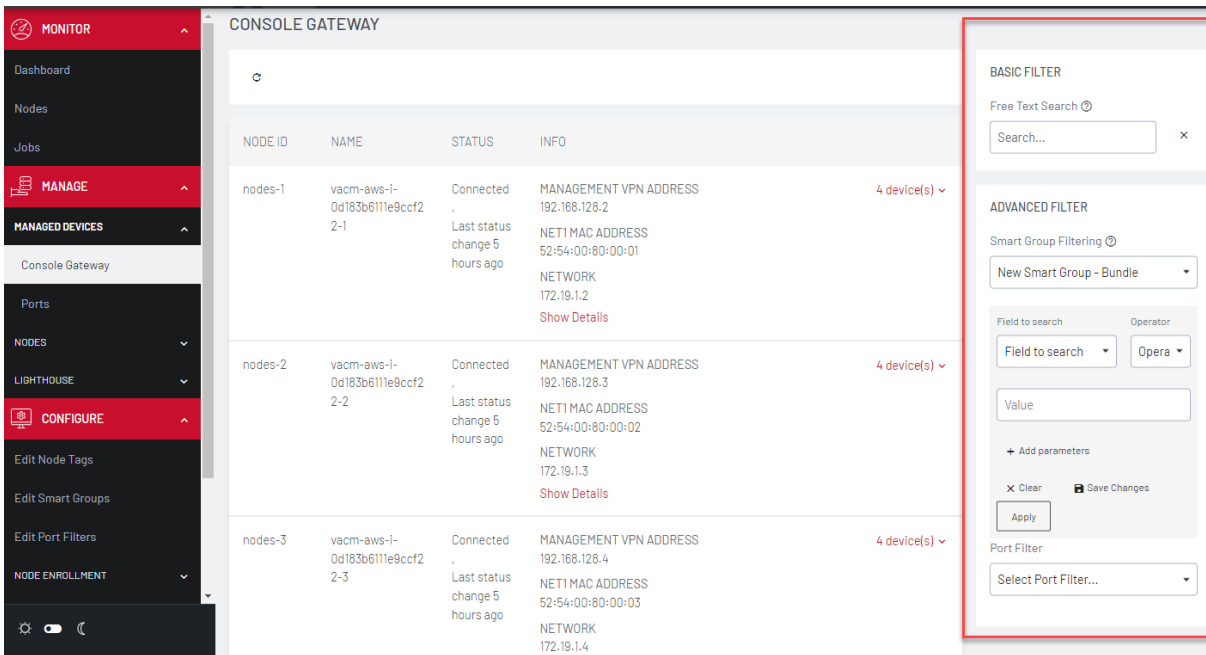
The **Free Text Search** field treats multiple search terms separated by the space character as being combined with the logical AND operator, returning results only if all terms are present in the item.

For example, the search phrase `production switch` returns only nodes that contain both `production` AND `switch` anywhere in searchable fields.

To search for a multi-word term, enclose the search term in double quote characters. For example, `"production switch"` will return results only if the entire search term is matched in the item.

FILTERING USING SMART GROUPS

Use **MANAGE > MANAGED DEVICES > Console Gateway** to customize the node display.



The screenshot shows the 'CONSOLE GATEWAY' interface. On the left is a navigation sidebar with sections for MONITOR, MANAGE, and CONFIGURE. The main area displays a table of nodes. On the right, a filter sidebar is visible, containing a BASIC FILTER section with a search box and an ADVANCED FILTER section with Smart Group Filtering, field search options, and a port filter dropdown.

NODE ID	NAME	STATUS	INFO
nodes-1	vacm-aws-i-0d183b611e9ccf2-2-1	Connected Last status change 5 hours ago	MANAGEMENT VPN ADDRESS 192.168.128.2 NET1 MAC ADDRESS 52:54:00:80:00:01 NETWORK 172.19.1.2 Show Details
nodes-2	vacm-aws-i-0d183b611e9ccf2-2-2	Connected Last status change 5 hours ago	MANAGEMENT VPN ADDRESS 192.168.128.3 NET1 MAC ADDRESS 52:54:00:80:00:02 NETWORK 172.19.1.3 Show Details
nodes-3	vacm-aws-i-0d183b611e9ccf2-2-3	Connected Last status change 5 hours ago	MANAGEMENT VPN ADDRESS 192.168.128.4 NET1 MAC ADDRESS 52:54:00:80:00:03 NETWORK 172.19.1.4

On the ADVANCED FILTER pane, on the **Smart Group Filtering** pane, use the **Select Smart Group** dropdown list. Select a group from the list and the page displays the nodes that belong to the selected smart group.

Use **Fields to search** to narrow the search:

To add more filtering options:

1. Click **Field to search**.
2. Select a field and enter a *Value* in the text box.
3. Select an **Operator** from the drop-down box.
4. Enter the search criteria.
5. Click **Apply**.

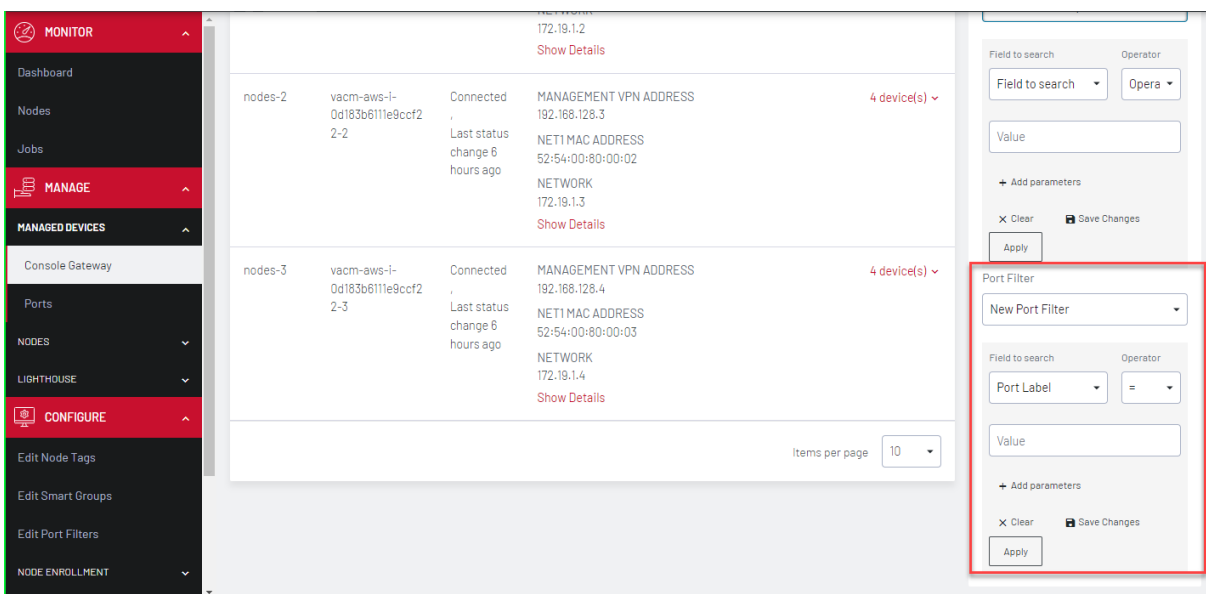
The list of nodes that meet the specified criteria display.

- Click the **+ Add Parameters** button to add more AND/OR parameters. Repeat from step 1.

FILTERING NODES USING THE PORT FILTER

Use **MANAGE > MANAGED DEVICES > Console Gateway** to customize the node display.

On the **ADVANCED FILTER** pane, on the **Port Filter** pane, use the **Select Port Filter** dropdown list. Select a filter from the list and the page displays the nodes that belong to the selected Port Filter.



ID	NAME	STATUS	IP ADDRESS	MAC ADDRESS	DETAILS
nodes-2	vacm-aws-i-0d183b611e9ccf2-2-2	Connected	192.168.128.3	52:54:00:80:00:02	MANAGEMENT VPN ADDRESS 192.168.128.3 NET1 MAC ADDRESS 52:54:00:80:00:02 NETWORK 172.19.1.3
nodes-3	vacm-aws-i-0d183b611e9ccf2-2-3	Connected	192.168.128.4	52:54:00:80:00:03	MANAGEMENT VPN ADDRESS 192.168.128.4 NET1 MAC ADDRESS 52:54:00:80:00:03 NETWORK 172.19.1.4

To narrow the search:

- Click **Field**.
- Select a field option such as *Port Label* or *Port Tag* and enter a *Value* in the text box.

3. For *Port Label* you can select an **Operator** from the drop-down box on the right. A range of operators are available allowing you to define any filters from very wide to very narrow ranges.
4. If you wish to narrow the search, select **+Add Parameters**. Select the *AND* or *OR* button to specify the requisite boolean value.
5. Select the next **Field to Search** option such as *Port Tag* and enter a value in the text box.
6. You can repeat from step 4 to add more parameters.
7. Click **Apply Filter**.
8. Click **Save Changes**. You can also select to **Clear**.

ENROL NODES

Enrolling nodes is the process of connecting nodes to Lighthouse to make them available for access, monitoring, and management.

Enrollment can be performed via:

- the Lighthouse Web UI
- the Node Web UI
- ZTP
- USB key.

Credentials must be provided to authenticate either the Lighthouse during Enrollment via the Lighthouse WebUI, or the node during the other Enrollment scenarios.

Lighthouse uses OpenVPN tunnels secured with certificate authentication to connect the Lighthouse instance and remote nodes. For the connections to work properly, the clocks/times between the Lighthouse instance and each remote node server need to be synchronized. During the enrollment process when a new remote node is being added, if that node is not using NTP (Network Time Protocol) to synchronize its time, the node will check the HTTP Date header sent by Lighthouse in the enrollment request.

The remote node will then set its own local system clock to match the time shown in that HTTP Date header from Lighthouse. This ensures the new remote node has its time matched to the Lighthouse before the VPN tunnel is established, preventing potential time sync issues between the tunnel endpoints.

If a remote node is relying on an NTP server to set its own time, it still checks the HTTP Date header sent by Lighthouse to affect the time synchronization but does not set its local time to that of the Lighthouse instance.

When enrolling via Lighthouse, an administration username and password for the node must be provided. When enrolling via the node, an Enrollment token must be provided. A default Enrollment token can be set on the **CONFIGURE > NODE Enrollment > Enrollment Settings** page, and individual tokens set per Enrollment bundle.

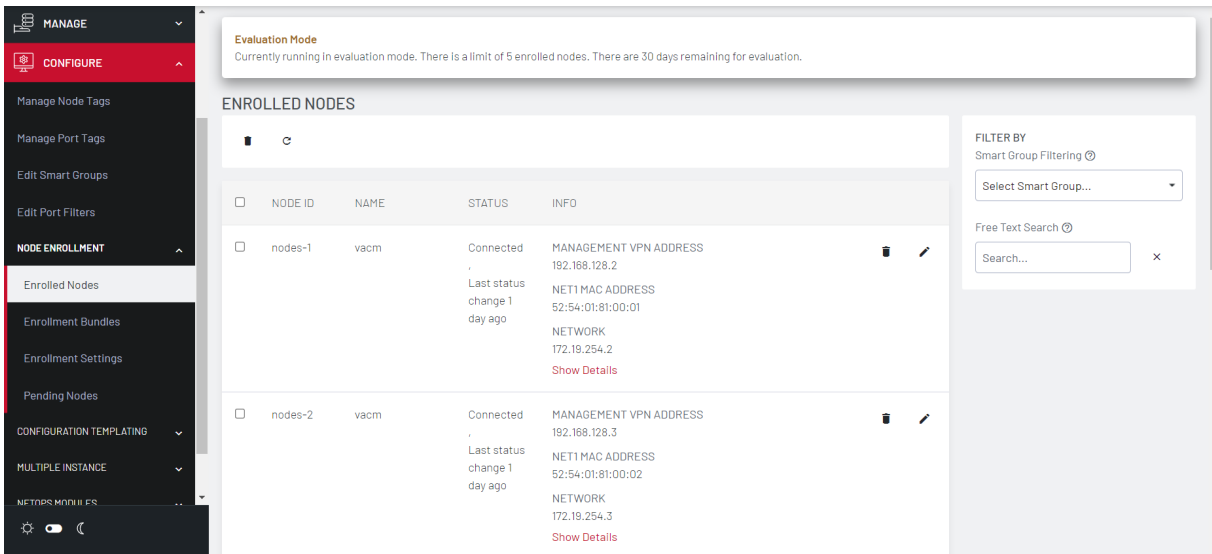
Enrollment is a two-step process:

1. After enrollment begins, nodes receive their Enrollment package, and establish a VPN connection to Lighthouse.
2. The node is now in the Pending state and needs to be Approved before the node is available for access, management, or monitoring.

Note: This second step can be skipped by selecting the Auto-approve node checkbox when configuring an Enrollment bundle.

THE ENROLLED NODES PAGE

The Enrolled Nodes page lists all the enrolled nodes on a Lighthouse instance.



ENROLLED NODES

<input type="checkbox"/>	NODE ID	NAME	STATUS	INFO		
<input type="checkbox"/>	nodes-1	vacm	Connected Last status change 1 day ago	MANAGEMENT VPN ADDRESS 192.168.128.2 NET1 MAC ADDRESS 52:54:01:81:00:01 NETWORK 172.19.254.2 Show Details		
<input type="checkbox"/>	nodes-2	vacm	Connected Last status change 1 day ago	MANAGEMENT VPN ADDRESS 192.168.128.3 NET1 MAC ADDRESS 52:54:01:81:00:02 NETWORK 172.19.254.3 Show Details		

To display the enrolled nodes:

1. Select **CONFIGURE > NODE Enrollment > Enrolled Nodes**
2. The enrolled nodes display in the chronological order in which they were enrolled to Lighthouse. For each node, the following details display:
 - model
 - firmware version
 - serial number
 - status.

3. Click **Items per page** to select the number of nodes per page. Choose a default value of 10, 20, 50, 80, or 100 nodes per page, or enter a custom value between 1 and 100.

This setting applies to the current user session only and will be lost when the current user logs out.

Note: **Items per page** also displays on the **Pending Nodes, Console Gateway**, and **Node Web UI** pages.

4. **Status** is the current connection status of the node and displays either of two things:
 - **Connected: Last status change x [time unit] ago:** The time since Lighthouse connected to the console server.
 - **Disconnected: last status change x [time unit] ago:** The time since Lighthouse disconnected from the console server.
 - **Configuration Retrieval Status** displays if any configuration retrieval sections failed when performing a configuration sync with this node, such as Groups, Users, Node Description, Authorization, or Serial Ports.
 - **Configuration Template Run Status** displays the result of the most recent configuration template push on this node, listing which templates finished applying, or failed to apply to the node. This information is displayed until the next template push has completed on this node.

Note:The **Configuration Retrieval Status** and **Configuration Template Run Status** are not displayed if there is no relevant data to display and are only displayed for users with **Lighthouse Administrator** or **Node Administrator** permissions.

- Results of the **Configuration Retrieval Status** and **Configuration Template Run Status** indicate:
 - **Success:** all templates were successfully executed on the node.
 - **Partial Failure:** some templates failed to execute on the node, or some config sections failed to synchronize.
 - **Failure:** all templates failed to execute on the node, or all config sections failed to synchronize.

You can select a summary of each status to see more detailed information as follows:

- Retrieval failed for: section_name, section_name, section_name.
 - Template(s) failed to apply: template_name, template_name, template_name.
 - Template(s) successfully applied: template_name, template_name, template_name.
5. If **SETTINGS > SERVICES > Cellular Health Reporting** is Enabled, the **Cellular Health** column displays the node's current cellular status. If this state is **Good|Moderate|Bad**, click the color indicator or the text to view more detailed health information as follows:

Cellular Health Details for lm7216-0013c6045f58

Cellular IP Address	Status	Conditions	Signal Quality	RSSI	Connection Type	Sim Issues	Connectivity Test
10.92.141.156 2001:8054:1140:a5:1ca6:9083:9a44-dab8	Up	Fallover Disabled	81	-43	lte	No	Connectivity Test Disabled

OK

- Cellular IP Address (IPv4 and IPv6)
- Cellular interface status (Up|Down)
- Conditions
- Signal Quality
- RSSI
- Connection Type
- SIM Issues
- Connectivity Test (Passed|Failed|Connectivity Test Disabled)

6. The INFO column displays more details about each node. Click **Show Details** to see more information about the node, or **Hide Details** to display fewer details.

ENROLLMENT BUNDLES

An Enrollment bundle is a downloadable file that stores provisioning information, allowing for bulk Enrollment and manipulation of remote nodes.

Applying an Enrollment bundle during Enrollment allows tags to be associated with nodes when they're first enrolled, rather than manually assigning tags after the nodes are enrolled.

This is useful for larger roll outs where there are many nodes deployed with a similar configuration and responsibilities. If relevant Smart Groups and tags have been set up, newly enrolled nodes are immediately visible for the relevant users to configure and use.

Associating templates with an Enrollment bundle allows to run a set of templates on a node, after it has been enrolled. Any template defined on the Lighthouse can be added to an Enrollment bundle, and each bundle supports any number of templates.

ASSIGNING SUBSCRIPTIONS

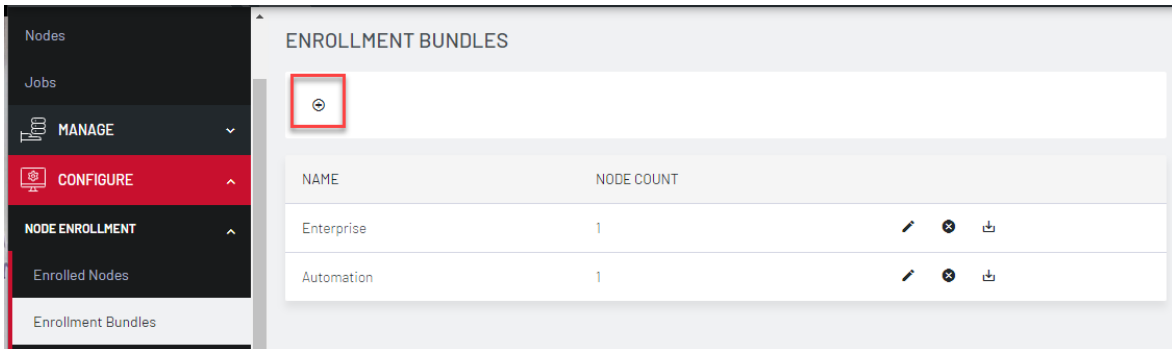
When a user has subscribed to Enterprise Edition, Enterprise Automation Edition, or both then assigning a subscription type to the bundle will be necessary. Based on the feature set for the node to utilize, this will mean they might need to create two bundles:

- An Enterprise tier subscription bundle to enrol nodes, and perform other basic functions (set up AAA, run scripts, create groups/users, set up logging, etc)
- An Automation Edition tier subscription allows all basic functions of the enterprise plus advanced feature set Automation Gateway, and Secure Provisioning for assigned nodes.

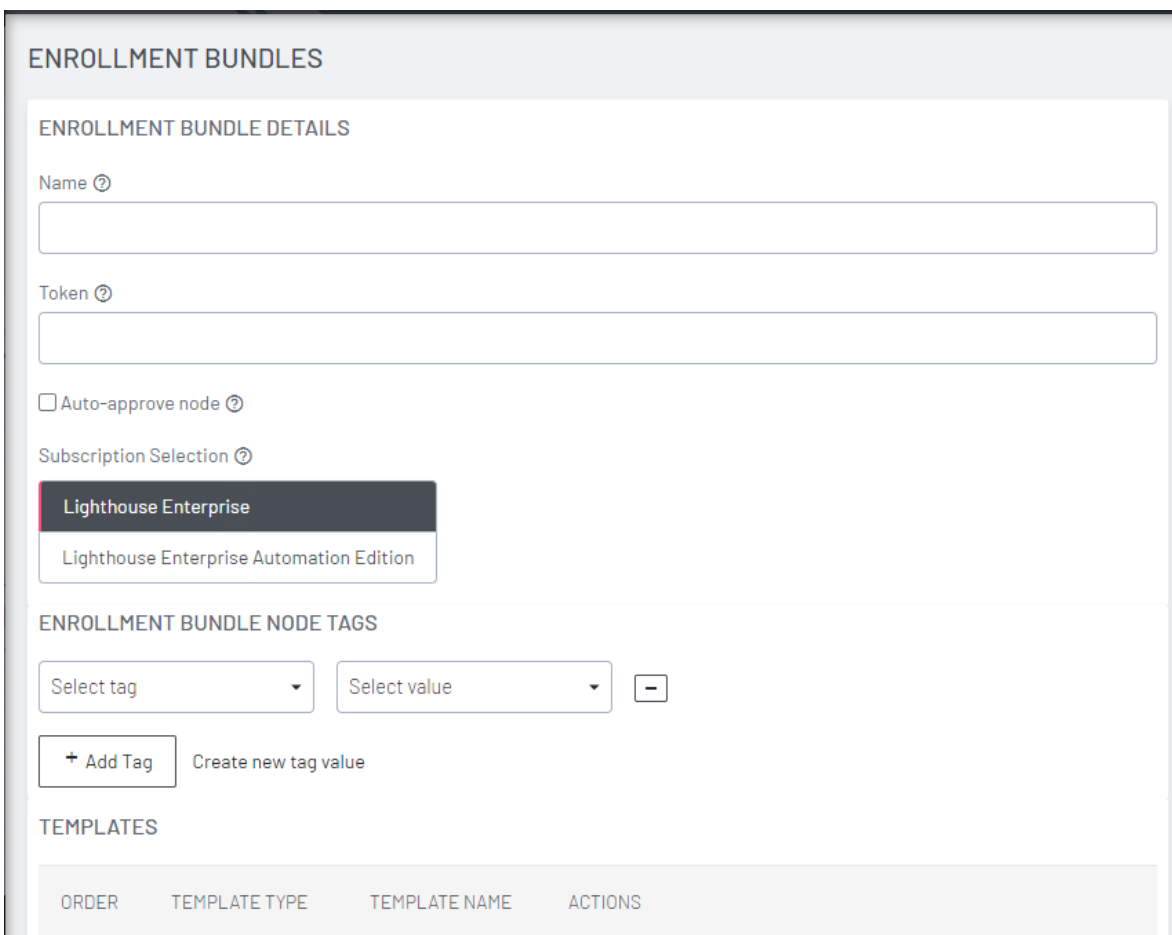
CREATING AN ENROLLMENT BUNDLE

To create an Enrollment bundle in a Lighthouse instance:


1. Select **CONFIGURE > NODE Enrollment > Enrollment Bundles**





2. Click the + button. **The Enrollment Bundle Details** page displays.




ENROLLMENT BUNDLE DETAILS

Name 

Token 




Auto-approve node 


Subscription Selection 

Lighthouse Enterprise

Lighthouse Enterprise Automation Edition

ENROLLMENT BUNDLE NODE TAGS

Select tag  Select value  

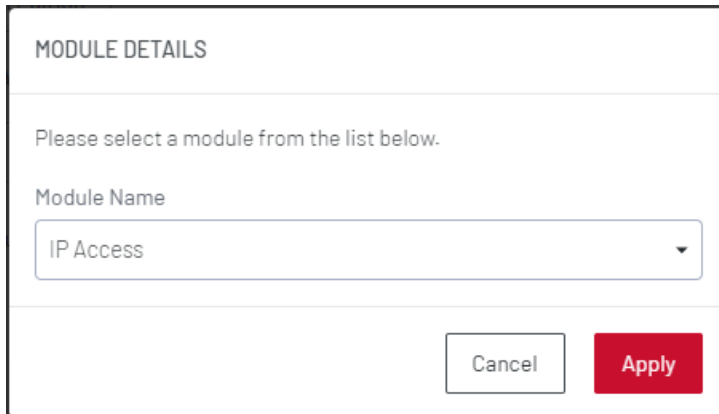
 Add Tag Create new tag value

TEMPLATES

ORDER	TEMPLATE TYPE	TEMPLATE NAME	ACTIONS
-------	---------------	---------------	---------

3. Enter a **Name** and **Authentication Token** for the bundle in the respective fields.

4. Select the number of **Tags** and **Values** to apply to any nodes that enroll using this Enrollment bundle.
5. (Optional) Select the **Auto-approve** node checkbox.
When this is checked, a device configured using this Enrollment bundle is not placed in pending mode during the Enrollment process. Instead, it is automatically approved for Enrollment after it has been identified.
6. Select the desired **Subscription Bundle Label** - Lighthouse Enterprise Edition or Lighthouse Automation Edition. This is the desired subscription type to assign to newly enrolled nodes using this bundle (optional when more than one subscription is active on the Lighthouse).
7. You can also use this bundle to automatically activate NetOps modules for any supported nodes. Scroll down to the **NETOPS MODULES** section and press the + button to open the **MODULE DETAILS** dialog.



MODULE DETAILS

Please select a module from the list below.

Module Name

IP Access

Cancel Apply

8. Select the desired **Module Name** from the drop-down list. Click **Apply**.

With the Enrollment bundle named, use the **Enrollment BUNDLE NODE TAGS** to populate it with the desired name-value pairs:

1. Select a field name from the left-most drop-down menu.
2. Select or enter a value from the right-most drop-down menu.

3. Click the + button to add a new pair of drop-down menus.
4. Select another field name and select or enter another value.
5. Repeat until all desired name-value pairs are displayed.
6. Click **Apply**.

With the Enrollment bundle named, use the **TEMPLATES** to populate it with the desired list of templates to be applied post-Enrollment:

1. Click the + button to add a new pair of drop-down menus.
2. Select a value from the **Template Type** menu. The selected template type filters the available names to those templates of that type.
3. Select a value from the **Template Name** menu.
4. Repeat until all desired type-name pairs are displayed.
5. Click **Apply**.

The templates in the table can be reordered using the arrow buttons in the far-left column of the table and are executed in the order they appear. The order buttons appear if there is more than one template in the table.

Template push operations stop if one template fails.

STRUCTURE OF AN ENROLLMENT BUNDLE

An Enrollment bundle file, `manifest.og`, contains a series of field-value pairs that an unconfigured device can use to configure itself.

Options that can be set in `manifest.og` include new firmware, custom configuration scripts, OPG config files, and Lighthouse Enrollment details.

By default, `manifest.og` includes the following field-value pairs (with example values):

```
address=192.168.88.20
api_port=4443
bundle=bne-dc
password=secret
```

Custom field-value pairs can be added manually. The field names are potential field names for a real-world, customized file, but the values following each field name are examples:

```
script=configure_ports.sh
image=acm7000-3.16.6.image
external_endpoints=192.168.1.2:4444,192.168.1.3:4445
```

ENROLLING NODES

Enrolling nodes is the process of connecting nodes to Lighthouse to make them available for access, monitoring, and management.

A node is a device that can be enrolled with Lighthouse, allowing it to be accessed, managed, and monitored.

You can enrol nodes in the following ways:

- via the node's Web UI
- via Lighthouse Web UI
- via OM, ACM, CM, and IM Web UI

- via USB drive
- Mass Enrollment using ZTP.

This section also covers how to back up nodes.

ENROLLMENT VIA NODE WEB UI

If a node is behind a firewall, Lighthouse cannot initiate an Enrollment. The node must be enrolled from the Node Web UI.

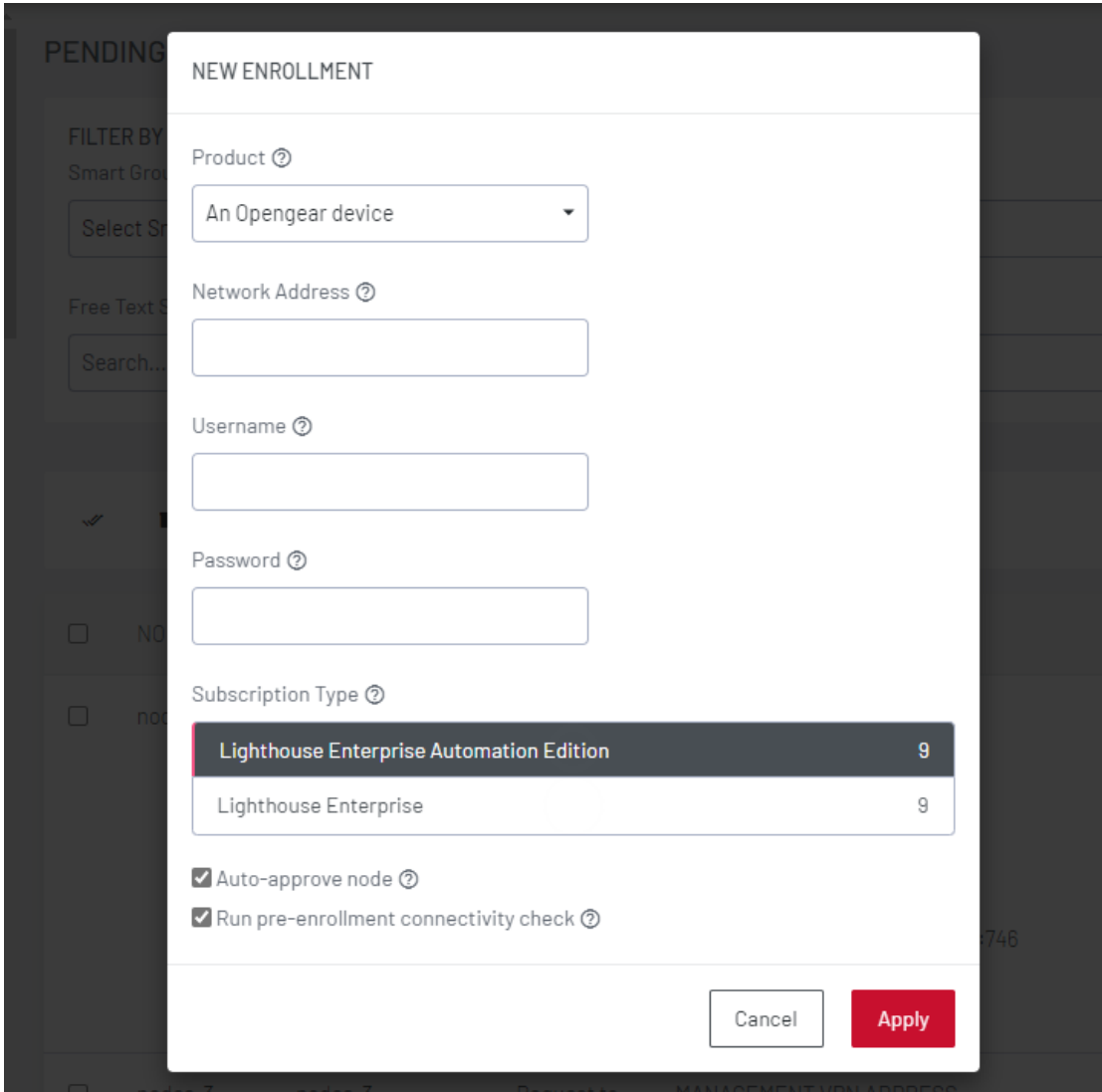
1. Log into the Node Web UI.
2. Select **Serial & Network > LIGHTHOUSE**.
3. Enter the **Server Address** of Lighthouse (which can be hostname, FQDN, or IP address)
4. Optionally, enter the **Server Port**.
5. Enter the **Enrollment Bundle** (if a specific bundle is being used), and the **Enrollment Token** (either the global token or the bundle-specific token).
6. Select **Apply Settings**. The Enrollment process begins.

After enrollment, the node displays in the **Pending Nodes** page, with a **Status** of *Approval*. Click the Approve icon in the **Actions** column.

ENROLLMENT VIA LIGHTHOUSE WEB UI

Enrollment via Lighthouse Web UI only works if the Node is reachable from Lighthouse. To enroll a node:

1. Select **Add Node** in the top menu bar to open a **NEW Enrollment** dialog.



NEW ENROLLMENT

Product ⓘ
An Opendgear device ▼

Network Address ⓘ

Username ⓘ

Password ⓘ

Subscription Type ⓘ

Lighthouse Enterprise Automation Edition	9
Lighthouse Enterprise	9

Auto-approve node ⓘ
 Run pre-enrollment connectivity check ⓘ

Cancel Apply

2. Select the **Product** type from the **Product** menu.

- An Opendgear device
- A generic third-party device, see Note below
- An Avocent ACS6000
- An Avocent ACS8000

- An Avocent ACS Classic
 - A Cisco 2900 Series
 - A Digi Passport
3. Enter the **Network Address**, **Username**, and **Password** of the node being enrolled. The **Username** and **Password** fields are for the login credentials required by the remote node being enrolled, not the login credentials used to login to the Lighthouse instance.
 4. Select the **Subscription Type**. Each type shows the number of available subscriptions.
 - Enterprise Edition
 - Automation Edition.
 5. If required, you can also select the **Auto-approve node** and **Run pre-enrollment connectivity checks**.
 6. Click **Apply**

Once enrolled, the console server's details are removed from the **Pending Nodes** page and added to the **CONFIGURE > NODE Enrollment > Enrolled Nodes** page.

ENROLLING NODES VIA OM, ACM, CM, AND IM WEB UI

Nodes can be enrolled from other UIs such as the **Operations Manager(OM)** as follows via:

- **OM**: Nodes can be enrolled into a Lighthouse instance on OPERATIONS MANAGER Web UI using the **CONFIGURE > LIGHTHOUSE Enrollment** menu item and the `lhvpn-callhome` command. See the OPERATIONS MANAGER User Guide for more details.

- **ACM, CM and IM:** On the Web UI, select **Serial & Network > Lighthouse** to open the **Request Enrollment with Lighthouse Server** page.

MASS ENROLLMENT USING ZTP

For mass node Enrolments using ZTP, three new custom DHCP fields are handled by ZTP scripts.

These fields contain the **URL, Bundle Name** and **Enrollment Password** used in an Enrollment which is kicked off after all other ZTP handling is completed. If a reboot is required because of a config file being provided the Enrollment starts after the reboot. Otherwise it happens immediately.

Here is a sample configuration file for the ISC DHCP Server:

```
option space opengear code width 1 length width 1;
option opengear.config-url code 1 = text;
option opengear.firmware-url code 2 = text;
option opengear.enroll-url code 3 = text;
option opengear.enroll-bundle code 4 = text;
option opengear.enroll-password code 5 = text;
class "opengear-config-over-dhcp-test" {
match if option vendor-class-identifier ~~ "^Opengear/";
vendor-option-space opengear;
option opengear.config-url "http://192.168.88.1/config.xml";
option opengear.enroll-url "192.168.88.20";
option opengear.enroll-bundle "";
option opengear.enroll-password "default";
}
```


Note: The maximum amount of data allowable as DHCP options is 1200 bytes, including all overhead inherent in the structuring of this data. Individual options are limited to 255 characters.

ENROLLMENT VIA USB DRIVE

An unconfigured device can be enrolled using a USB drive loaded with an Enrollment bundle. (See "[Creating an Enrollment bundle](#)" on page 140.)

Download the Enrollment bundle, `manifest.og` from a Lighthouse instance as follows:

1. Select **CONFIGURE > NODE Enrollment > Enrollment Bundles**. A list of existing **Enrollment Bundles** displays.
2. In the **Actions** column of the particular bundle, click the download button, a downward arrow in a circle.
3. Depending on the browser's configuration, a `manifest.og` file either downloads to the local system or displays a dialog asking to specify where to download the file.

To enroll a node via USB drive:

1. Copy `manifest.og` to the root directory on a USB drive.
2. Plug the USB drive into an unconfigured and powered-down console server.
3. Power the console server up.

On first boot, the device searches for the file — `manifest.og` — on any USB drives attached to the device and configures the device based on its contents.

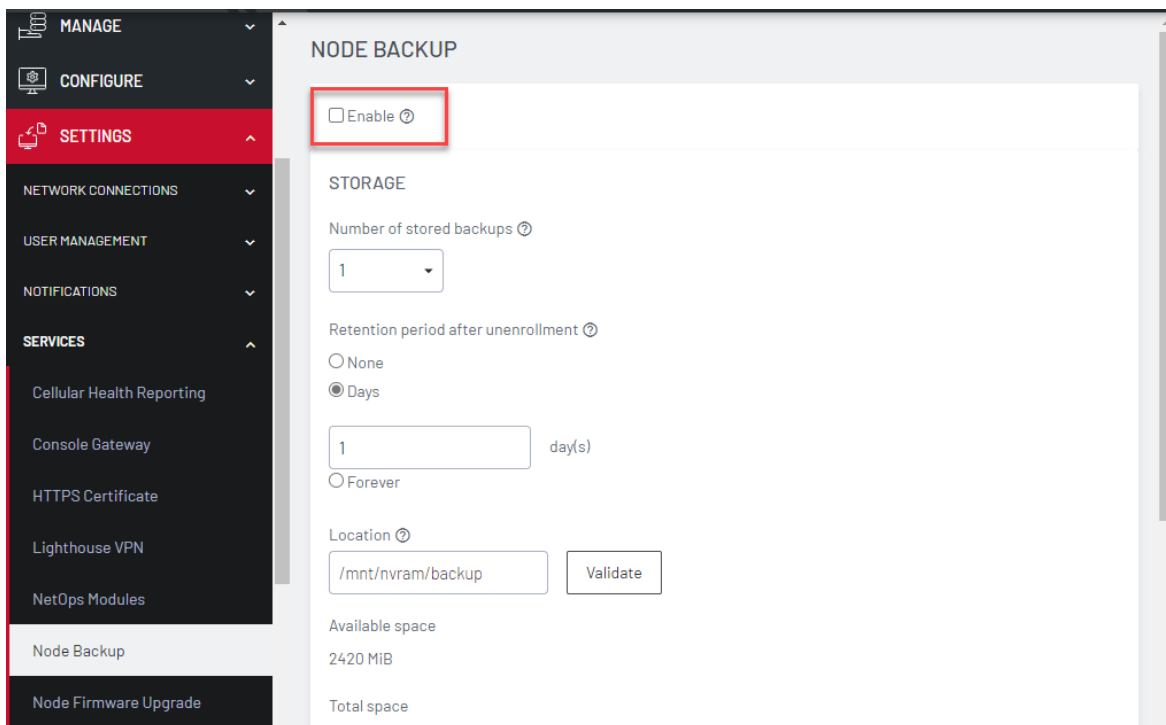
BACKING UP NODES

Administrative users can enable automatic node backup. Up to 10 backups can be stored on a rolling basis.

Note: Node backup requires firmware 4.6 or later.

To set up node backup:

1. Select **SETTINGS > SERVICES > Node Backup**.



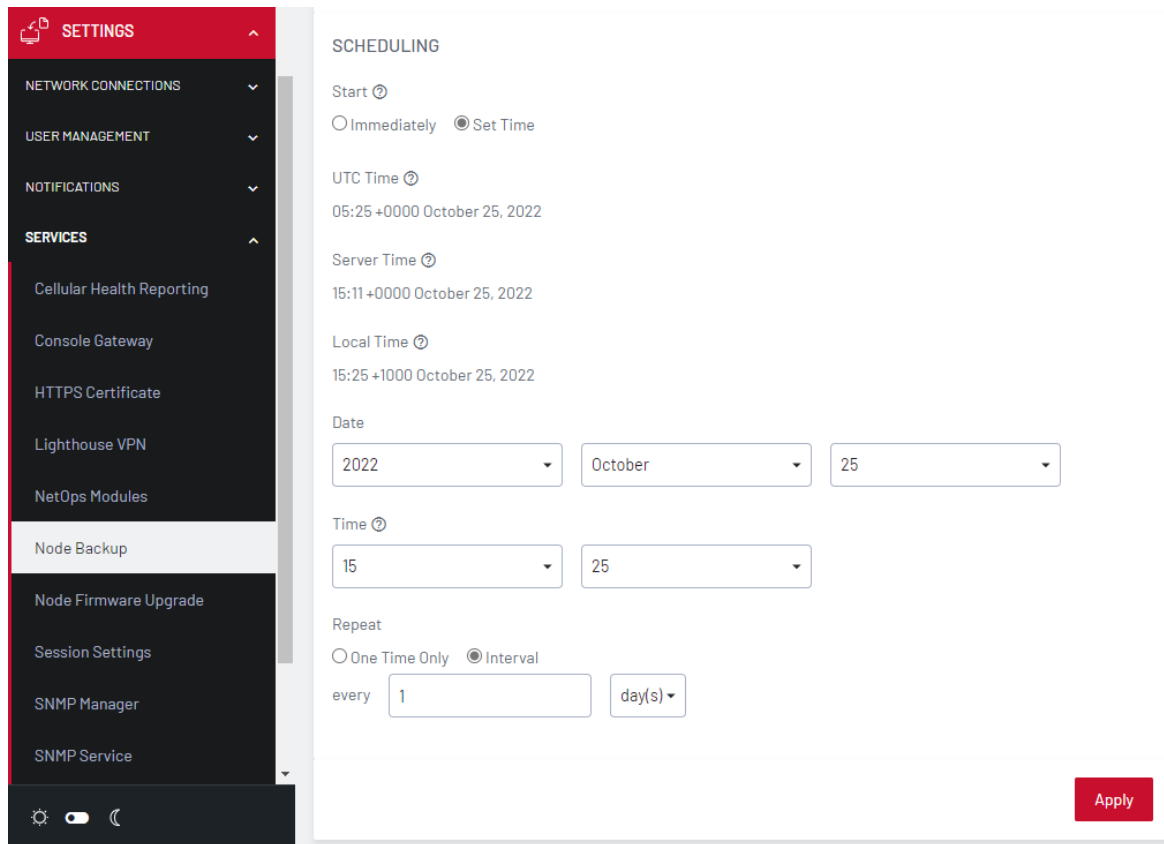
2. Select the **Enable** checkbox to turn on this service.
3. Under the **Storage** section, select the **Number of stored backups** you wish to keep.
4. In **Retention period after unEnrolment** select **None**, **Days** or **Forever**.

If you select **Days** enter the number of days.

5. Enter the **Location** you wish to store the backup files. We suggest you store backups at `/mnt/nvram/`.
6. Click **Validate** to make sure the location exists and has enough space to store them. The **Available space**, **Total Space** and **Estimated disk usage** MiBs display.
7. Click **Apply** or set a schedule using the **Scheduling** fields.

To setup an automated schedule for performing node backups:

1. Scroll down to the **SCHEDULING** section.



The screenshot shows the 'SETTINGS' page with a sidebar on the left containing various service categories. The 'SERVICES' section is expanded, and 'Node Backup' is selected. The main content area displays the 'SCHEDULING' configuration for the selected service. The 'Start' section has radio buttons for 'Immediately' and 'Set Time', with 'Set Time' selected. Below this, there are fields for 'UTC Time', 'Server Time', and 'Local Time', each showing a date and time. The 'Date' section consists of three dropdown menus for year (2022), month (October), and day (25). The 'Time' section has two dropdown menus for hour (15) and minute (25). The 'Repeat' section has radio buttons for 'One Time Only' and 'Interval', with 'Interval' selected. Below this, there is a text input for 'every' (1) and a dropdown for the unit (day(s)). An 'Apply' button is located at the bottom right of the settings area.

2. For the **Start** time, choose either **Immediately** or choose **Set Time** to open editable **Date** and **Time** fields.
3. Choose how often you wish to **Repeat** the backup by selecting either **One Time Only** or **Interval**.
4. If you selected **Interval**, enter the values for **Days** or **Weeks**.

Note: You can modify these options by returning to **SETTINGS > SERVICES > Node Backup** at any time.

WORK WITH NODES


After a node has been enrolled, you can connect to it directly, either to monitor it, or to run commands on it. Multiple nodes can be selected.

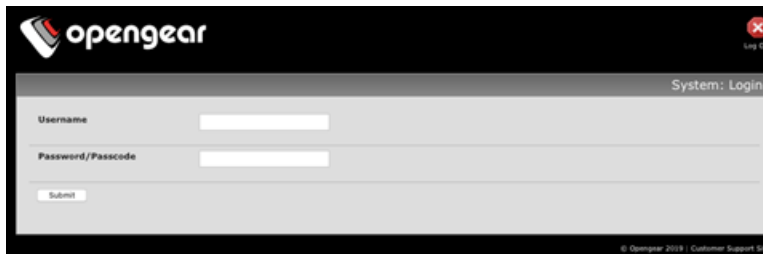
CONNECT TO THE WEB-MANAGEMENT INTERFACE OF A NODE

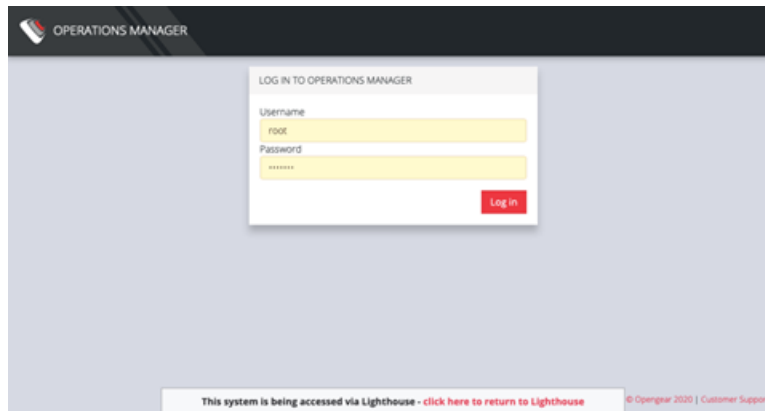
After a node has been enrolled, you can connect to the enrolled node's web-management interface as follows:

1. Select **MANAGE > NODES > Node Web UI**. The nodes display:

NODE ID	NAME	STATUS	CELL HEALTH	INFO
nodes-5	SPT-OM2248	Connected Last status change 2 weeks ago	● Cellular Interface Disabled Last status change 2 weeks ago	MANAGEMENT VPN ADDRESS 192.168.128.5 NET1 MAC ADDRESS 00:13:c6:08:07:7c NET1:STATIC1 192.168.0.1 NET1:DHCP 10.220.3.6 NET1:IP6AUTO Unavailable WWAN0:DHCP Unavailable WWAN0:IP6AUTO Unavailable NET2:STATIC9 10.10.10.1 Show Details

2. Click  the **Access Web UI** link for the particular node. The web-based login for that node loads.
3. Authenticate using the username and password required by that node. The appearance of the Web UI depends on which device you have added. Below is the **ACM/CM/IM Web UI**, followed by the OM Web UI.





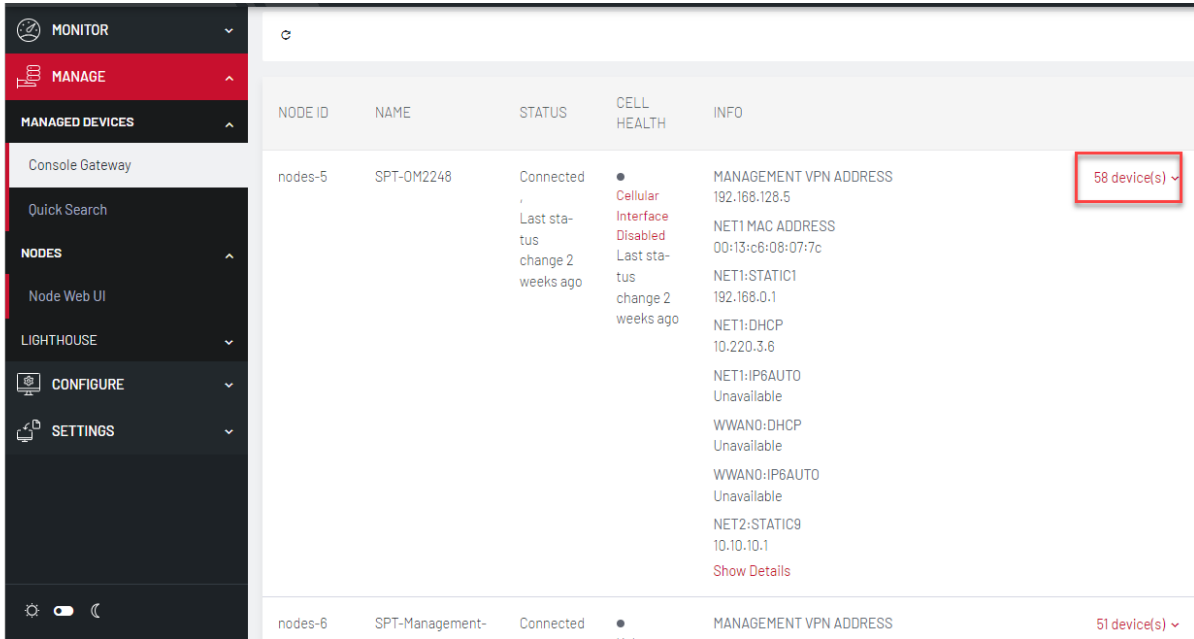
A message displays at the bottom of the browser and provides a link to return to Lighthouse.

CONNECTING TO A NODE'S SERIAL PORTS

You can connect to the enrolled node's serial ports via the Console Gateway option on the user interface if required. This allows the user to directly connect to any devices that are connected to the serial ports of the selected node.

FIND THE SERIAL PORTS

To search for serial ports on Lighthouse select **MANAGE > MANAGED DEVICES > Console Gateway**



NODE ID	NAME	STATUS	CELL HEALTH	INFO
nodes-5	SPT-OM2248	Connected Last status change 2 weeks ago	● Cellular Interface Disabled Last status change 2 weeks ago	MANAGEMENT VPN ADDRESS 192.168.128.5 NET1 MAC ADDRESS 00:13:c6:08:07:7c NET1:STATIC1 192.168.0.1 NET1:DHCP 10.220.3.6 NET1:IP6AUTO Unavailable WWAN0:DHCP Unavailable WWAN0:IP6AUTO Unavailable NET2:STATIC9 10.10.10.1 Show Details
nodes-6	SPT-Management-	Connected	●	MANAGEMENT VPN ADDRESS 192.168.128.5

or

Select **MANAGE > MANAGED DEVICES > Quick Search** A page displays all the connected nodes, the right most column displays the number of devices connected to the node.



Node ID	Port	Management ID	Status	Last Status Change	Actions
ACM7004-5-L RS1	port5	SPT-Management-IM7248	Connected	Last status change 2 weeks ago	Web Terminal SSH
OM1208-L RS1	port8	SPT-Management-IM7248	Connected	Last status change 2 weeks ago	Web Terminal SSH
ACM7008-L RS1	port7	SPT-Management-IM7248	Connected	Last status change 2 weeks ago	Web Terminal SSH
OM2200 RS2	port8	SPT-Management-IM7248	Connected	Last status change 2 weeks ago	Web Terminal SSH
Port 1	port1	SPT-IM7216	Connected	Last status change 8 days ago	Web Terminal SSH
Port 13	port13	SPT-IM7216	Connected	Last status change 8 days ago	Web Terminal SSH
Port 2	port2	acm7008-2-l	Connected	Last status change 2 weeks ago	Web Terminal SSH

The **Items per page** drop-down on **Quick Search** page allows the user to select the number of ports per page. This setting applies to the current user session only and will be lost when user logs out.

Note:Port-centric search allows filtering via the Managed Device Filters and displays a list of ports within enrolled nodes that match the search terms, while node-centric search allows filtering via Smart Groups and node properties.

Quick Search can be used to filter on the managed device label.

NODE-CENTRIC SEARCHING

1. Select **MANAGE > MANAGED DEVICES > Console Gateway**.
2. Find the particular port using the **Smart Group Filtering** options to restrict the listed nodes.
3. Click the **+** button in the **Access Console Ports** row adjacent the particular node.

PORT-CENTRIC SEARCHING

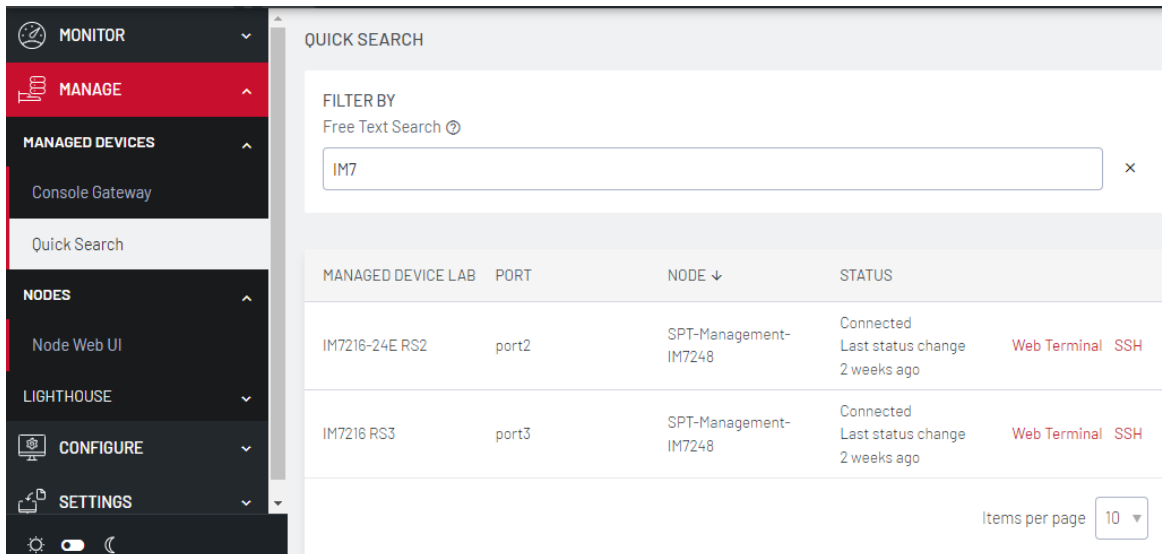
1. Select **MANAGE > MANAGED DEVICES > Console Gateway**.
2. Find the particular port by using the **Managed Device Filtering** options to restrict the listed managed devices within enrolled nodes.

Once the serial port is located, serial port access via **Console Gateway** can be accomplished in two ways:

- Web Terminal
- SSH

QUICK SEARCH

1. Select **MANAGE > MANAGED DEVICES > Quick Search**.
2. Enter the managed device label, aka name, in the **Quick Managed Device Search** field. This search live-updates as user type.



The screenshot shows the Lighthouse interface with the 'MANAGE' menu selected. The 'QUICK SEARCH' section is active, displaying a search box with 'IM7' entered. Below the search box, a table lists the search results:

MANAGED DEVICE LAB	PORT	NODE ↓	STATUS
IM7216-24E RS2	port2	SPT-Management-IM7248	Connected Last status change 2 weeks ago Web Terminal SSH
IM7216 RS3	port3	SPT-Management-IM7248	Connected Last status change 2 weeks ago Web Terminal SSH

At the bottom right of the search results, there is a dropdown menu for 'Items per page' set to 10.

3. Use **Web Terminal** and/or **SSH** links on a particular port to access it.

ACCESS VIA HTML5 WEB TERMINAL

To provide easy console port access, Lighthouse includes a HTML5 Web Terminal. The HTML5 Web Terminal includes native cut, copy and paste support. The terminals available on nodes do not.

To access a console port via the Web Terminal:

1. Locate the particular port by using one of the search techniques described in ["Connecting to a node's serial ports" on page 154](#).

2. Click the **Web Terminal** link for the particular port. A new tab opens containing the Web Terminal.

To close a terminal session, close the tab, or type ~. in the **Web Terminal** window.

ACCESS A SERIAL PORT VIA SSH

To access ports via SSH, use a direct SSH link from the Web UI to connect to the port.

To access a console port via a Direct SSH link:

1. Locate the particular port by using one of the search techniques discussed in ["Connecting to a node's serial ports" on page 154..](#)

Locate the particular port by using one of the search techniques discussed in ["Connecting to a node's serial ports" on page 154..](#)

2. Click the **SSH** link to connect to the URL.

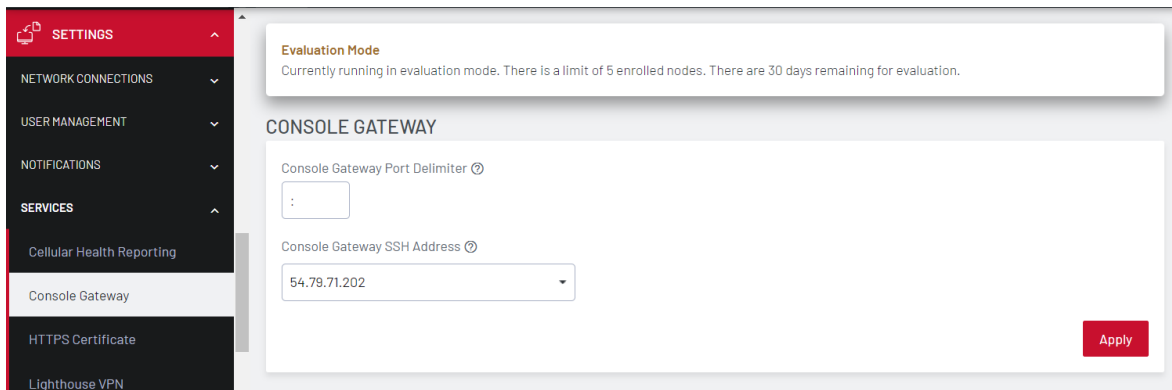
These auto-generated links use the colon (:) as the field-delimiter. The auto-generated SSH link has the following form:

```
ssh://user-name:console-server-name:port-number@lighthouse-  
ip-address
```

Some web browsers associate the colon character with delimiting the protocol at the beginning of a URI so they don't pass these auto-generated URIs correctly.

To work around this, the default delimiter character can be changed. To change this character:

1. Select **SETTINGS > SERVICES > Console Gateway**



- 2.
3. Enter a delimited character in the **Console Gateway Port Delimiter** text-entry field. The carat, `^`, is the most common alternative.
4. Use the **Console Gateway SSH Address** drop-down menu to choose an address from which to SSH. The list of available addresses contains the current network interfaces and external network addresses. The value defaults to `net1:dhcp` if it exists and `net1:static` otherwise. The additional external addresses can be added to this list using the **SETTINGS > SYSTEM > Administration** page.

To use the console chooser menu, SSH to the Lighthouse appliance with the username format `username:serial`. This connects to the Lighthouse and presents a list of nodes that the user can access. Once the user selects a node, they are presented with a list of console ports they have access to. When one is selected, the user is connected to that port. For faster access, there are username format shortcuts that give more specific lists of serial ports, or direct access without a menu.

- **username:node_name**

When a valid node name is specified, a list of console ports that the user can access on that node is shown. If they do not have access to this node, the connection fails.

- **username:node_name:port_name**

When a valid node name and port name are specified, and the user has access to that node and port, the user is connected to this port. If they do not have access to that port, the connection fails.

- **username:port_name**

When a valid port name is specified, the user is connected to first port with that port name found. If the user does not have access to this port, the connection fails.

NOTE: Node names and port names are not case sensitive.

EXAMPLE CONSOLE GATEWAY SESSION

```
$ ssh adminuser:serial@lighthouse-name-or-ip-here
1: cm71xx
Connect to remote > 1
1: Cisco Console 2: Port 2
Connect to port > 1
router#
```

SELECTING NODES USING SHELL-BASED TOOLS

There are a number of ways to select nodes, also known as console servers, as targets on which to run a command. These can be used multiple times, or together, to select a range of console servers:

Select individually by name, address, Lighthouse VPN address, config index or smart group (as per `--list-nodes` output):

```
node-command --node-name BNE-R01-IM4248
node-command --node-address 192.168.0.33
node-command --node-index nodes-1
node-command --smartgroup="model-acm"
```

To Select all nodes

```
node-command --all
```

To running commands on selected nodes

Once nodes are selected, the commands to be run for each can be given. These are run on each managed node in parallel. Any command which can be run from a node shell can be run on each managed node.

Note:All commands are run as root.

For example, to check the version on two specific, configured nodes, selecting one by name and the other by index, run the following command:

```
node-command --node-name BNE-R01-ACM7004-5 --node-index
nodes-2 cat
/etc/version
```

When using non-trivial selection arguments, check which target nodes have been selected on the initial command pass by using the `--list-nodes` switch rather than the final command.

NODE ORGANIZATION AND FILTERING

To provide clear and customized access to nodes, Lighthouse uses Smart Groups which allow node properties and user-supplied tags, consisting of a name and value, to be compiled into a search expression.

These search expressions can be saved and used to filter the various lists of nodes in the Web UI, for example when selecting a serial port to connect to or to connect to the node's Web UI. They can also be used for define and restrict the nodes that a particular group of users can access.

To help locate managed devices, Lighthouse includes Port Filtering which allows users to search for port labels and port tags on a node. This search can be saved and applied on the **MANAGE > MANAGED DEVICES > Console Gateway** page.

FILTER NODES

Filters enable you to quickly find a particular node or set of nodes. The filters are:

- **Free Text Search**
- **Smart Group Filtering**, and
- **Port Filtering**.

You can see how to use these in "[Monitor Nodes](#)" on page 127.

CREATING SMART GROUPS

Smart Groups are used within Lighthouse to group related nodes.

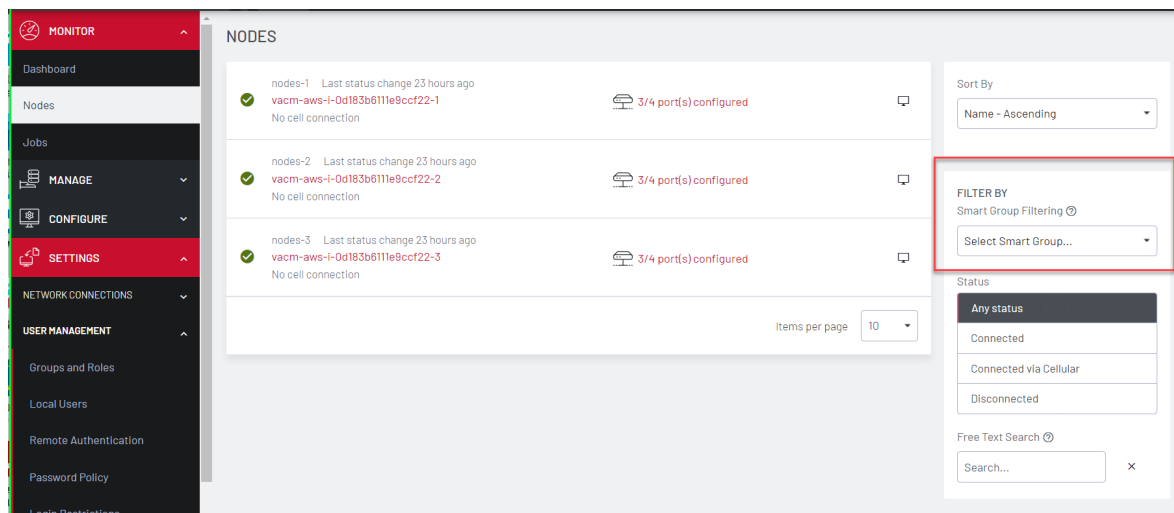
Smart Groups can also be used to filter visible nodes on pages that display enrolled nodes (such as **CONFIGURE > NODE Enrollment > Enrolled Nodes**) to make it easier to drill down to a particular console.

Smart Groups are dynamic, when more nodes are added to the system, the filters update automatically.

A user group can be linked to a particular **Smart Group**. When a user group is linked to a smart group in this fashion, members of the group inherit rights over all nodes in the smart group based on the group's role. "[Modifying existing groups](#)" on [page 237](#) for how to set a group's role and linked Smart Group.

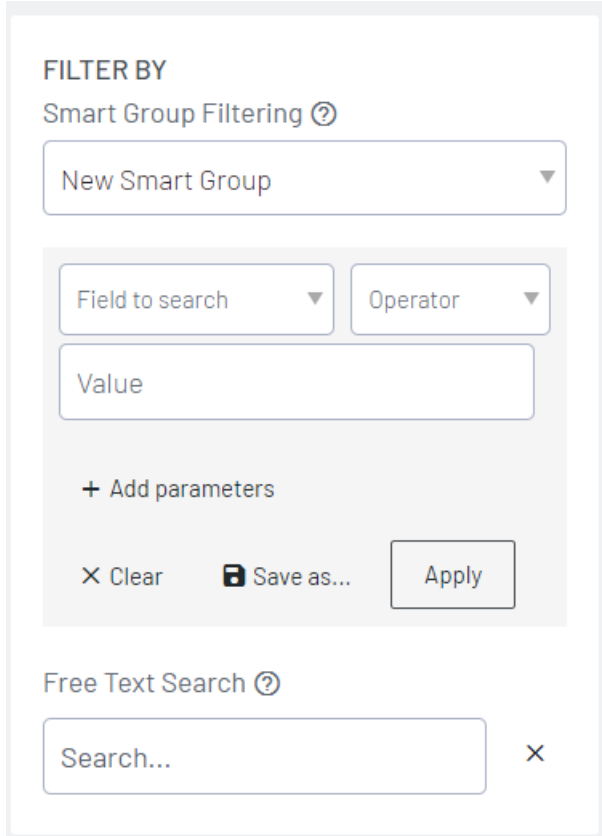
To create a Smart Group:

1. Navigate to any page which displays the Smart Group search interface, for example **MONITOR > Nodes**.



2. Move to the **Smart Group Filtering** and select **New Smart Group** from the displayed list

3. Click the **Field to search** dropdown to select a node attribute to filter on.



The screenshot shows a filtering interface with the following elements:

- FILTER BY** section:
- Smart Group Filtering** with a help icon and a dropdown menu currently showing "New Smart Group".
- A sub-section containing:
 - Field to search** dropdown menu.
 - Operator** dropdown menu.
 - Value** text input field.
 - + Add parameters** button.
 - X Clear** button, **Save as...** button, and **Apply** button.
- Free Text Search** section with a help icon and a text input field containing "Search..." and a close button (X).

Node attributes include details about the device (**Internal VPN Address, MAC Address, Name, Product, SSH Port, Firmware Version, Model, Serial Number, Node ID, Connection Status, Cell Health**), and include any **Tags** that have been configured in the system. For filtering access to devices, tags are the most useful attributes to filter on. When a tag is selected, the **Field to search** text box contains tag values.

4. Select the **Operator** to apply to the Value.
5. Select the **Value** to be matched against.
6. To enter multiple search parameters, click - **Add parameters**
7. The AND OR buttons display

- Select AND if the filter must match all values.
- Select OR if one or the other values must match.

8. Enter the additional details in the Field to search, Operator and Value fields.

Note:Note: Click the - button to remove the additional Search parameters if necessary.

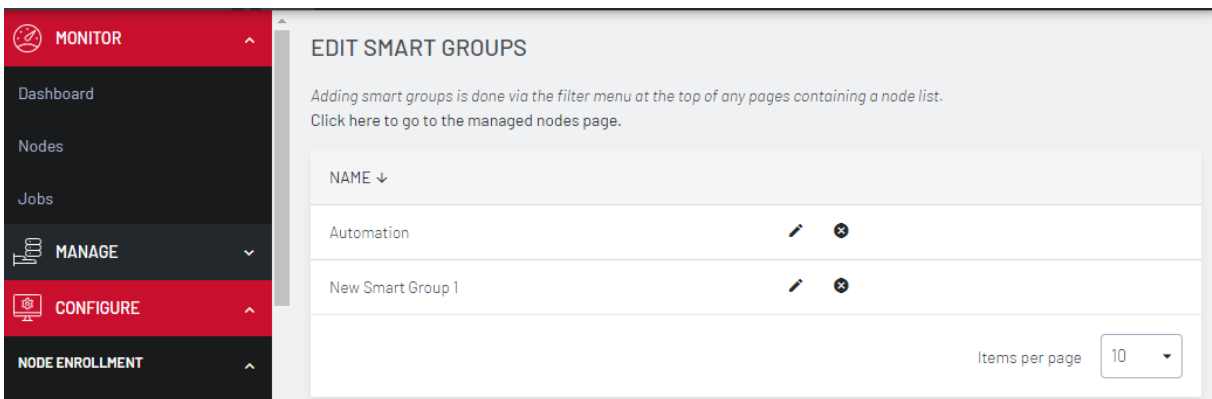
9. Click **Apply** to see the results of the filter.
10. Click **Save As** and type in a name for your new Smart Group.

This Smart Group can now be used for filtering nodes for display and for access.

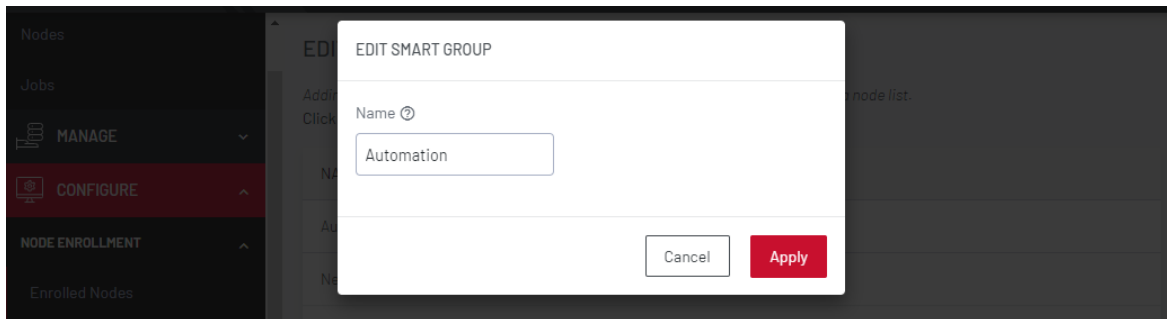
EDITING A SMART GROUP

To edit a Smart Group:

1. Select **CONFIGURE > Edit Smart Groups**.



2. Click **Delete** to delete an existing Smart Group.
3. Click **Edit Group** button to change a Smart Group's name.



To change the search parameters used by a Smart Group:

1. Navigate to a page that displays Smart Groups for filtering (for example, **CONFIGURE > NODE Enrollment > Enrolled Nodes**).
2. Select the required Smart Group to be changed from the **Select Smart Group** drop-down menu.
3. Change the **Field to search** and **Operator** values as required.
4. Click **Save Changes**.
5. Retain the Smart Group **Name** and click **Apply**. The changed search parameters overwrite the parameters of the Smart Group.

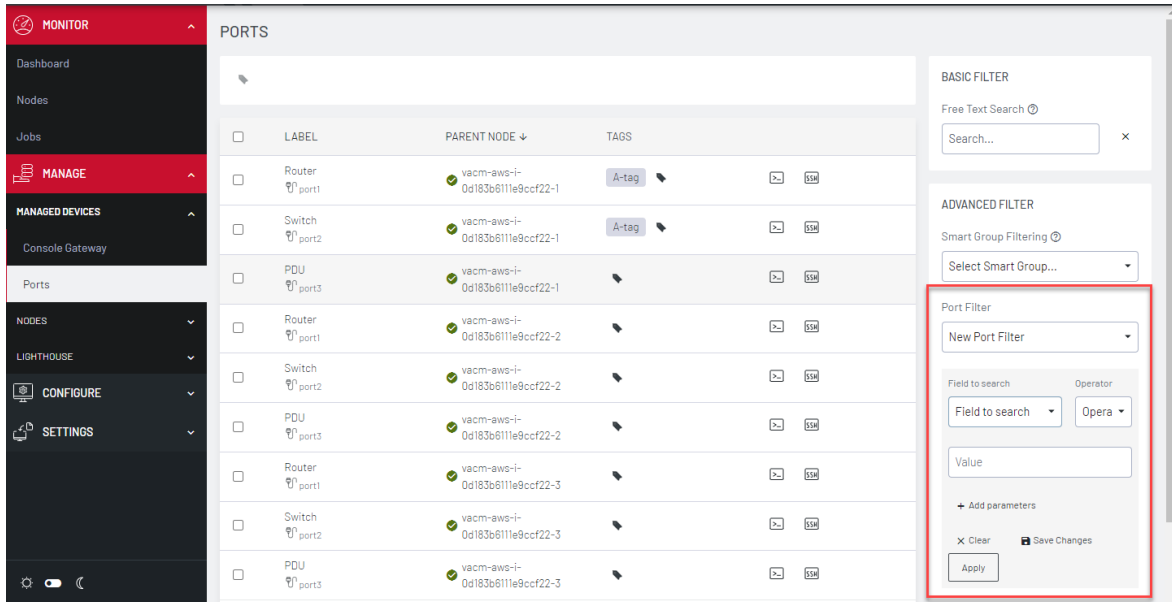
CREATING PORT FILTERS

Use **Port Filters** to easily find ports on nodes. The **MANAGE > MANAGED DEVICES > Ports** page makes it easier to find a particular port.

Ports are dynamically updated when more nodes with managed devices are added. Ports can be filtered by multiple parameters using either the AND and OR boolean operators.

To create a Port Filter:

1. Select the **MANAGE > MANAGED DEVICES > Ports** page.
2. On **ADVANCED FILTER** pane and select **Port Filter**.



The screenshot shows the Lighthouse interface with the 'MANAGE' sidebar and the 'PORTS' main view. A table of ports is displayed with columns for LABEL, PARENT NODE, and TAGS. On the right, the 'ADVANCED FILTER' pane is open, and the 'Port Filter' section is highlighted with a red box. This section includes a dropdown for 'New Port Filter', a 'Field to search' dropdown, an 'Operator' dropdown, and a 'Value' input field. There are also buttons for 'Add parameters', 'Clear', 'Save Changes', and 'Apply'.

3. Click **Field to search** to select a node attribute to filter on.
 - Select either **Port Label** or **Port Tag**.
4. If using Port Labels, click **Operator** to select the operator to apply to the Value.
5. Enter the **Value** to be matched against.
6. To enter multiple search parameters, click - **Add parameters**
7. The AND OR buttons display
 - Select AND if the filter must match all values.
 - Select OR if one or the other values must match.
8. Enter the additional details in the Field to search, Operator and Value fields.

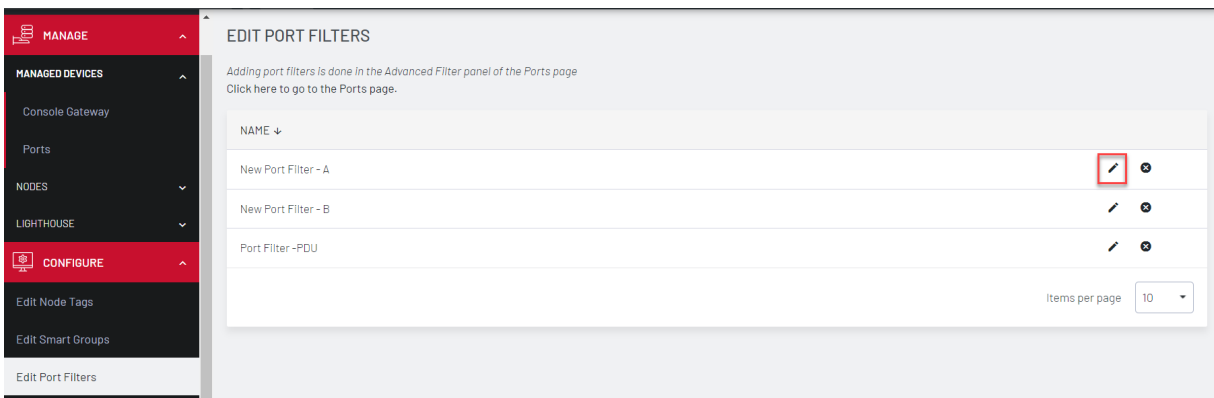
Note:Note: Click the **x** button to remove the additional Search parameters if necessary.

9. Click **Apply** to see the results of the filter.
10. Click **Save As** and enter a name for the filter.

The new **Port Filter** can now be used for filtering nodes by ports.







EDITING AN EXISTING PORT FILTER

To edit an existing Port Filter, select **CONFIGURE > Edit Port Filters** page.



EDIT PORT FILTERS

*Adding port filters is done in the Advanced Filter panel of the Ports page.
Click here to go to the Ports page.*

NAME ↓		
New Port Filter - A		
New Port Filter - B		
Port Filter -PDU		

Items per page 10

- Click the **Delete** button to delete an existing Port Filter.
- Click the **Edit** button to change a Port Filter's name.

EDIT PORT FILTER

Name ?

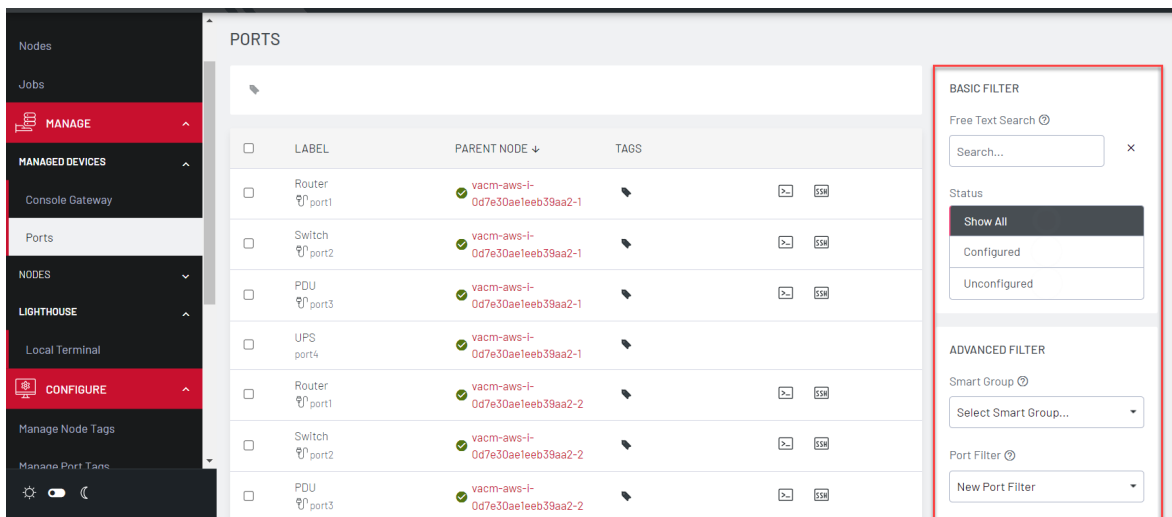
New Port Filter - A

Cancel

Apply

To change the search parameters for a Port Filter:

1. Navigate to a page that displays the Port Filters, such as **MANAGE > MANAGED DEVICES > Ports**.



The screenshot shows the Lighthouse interface with a sidebar on the left containing navigation options like 'MANAGE', 'MANAGED DEVICES', and 'CONFIGURE'. The main content area displays a table of ports. On the right, a filter sidebar is visible, with the 'BASIC FILTER' section highlighted by a red box. This section includes a search bar, a status filter (set to 'Show All'), and a 'Port Filter' dropdown menu currently set to 'New Port Filter'.

PORTS	LABEL	PARENT NODE	TAGS
<input type="checkbox"/>	Router port1	vacm-aws-l-0d7e30ae1eeb39aa2-1	[+] [SM]
<input type="checkbox"/>	Switch port2	vacm-aws-l-0d7e30ae1eeb39aa2-1	[+] [SM]
<input type="checkbox"/>	PDU port3	vacm-aws-l-0d7e30ae1eeb39aa2-1	[+] [SM]
<input type="checkbox"/>	UPS port4	vacm-aws-l-0d7e30ae1eeb39aa2-1	[+] [SM]
<input type="checkbox"/>	Router port1	vacm-aws-l-0d7e30ae1eeb39aa2-2	[+] [SM]
<input type="checkbox"/>	Switch port2	vacm-aws-l-0d7e30ae1eeb39aa2-2	[+] [SM]
<input type="checkbox"/>	PDU port3	vacm-aws-l-0d7e30ae1eeb39aa2-2	[+] [SM]

2. Select the required Port Filter from the **Port Filter** list.

3. Change the parameters (for example, **Operator** values) as required.
4. Do not change the name of the Port Filter.
5. Click **Save as**.
6. Click **Apply**. The modified **Port Filter** overwrites the existing Port Filter.

Note: Do not change the name of the Port Filter.

UPGRADE NODES VIA THE UI

When you need to upgrade nodes to the latest firmware, for example, for security fixes, use the Node Upgrade UI to upgrade up to 5000 connected nodes per task. The Node Upgrade UI allows you to upgrade nodes either immediately or at a scheduled time, even outside normal business hours.

The Node Upgrade UI is available in the Web UI under **Settings > Services > Node Firmware Upgrade**.

Completed jobs with the nodes selected can be duplicated so as to allow easy sequential upgrades. Nodes that failed to upgrade can be re-scheduled.

Upon opening the Node Firmware Upgrade window there are two tabs accessible, plus access to the upgrade scheduling wizard, these are:

- Upgrade Tasks – a filtered dashboard where you can view scheduled and completed tasks and see their status.
- File Manager – An area that allows upgrade files to be uploaded and a table that displays previously uploaded files.

- Node Firmware Upgrade scheduling wizard –This is where you can set up and schedule firmware upgrades. The wizard is accessed by clicking on the + button in the Upgrade Tasks tab.

Completed jobs with the nodes selected can be duplicated so as to allow easy sequential upgrades. Nodes that failed to upgrade can be re-scheduled.

FIRMWARE FILES

Before you upgrade, you need access to firmware files.

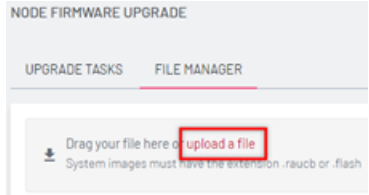
UPLOAD A FIRMWARE FILE

The Node Upgrade UI is available in the Web UI under **Settings > Services > Node Firmware Upgrade** Use the Upload tool on the File Manager tab to upload one file at a time.

Note: Only one file may be uploaded at a time using the upload tool. If multiple files are selected and placed in the drag and drop field, only the last file that was selected will be uploaded.

1. Select the 'File Manager' tab in the Node Firmware Upgrade UI section.
2. Either select 'upload a file' to open an explorer view, then select the file. Or

3. Drag and drop the file into the upload area.



In-progress uploads can be cancelled by clicking the Close button (X).

The file upload will continue even if you click elsewhere in the Lighthouse UI, however, the upload will be cancelled if you close the website or if the HTTPS connection to Lighthouse is closed.

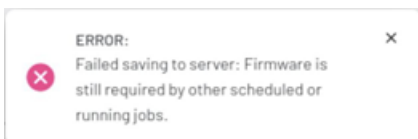
DELETE A FIRMWARE FILE

The Node Upgrade UI is available in the Web UI under **Settings > Services > Node Firmware Upgrade**. Use the Delete tool on the File Manager tab to delete one file at a time.

To delete a firmware file that is no longer needed:

1. Select the **File Manager** tab on the **Node Firmware Upgrade UI** page.
2. Click the delete button (■) next to the firmware file you wish to delete.

Note: If the selected firmware file is required by an ongoing or upcoming firmware upgrade task, an error message displays and the file is not deleted.



NODE UPGRADE TASKS

To upgrade a node you will need to set up a task.

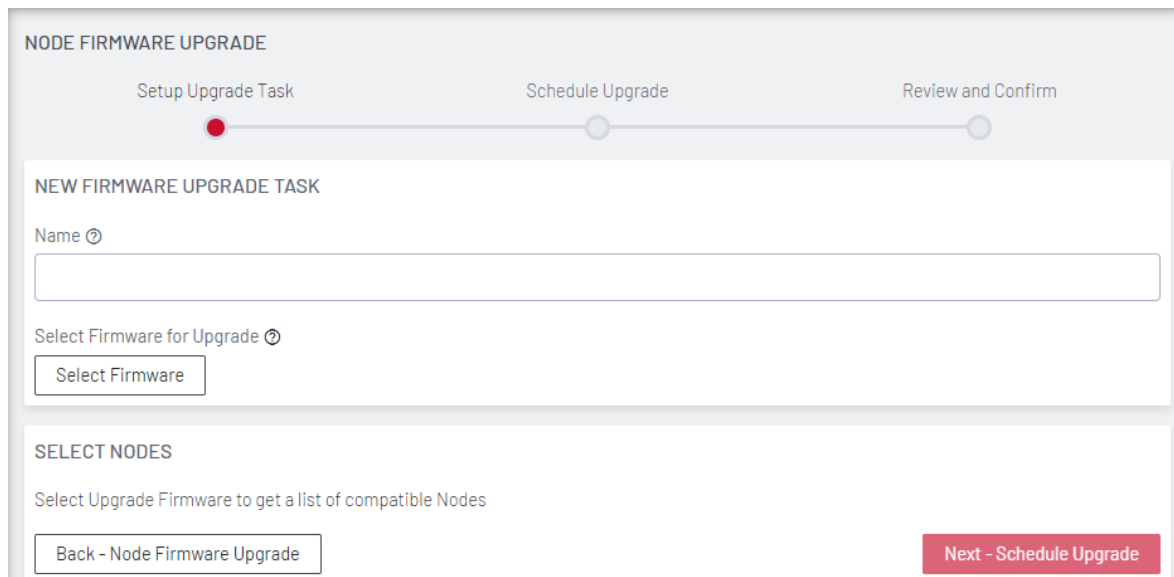
CREATE AN UPGRADE TASK

The Node Upgrade UI is available in the Web UI under **Settings > Services > Node Firmware Upgrade** Use the Upgrade tasks tab to

- Upgrade a node
- Schedule a node upgrade
- Upload a new firmware file

To upgrade a node use the task information table:

1. Click the Schedule an Upgrade button (+) above the task information table to schedule an upgrade (or start one immediately).
2. The **Node Firmware Upgrade** wizard displays. Enter a name/title for the upgrade task.



NODE FIRMWARE UPGRADE

Setup Upgrade Task Schedule Upgrade Review and Confirm

NEW FIRMWARE UPGRADE TASK

Name ⓘ

Select Firmware for Upgrade ⓘ

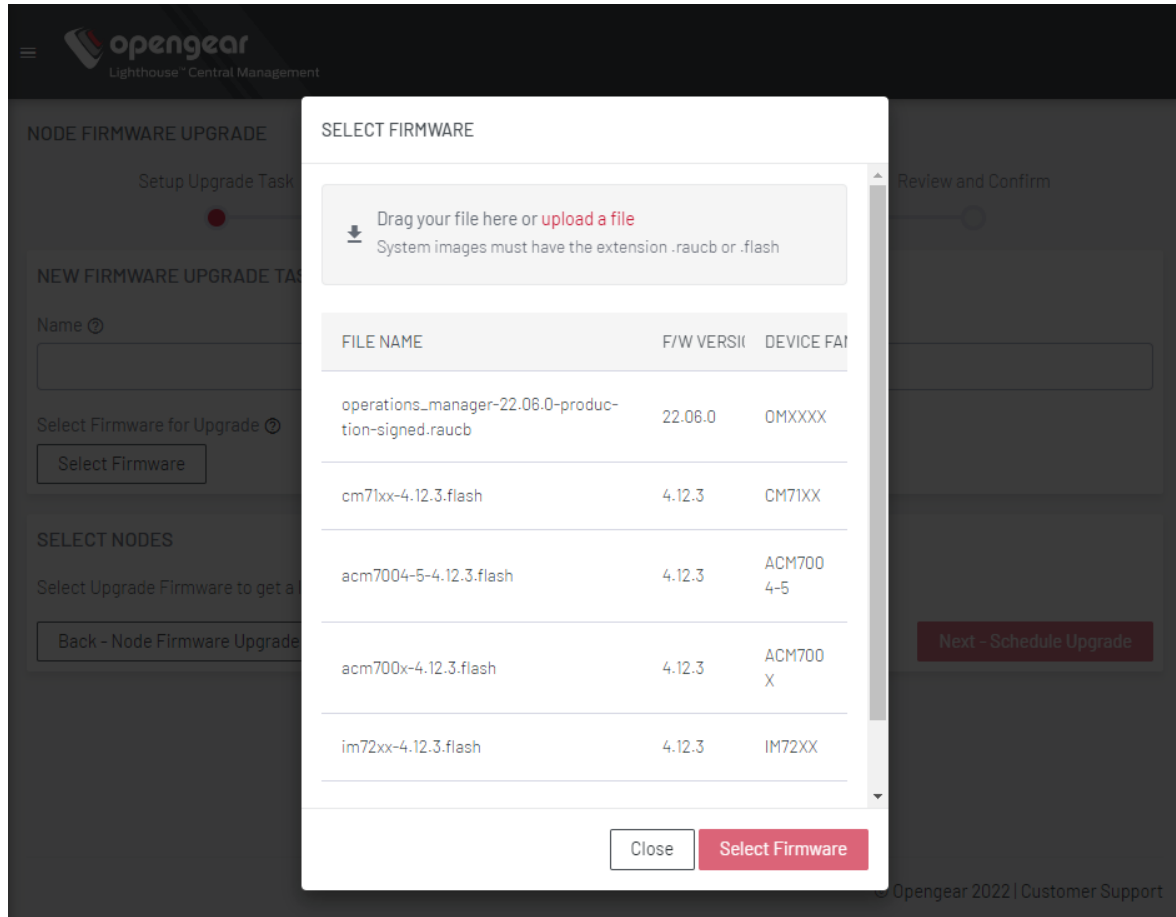
Select Firmware

SELECT NODES

Select Upgrade Firmware to get a list of compatible Nodes

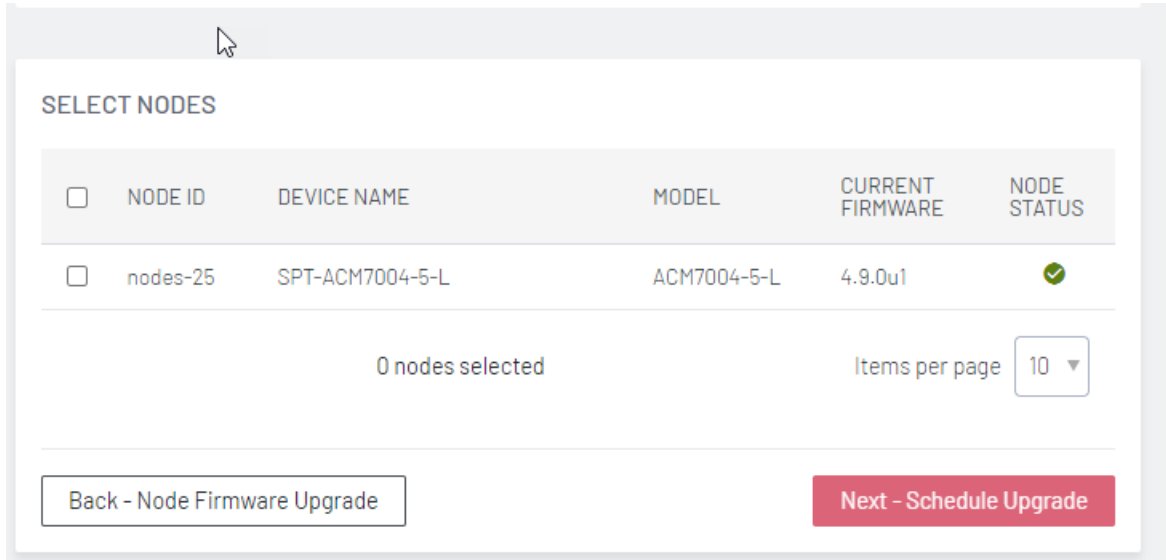
Back - Node Firmware Upgrade Next - Schedule Upgrade

3. Click the **Select Firmware** button. The Select Firmware list displays.



4. Select the firmware upgrade or upload new firmware for the upgrade task. Click **Select Firmware** button.

- Select the nodes to be upgraded. Select **Next - Schedule Upgrade**.



SELECT NODES

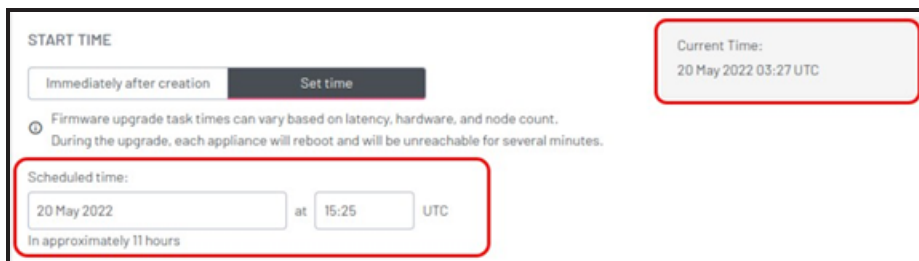
<input type="checkbox"/>	NODE ID	DEVICE NAME	MODEL	CURRENT FIRMWARE	NODE STATUS
<input type="checkbox"/>	nodes-25	SPT-ACM7004-5-L	ACM7004-5-L	4.9.0u1	✓

0 nodes selected Items per page 10 ▾

Back - Node Firmware Upgrade Next - Schedule Upgrade

Note: Compatible nodes that have already been scheduled for an upgrade cannot be selected, these are visible in the list but appear greyed-out. Nodes that are not compatible with the firmware file will not be listed.

- Select the **Start time** as either **Immediately after creation** for immediate start, or, **Set time**. For Set Time, enter the Scheduled time Date and Time.



START TIME

Immediately after creation Set time

Current Time: 20 May 2022 03:27 UTC

Firmware upgrade task times can vary based on latency, hardware, and node count. During the upgrade, each appliance will reboot and will be unreachable for several minutes.

Scheduled time: 20 May 2022 at 15:25 UTC

In approximately 11 hours

Note: The scheduled time is always in UTC.

- If Upgrade in Failover is selected, it is selected either in bulk, by dropdown selection (a), or, individually by a toggle switch beside each table row (b):



Note: Selecting this option may result in considerable cell charges in the event of a failover.

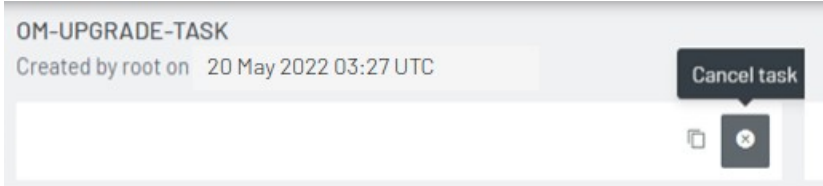
- Click **Next – Review and Confirm** to go to the review screen. Check the schedule details are correct. To change schedule details, click **Back – Schedule Upgrade**, all data local data will be preserved while you change parameters on previous screens.
- Select **Confirm**, and type **Yes** at the prompt, then click **Confirm** to create the task.

CANCEL AN UPGRADE TASK

You can cancel a task that has not yet completed the upgrade.

To cancel an upgrade task"

- Select **Settings > Services > Node Firmware Upgrade**
- In the task list, select the task name you wish you cancel, the Task Details screen displays.
- Click the X button (top-right) to cancel the task.



Note: You cannot cancel upgrade tasks that have already been completed.

Limitations:

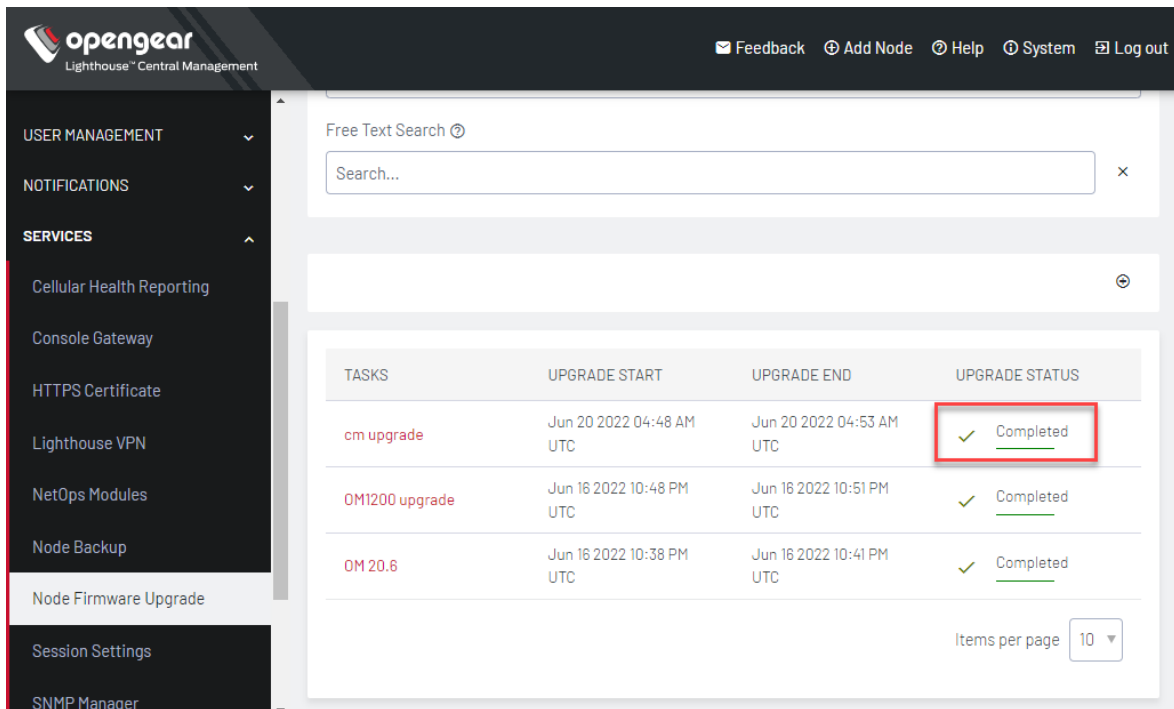
- Do not cancel an upgrade job just as it is about to begin, for example, 10 seconds before or after the start time.
- If an upgrade is cancelled while in progress, only nodes that have not yet been upgraded will be cancelled.

COPY A SCHEDULED TASK

You can copy a scheduled task in order to create a new upgrade task. The new upgrade task will use the nodes that were selected for the original task you are copying, for example to add or remove nodes from the list. You can also select different firmware or use the same firmware for the list of nodes.

Note: For a task to be copied, the task must have already run or been cancelled, and display an Upgrade Status of Completed.

1. Navigate to the Node Firmware Upgrade Home screen. The Node Upgrade UI is available in the Web UI under **Settings > Services > Node Firmware Upgrade**



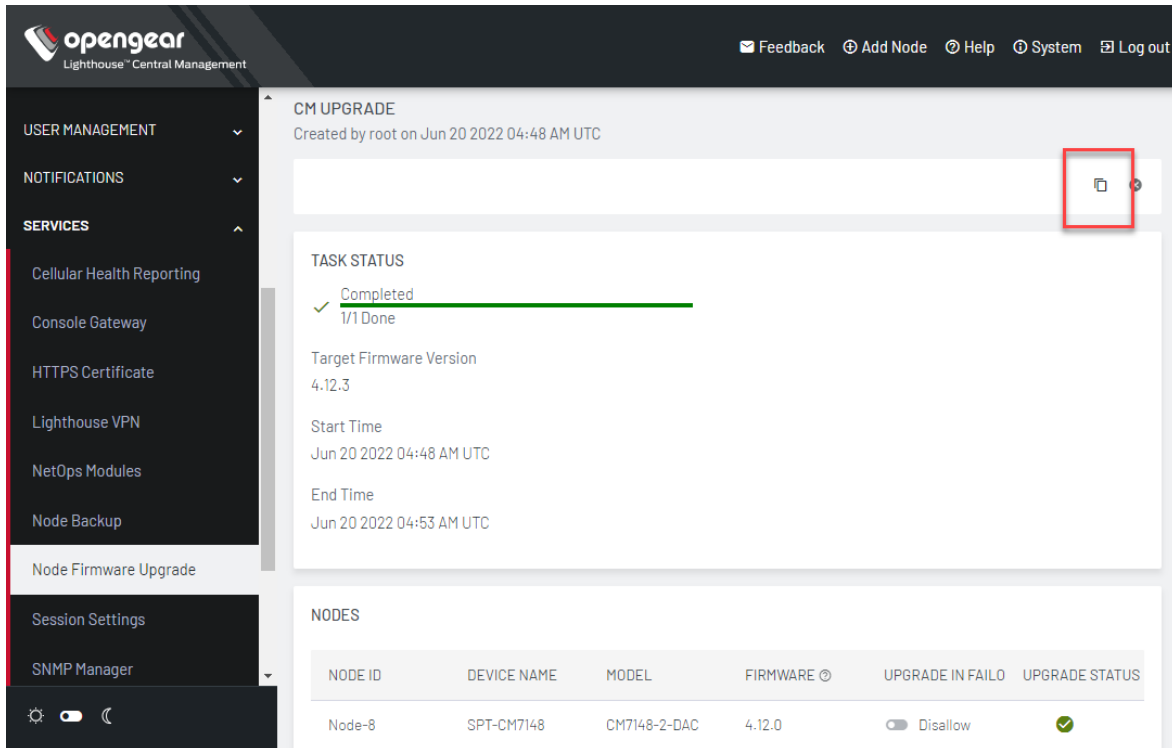
The screenshot shows the OpenGear Lighthouse Central Management web interface. The left sidebar contains a navigation menu with the following items: USER MANAGEMENT, NOTIFICATIONS, SERVICES (expanded), Cellular Health Reporting, Console Gateway, HTTPS Certificate, Lighthouse VPN, NetOps Modules, Node Backup, Node Firmware Upgrade (selected), Session Settings, and SNMP Manager. The main content area features a search bar and a table of upgrade tasks. The table has the following data:

TASKS	UPGRADE START	UPGRADE END	UPGRADE STATUS
cm upgrade	Jun 20 2022 04:48 AM UTC	Jun 20 2022 04:53 AM UTC	✓ Completed
OM1200 upgrade	Jun 16 2022 10:48 PM UTC	Jun 16 2022 10:51 PM UTC	✓ Completed
OM 20.6	Jun 16 2022 10:38 PM UTC	Jun 16 2022 10:41 PM UTC	✓ Completed

At the bottom right of the table, there is a dropdown menu for 'Items per page' set to 10.

2. Select the task you wish you copy, by clicking the task name in the task table

3. Click the Copy button to copy the task



The screenshot shows the OpenGear Lighthouse Central Management interface. The left sidebar contains navigation options: USER MANAGEMENT, NOTIFICATIONS, SERVICES (with sub-items: Cellular Health Reporting, Console Gateway, HTTPS Certificate, Lighthouse VPN, NetOps Modules, Node Backup, Node Firmware Upgrade, Session Settings, and SNMP Manager), and system controls. The main content area displays a 'CM UPGRADE' task created by root on Jun 20 2022 04:48 AM UTC. The task status is 'Completed' with a progress bar at 1/1 Done. Details include Target Firmware Version 4.12.3, Start Time Jun 20 2022 04:48 AM UTC, and End Time Jun 20 2022 04:53 AM UTC. Below the task details is a 'NODES' table with one entry for Node-8.

NODE ID	DEVICE NAME	MODEL	FIRMWARE	UPGRADE IN FAILO	UPGRADE STATUS
Node-8	SPT-CM7148	CM7148-2-DAC	4.12.0	Disallow	✓

4. A new task is created with the same nodes.

DELETE AN UPGRADE TASK

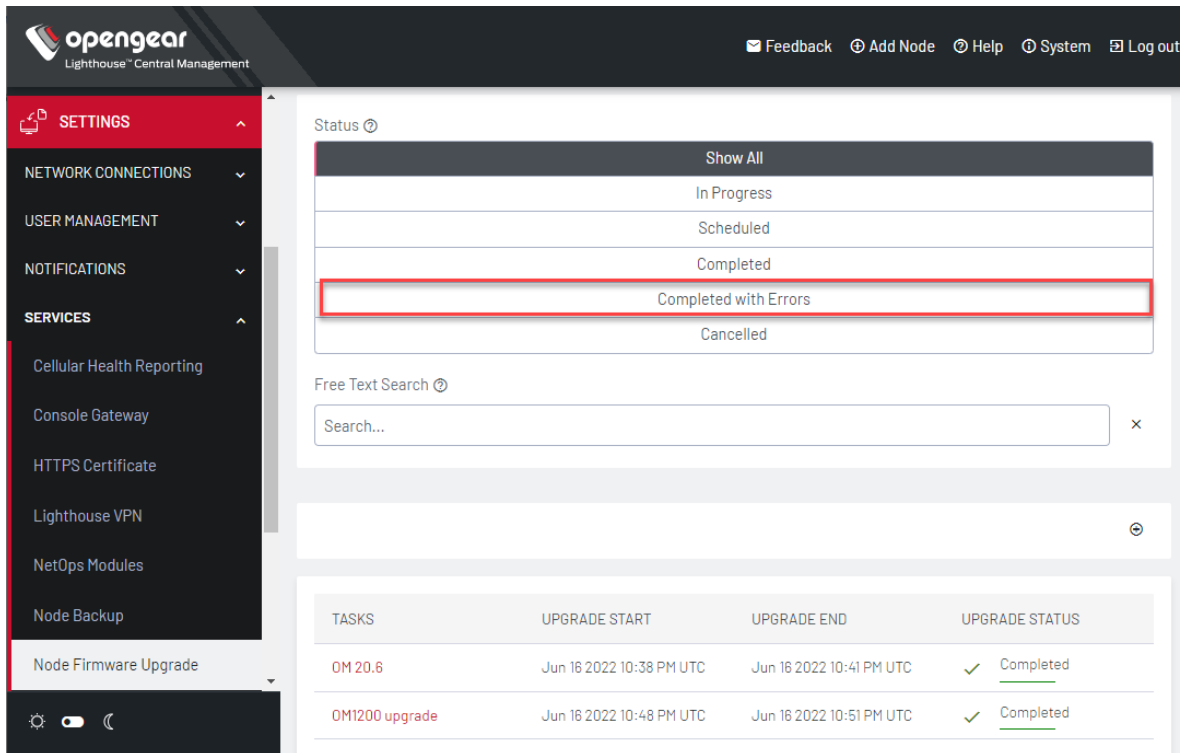
Upgrades cannot be permanently deleted as they can offer a valuable insight into the health of the nodes when problem-solving and provide the version path that they have traversed over their lifetime.

If the number of jobs is becoming unmanageable, or jobs need to be deleted for security measures, the support team will be able to advise on how to remove/clear them.

RETRY AN UPGRADE TASK

If an upgrade task fails, you can retry the node upgrades, provided the firmware file is still available.

1. Navigate to the Node Firmware Upgrade Home screen. The Node Upgrade UI is available in the Web UI under **Settings > Services > Node Firmware Upgrade**
2. Select the task you wish you retry, by clicking the task name in the task table. You can filter the task list by using the **Completed with Errors** filter.



The screenshot shows the OpenGear Lighthouse Central Management web interface. The left sidebar contains a navigation menu with 'SETTINGS' selected. Under 'SERVICES', 'Node Firmware Upgrade' is highlighted. The main content area shows a 'Status' filter dropdown with 'Completed with Errors' selected and highlighted with a red box. Below the filter is a 'Free Text Search' input field. A table of upgrade tasks is displayed below:

TASKS	UPGRADE START	UPGRADE END	UPGRADE STATUS
OM 20.6	Jun 16 2022 10:38 PM UTC	Jun 16 2022 10:41 PM UTC	✓ Completed
OM1200 upgrade	Jun 16 2022 10:48 PM UTC	Jun 16 2022 10:51 PM UTC	✓ Completed

3. In the task detail screen, click the **Repeat for failed upgrades** button.



The screenshot shows the task detail screen. Under the heading 'TASK STATUS', there is a green progress bar and a red warning triangle icon. The text 'Completed 3/3 Done' is displayed. A button labeled 'Repeat for failed upgrades' is visible to the right.

Note: If the relative Firmware file has been deleted, the **Repeat for failed upgrades** button is not displayed.

4. The **Node Firmware Upgrade** page displays. See "[Create an upgrade task](#)" on [page 174](#).

NODE UPGRADE RUNTIME BEHAVIOUR

The following describes the behavior of the Node Upgrade tool while performing routine upgrade tasks.

PROMOTING A SECONDARY INSTANCE TO PRIMARY

- All scheduled upgrades are cancelled when a secondary node is promoted to be the new primary node.
- Firmware files are not replicated among the multiple instance cluster and must be re-uploaded to the new primary after promotion.

DOWNGRADING AND SKIPPING VERSIONS

Lighthouse does not allow downgrading of nodes, nor does it allow upgrading to an identical version. The node upgrade will skip nodes that are at the upgrade version or later, for example, if upgrading from version 21.Q3 to 21.Q4, it will ignore any nodes that are already at 21.Q4 or 22.Q1.

Skipping versions

If a node is scheduled to be upgraded from 21.Q3 directly to 22.Q1 (skipping 21.Q4), it will upgrade the node even if it has been manually upgraded to 21.Q4 before the scheduled upgrade starts.

Note:Lighthouse does not check or validate the version jumps for nodes, so there is a risk that the upgrade could fail if major versions are being skipped. Skipping versions is not recommended or supported, however, it is not disallowed.

TIME ZONES

Node upgrades can only be initiated or scheduled by an operator with administrator credentials while logged in at the primary lighthouse. The scheduling of the node upgrade is based on the time zone of the primary lighthouse.

If the time zone of the primary lighthouse is changed before a scheduled upgrade starts, the schedule time will be based upon the new time zone. This may result in jobs not running at all, being skipped, ignored, or otherwise running at unpredictable times.

Note:It is recommended that you avoid changing the system time of lighthouse, or its time zone, while jobs are scheduled.

OFFLINE NODES

If a node is offline or otherwise unreachable at the time of upgrade, the node will be skipped.

If the node is offline there is a one minute buffer before the scheduled upgrade is skipped and Lighthouse will report the node with a failed to upgrade status.

NODE CONNECTION INTERRUPTED

If the connection to the node is interrupted during the upgrade, the upgrade may be cancelled and will fail unless the upgrade was in the final stages and had no need for further interaction with Lighthouse. In this scenario Lighthouse may still report the node upgrade as failed if it was unable to confirm that the upgrade succeeded due to the node being disconnected during the validation period.

Failure to upgrade one node does not affect other nodes in the upgrade job.

UNENROLLING NODES AT UPGRADE

Unenrolling nodes as they are being upgraded is not supported as this could result in unexpected behavior.

LIGHTHOUSE AVAILABILITY AND STABILITY

Lighthouse must be online and fully booted (preferably for at least a few minutes) before the upgrade starts. It is good practice to have Lighthouse online for a few hours before a node upgrade. This ensures that all the nodes that will be upgraded have re-established their connection and allows time to troubleshoot any issues.

Do not attempt to change major Lighthouse settings, especially those involving the network or timezone, when an upgrade is underway or imminent.

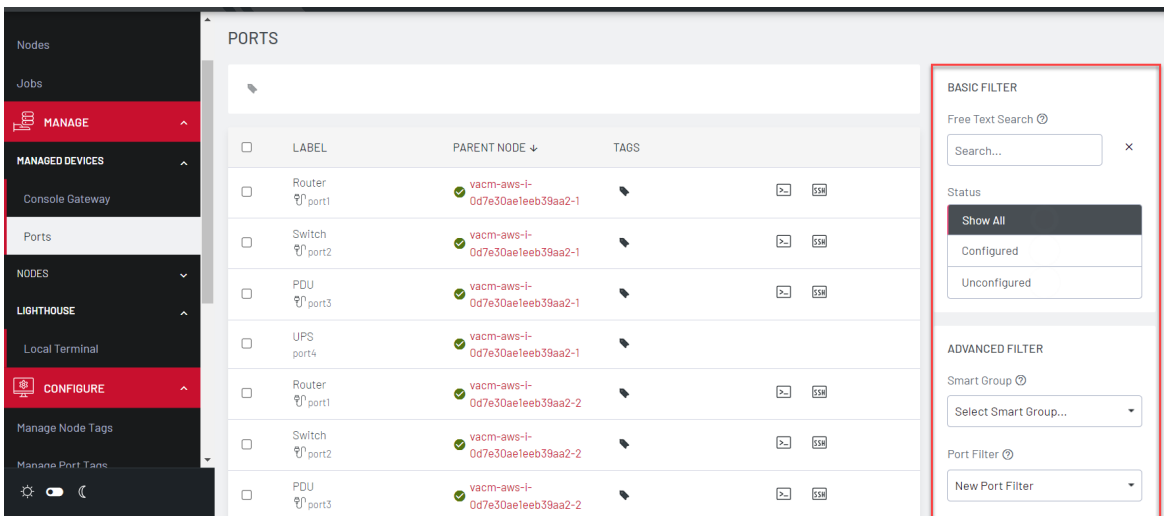
Do not conduct multiple major operations on nodes simultaneously, for example, do not apply templates to the node while it is being upgraded. Do not login to a node and change settings moments before an upgrade occurs.

Note: If Lighthouse is offline when a scheduled upgrade is due to start, the upgrade will not be run.

MANAGE PORTS

Lighthouse allows you to manage all ports connected to nodes. **MANAGE > MANAGED DEVICES > Ports** displays the status and number of all the ports on Lighthouse, which you have permissions to view/edit.


1. Select **MANAGE > MANAGED DEVICES > Ports**. The Ports page displays the Labels, Parent Node and Tags of the connected ports which the user has permissions to view/edit.



	LABEL	PARENT NODE ↓	TAGS
<input type="checkbox"/>	Router port1	vacm-aws-l- 0d7e30ae1eeb39aa2-1	
<input type="checkbox"/>	Switch port2	vacm-aws-l- 0d7e30ae1eeb39aa2-1	
<input type="checkbox"/>	PDU port3	vacm-aws-l- 0d7e30ae1eeb39aa2-1	
<input type="checkbox"/>	UPS port4	vacm-aws-l- 0d7e30ae1eeb39aa2-1	
<input type="checkbox"/>	Router port1	vacm-aws-l- 0d7e30ae1eeb39aa2-2	
<input type="checkbox"/>	Switch port2	vacm-aws-l- 0d7e30ae1eeb39aa2-2	
<input type="checkbox"/>	PDU port3	vacm-aws-l- 0d7e30ae1eeb39aa2-2	

2. **BASIC FILTER**, and **ADVANCED FILTER** allow you to sort the display of ports, by *Free Text*, *Smart Group* or *Port Filter*.
3. The **BASIC FILTER** Free Text Search allows you to search by the name of a port label or port tag.

The **Port Filter** drop down menu allows you to fine tune your search by either selecting an existing Port Filter or to creating a New Port Filter.

4. The **Tag** icon  allows you to create, assign or remove a new Port Tag. You can use port tags to control user access to ports.

You can also access the *Web Terminal* and *SSH* links for individual ports via the icons to the right of each row, if you have the requisite permissions.

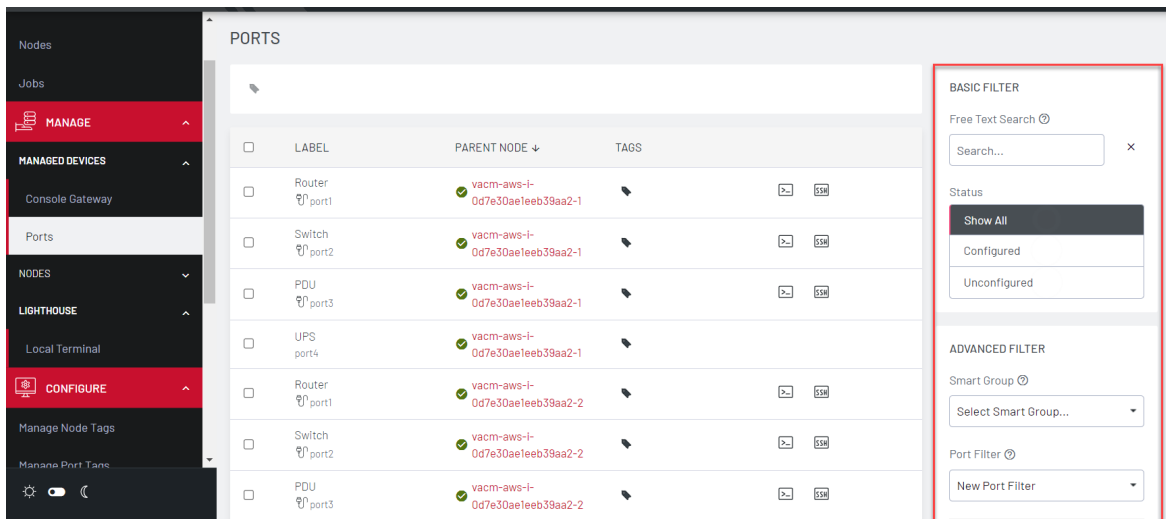
FILTERING PAGES DISPLAYING PORTS

If you want to quickly find a particular port or set of ports, you can drill down to specific ports by using the BASIC and ADVANCED filters. You can filter on:

- **Free Text Search**
- **Smart Group**, and
- **Port Filters**
- **Status.**

The filters can be used independently from each other or in combination.

1. Select **MANAGE > MANAGED DEVICES > Ports**. The Ports page displays the Labels, Parent Node and Tags of the connected ports.



	LABEL	PARENT NODE ↓	TAGS
<input type="checkbox"/>	Router port1	vacm-aws-l- 0d7e30ae1eeb39aa2-1	
<input type="checkbox"/>	Switch port2	vacm-aws-l- 0d7e30ae1eeb39aa2-1	
<input type="checkbox"/>	PDU port3	vacm-aws-l- 0d7e30ae1eeb39aa2-1	
<input type="checkbox"/>	UPS port4	vacm-aws-l- 0d7e30ae1eeb39aa2-1	
<input type="checkbox"/>	Router port1	vacm-aws-l- 0d7e30ae1eeb39aa2-2	
<input type="checkbox"/>	Switch port2	vacm-aws-l- 0d7e30ae1eeb39aa2-2	
<input type="checkbox"/>	PDU port3	vacm-aws-l- 0d7e30ae1eeb39aa2-2	

2. Use the BASIC FILTER and ADVANCED FILTER dropdowns to sort the display of ports, by *Free Text*, *Status*, *Smart Group* or *Port Filter*.
3. In Status, you can select to Show All, or Configured or Unconfigured ports.

FILTERING USING THE FREE TEXT SEARCH FIELD

The **Free Text Search** input field allows near real-time filtering of ports using the following criteria:

- Port Label
- Port Tag

Enter your search term in the **Free Text Search** field and click **Enter**.

The **Free Text Search** field treats multiple search terms separated by the space character as being combined with the logical AND operator, returning results only if all terms are present in the item.

For example, the search phrase `production switch` returns only ports that contain both `production` AND `switch` anywhere in searchable fields.

To search for a multi-word term, enclose the search term in double quote characters. For example, "production switch" will return results only if the entire search term is matched in the item.

FILTERING USING THE SMART GROUP FILTERING DROP-DOWN MENU

You can search for groups of ports by using the **Select Smart Group** field. Enter the search criteria in **Select Smart Group** and a menu displays the ports that belong to the selected group, provided you have the requisite permissions.

See "[Creating Smart Groups](#)" on page 163 for how to create such groups.

After a particular Smart Group has been selected, further filtering options become available under **Fields to search**:

To add more filtering options:

1. Click **Field to search**.
2. Select a field and enter a value in the text box.
3. Select an **Operator** from the drop-down box on the right.
4. Click the **+ Add Parameters** button. Select a parameter.
5. Click **Apply**.

The list of ports that meet the specified criteria display.

FILTERING USING THE PORT FILTER DROP-DOWN MENU

You can search for groups of ports by using the **Port Filter** field. Enter the search criteria in **Port Filter** and the page displays the ports that belong to the selected group.

To add a new Port Filter:

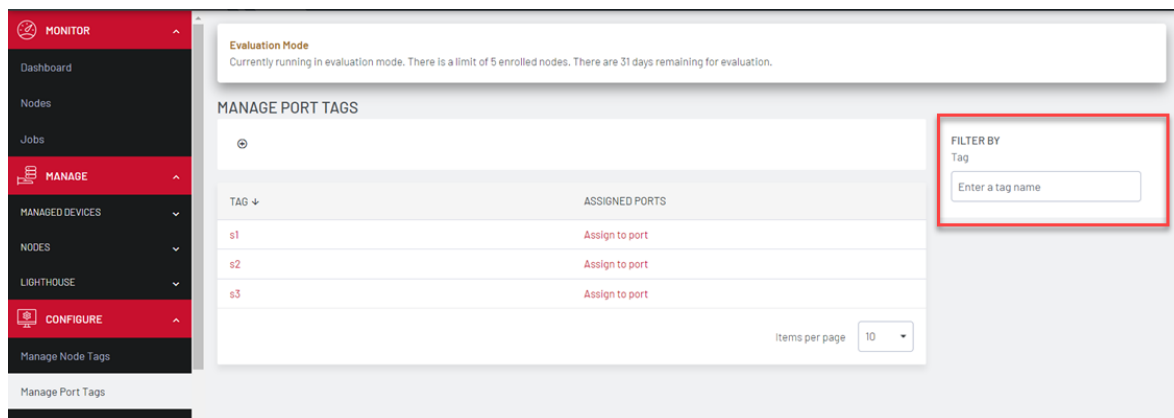
1. Click **Field** .
2. Select a field option such as *Port Label* or *Port Tag* and enter a value in the text box.
3. Select the next **Field to Search** option such as *Port Tag* and enter a value in the text box.
4. For Port Labels you can select an **Operator** from the drop-down box on the right.
5. If you wish to narrow the search, select **+Add Parameters**. Select the *AND* or *OR* button to specify the requisite boolean value.
6. You can repeat from step 4 to add more parameters.
7. Click **Apply Filter**.
8. Click **Save Changes**. You can also select to **Clear**.

FILTERING USING THE PORT TAGS

You can search for groups of ports by using the **Tags** filter on the **Manage Port Tags** page.

To find a tag

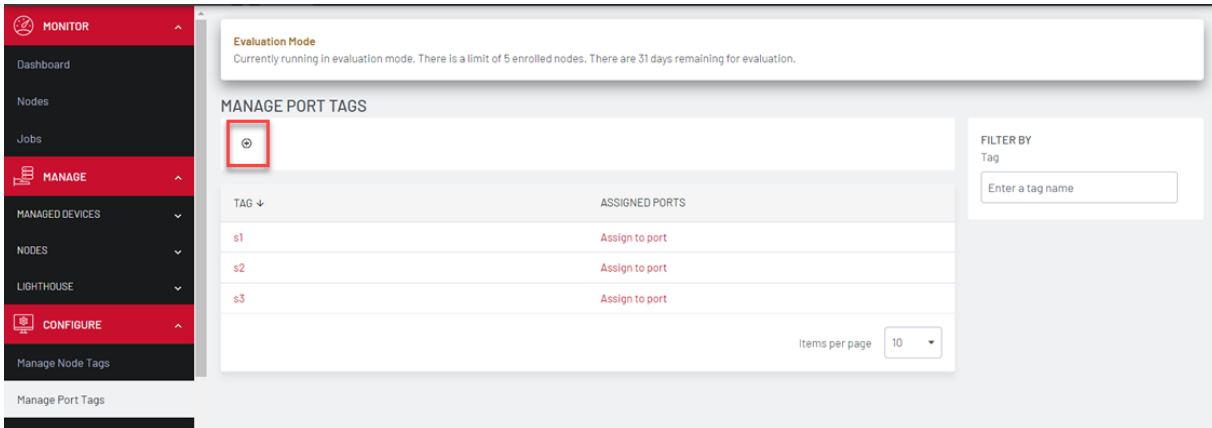
1. Select **CONFIGURE > Manage Port Tags**. The **Manage Port Tags** page displays the *Tags*.|




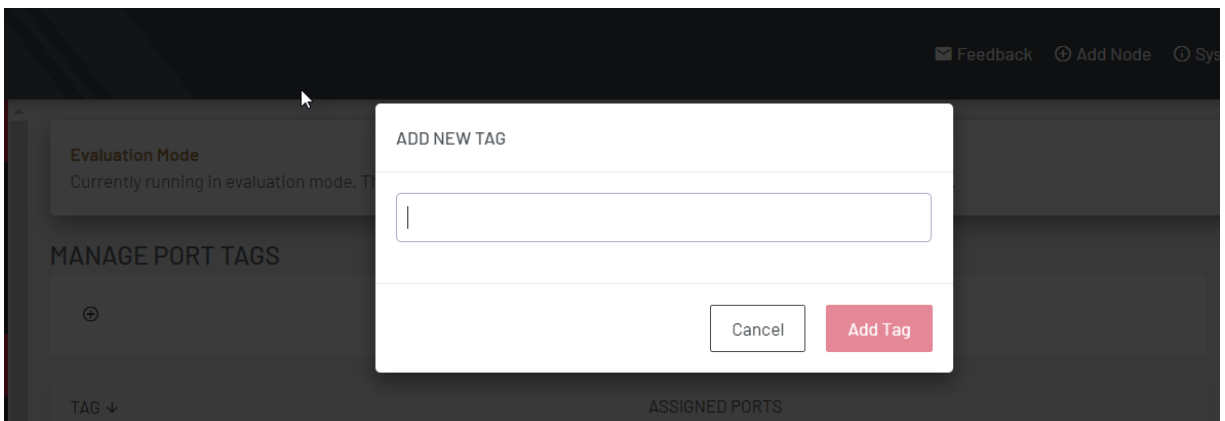
2. Enter a value in the FILTER BY text box, such as a name of a tag, or even part of a name
3. The **Manage Port Tags** page displays the list of ports with the selected tag only.
4. You can then click the Assigned Port link to view or manage the tagged ports.

CREATE A NEW PORT TAG

1. Select **CONFIGURE > Manage Port Tags**. The **Manage Port Tags** page displays the *Tags* and the number of *Assigned Ports*, if any



Select  Create New Tag icon on the upper right. The **ADD NEW TAG** dialog displays.

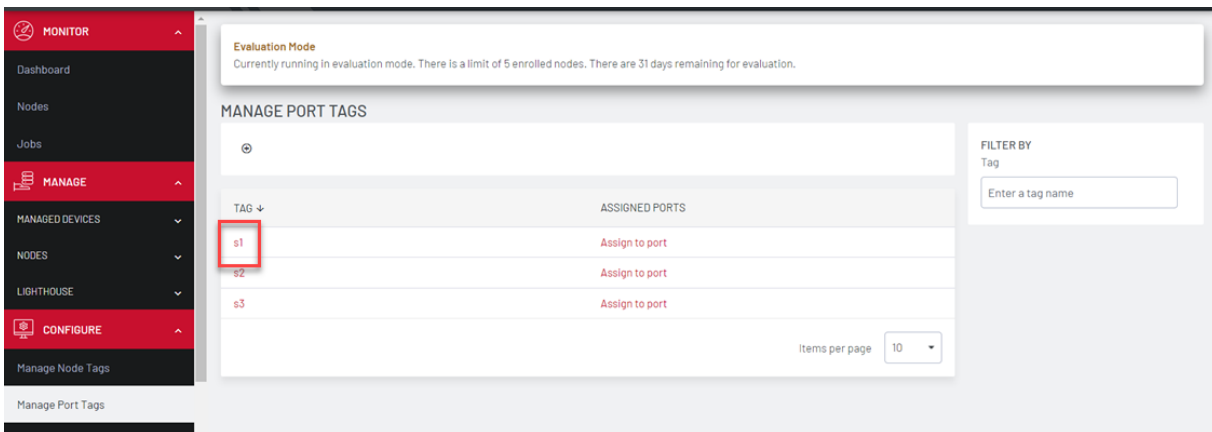


1. Enter the port tag name in the field and click **Add Tag**.
2. You can also enter multiple port tag names separated by commas.
3. The new tags display on the **Manage Port Tags** page.
4. Click the *Assign to Port* link to assign the tag to a specific port. The **Ports** page displays.

5. After the tag is assigned, the **Manage Port Tags** page displays the number of ports that a tag is assigned to in the *Assigned Ports* column. You can click on the number in the Assigned ports column to view a filtered version of the PORTS page.

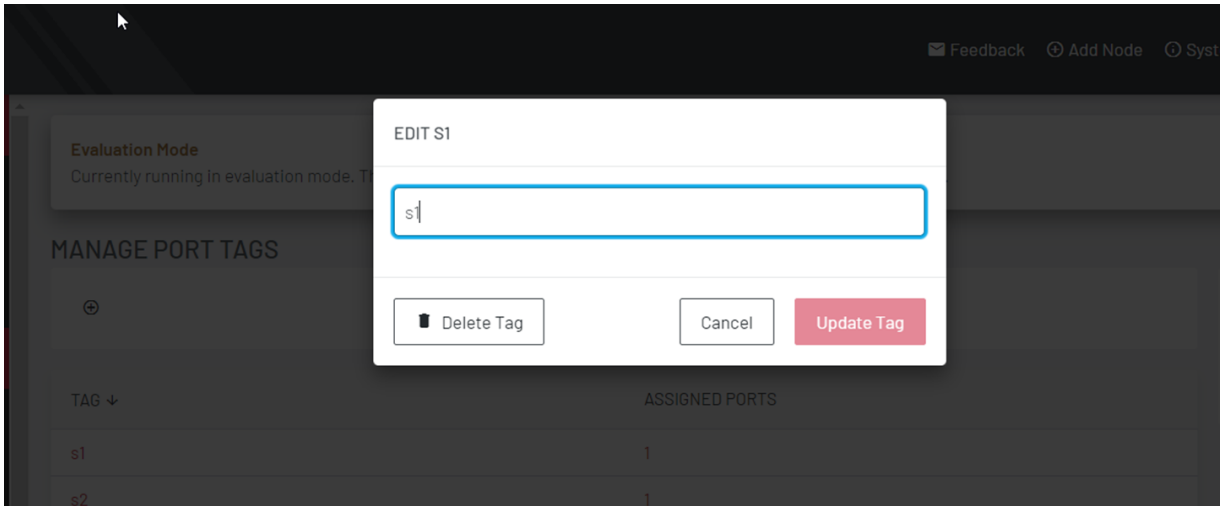
EDIT A PORT TAG

Select **CONFIGURE > Manage Port Tags**. The **Manage Port Tags** page displays the *Tags*.



The screenshot shows the 'MANAGE PORT TAGS' interface. At the top, there is an 'Evaluation Mode' notification. Below it, the main content area is titled 'MANAGE PORT TAGS'. On the left, there is a sidebar with navigation options: MONITOR, Dashboard, Nodes, Jobs, MANAGE (highlighted), MANAGED DEVICES, NODES, LIGHTHOUSE, and CONFIGURE (highlighted). The main content area contains a table with two columns: 'TAG' and 'ASSIGNED PORTS'. The table has three rows: 's1', 's2', and 's3'. The 's1' tag is highlighted with a red box. To the right of the table, there is a 'FILTER BY Tag' section with an input field labeled 'Enter a tag name'. At the bottom right of the table, there is a 'Items per page' dropdown menu set to '10'.

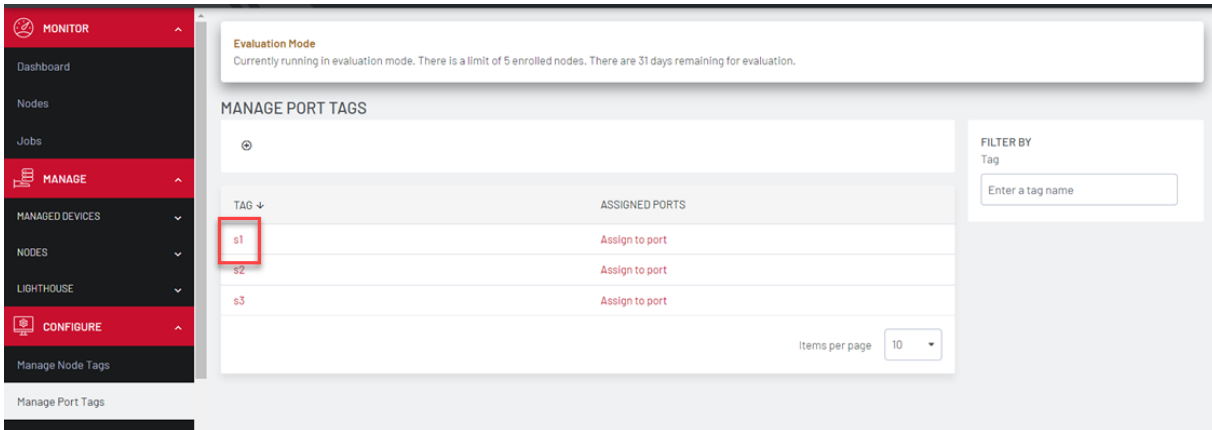
Select the tag to edit. The **EDIT <TAGNAME>** dialog displays.



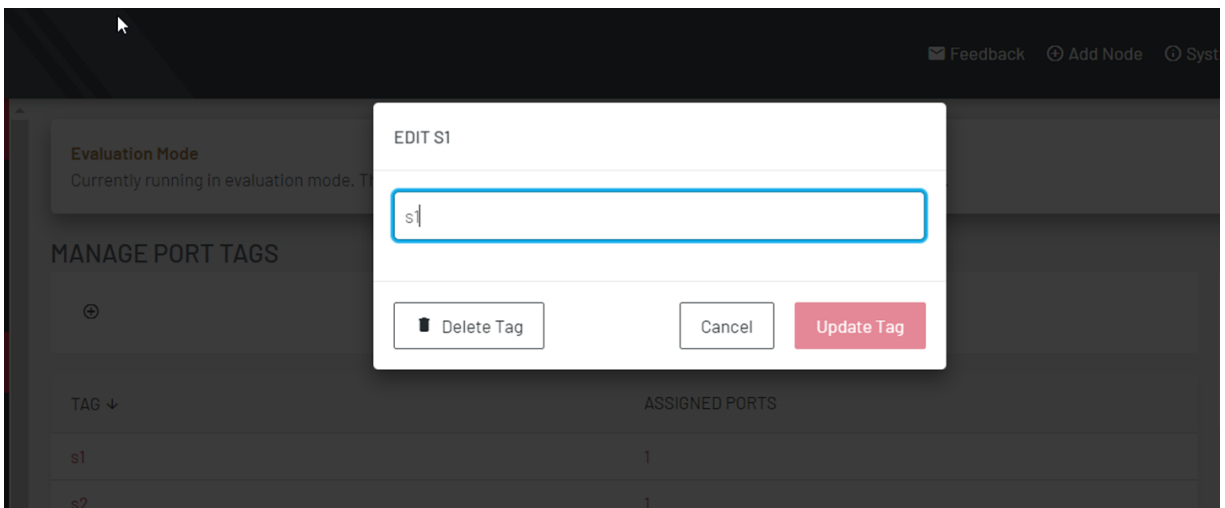
1. Edit the port tag name in the field and click **Update Tag**.
2. The edited tag name displays on the **Manage Port Tags** page.

DELETE A PORT TAG

Select **CONFIGURE > Manage Port Tags**. The **Manage Port Tags** page displays the *Tags*.



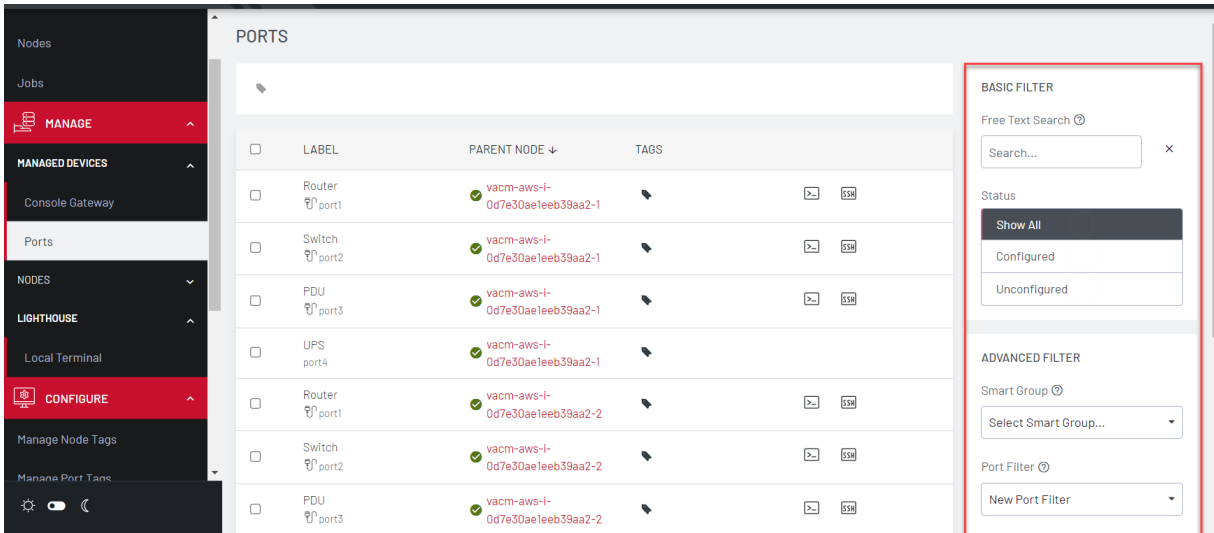
Select the tag to delete. The **EDIT <TAGNAME>** dialog displays.



1. Click **Delete Tag**.
2. A confirmation message displays. Click Confirm to delete the tag.

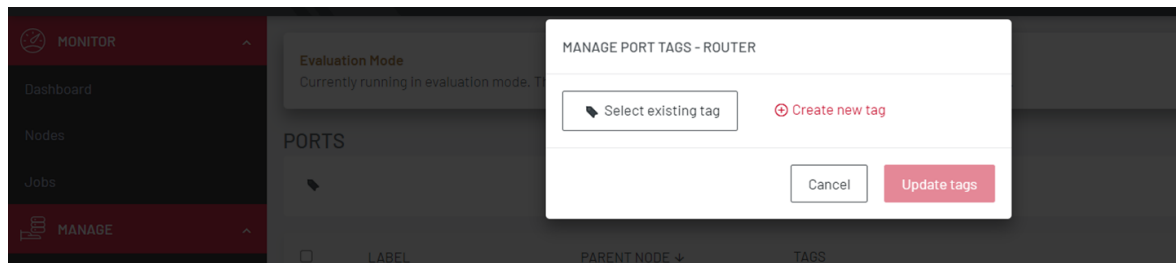
ASSIGN A PORT TAG

1. Select **MANAGE > MANAGED DEVICES > PORTS**. The **PORTS** page displays .



2. You can select one or more ports. Click the tag icon  .

3. The **MANAGE PORT TAGS** dialog displays.



4. To assign port tags to the selected port(s), click the **Select existing tag** button. A dropdown list of existing tags displays. Select the required tags.
5. Click **Confirm** on the **Confirm Changes** message box.

6. Select the required tag(s) and click **Update tags**
7. The added tags display on the **PORTS** page

PORTS

<input type="checkbox"/>	LABEL	PARENT NODE ↓	TAGS		
<input type="checkbox"/>	Router 🔌port1	✔ vacm	s1 s2 🔌	[-]	SSH
<input type="checkbox"/>	Switch 🔌port2	✔ vacm	🔌	[-]	SSH
<input type="checkbox"/>	PDU 🔌port3	✔ vacm	🔌	[-]	SSH
<input type="checkbox"/>	Router 🔌port1	✔ vacm	🔌	[-]	SSH
<input type="checkbox"/>	Switch 🔌port2	✔ vacm	🔌	[-]	SSH

8. The number of assigned ports also display on the **Manage Port Tags** page.

CONFIGURING LIGHTHOUSE

Lighthouse can be customized as required, by the creation of users and user Groups, for authentication, and to enable network traffic mirroring.

Lighthouse supports the creation of Users and Groups, Authentication and Script templates. Templates are a centralized way of changing the configuration for enrolled Opengear console server nodes by pushing pre-defined configuration templates to selected nodes.

CREATE TEMPLATES

Administrators can access **CONFIGURE > CONFIGURATION TEMPLATING > Users and Groups Templates** to create, edit, and delete templates. Each template must contain at least one group.

Each template contains a list of user-defined groups and/or individual users. Each group has a defined role which determines what privileges group members have. User roles are defined by the groups they are a member of.

The available group roles are:

- **Node Administrator** — maps to the administrator role on the nodes.
- **Node User** — maps to the ports user role and the pmshell role on the nodes. Ports access can be restricted if required.

CREATING NEW USER AND GROUP TEMPLATES

Administrators can access **CONFIGURE > CONFIGURATION TEMPLATING > Users and Groups Templates** to create, edit, and delete users and groups templates. Each template must contain at least one group.

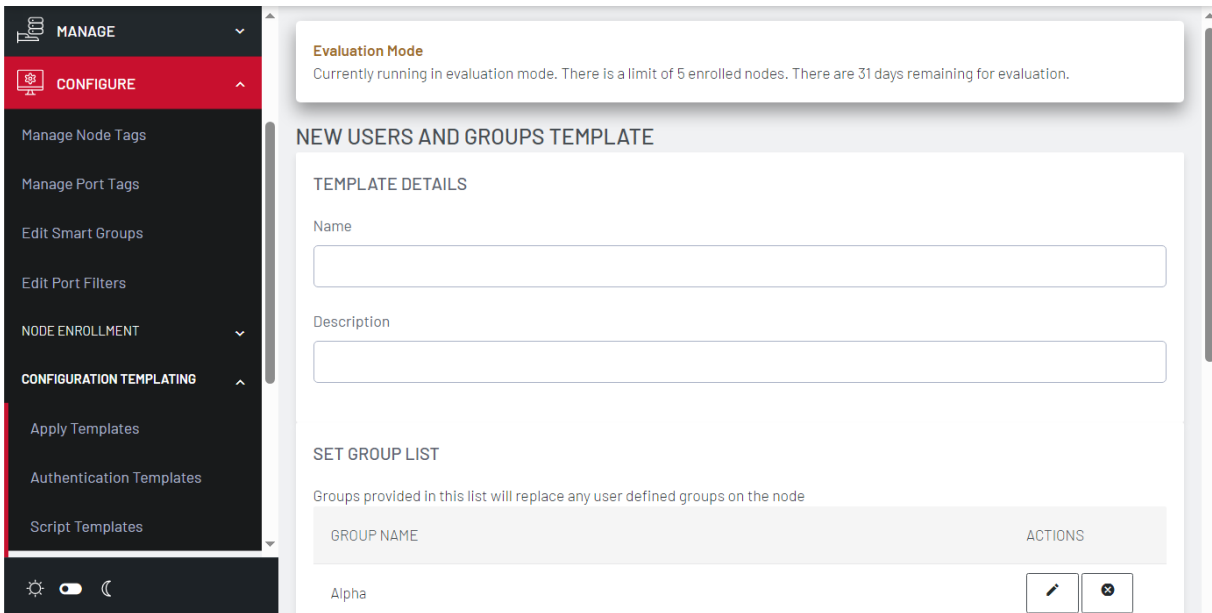
Each template contains a list of user-defined groups and/or individual users. Each group has a defined role which determines what privileges group members have. User roles are defined by the groups they are a member of.

The available group roles are:

- **Node Administrator** — maps to the administrator role on the nodes.
- **Node User** — maps to the ports user role and the pmshell role on the nodes. Ports access can be restricted if required.

To create a new users and groups template:

1. Select **CONFIGURE > CONFIGURATION TEMPLATING > Users and Groups Templates**.
2. Click the **+** button. The **New Users and Groups Template page** displays.



Evaluation Mode
Currently running in evaluation mode. There is a limit of 5 enrolled nodes. There are 31 days remaining for evaluation.

NEW USERS AND GROUPS TEMPLATE

TEMPLATE DETAILS

Name

Description

SET GROUP LIST

Groups provided in this list will replace any user defined groups on the node

GROUP NAME	ACTIONS
Alpha	<input type="text"/> <input type="text"/>

3. Enter a **Name** and **Description** for a template in the **Template Details** section.
4. Click the **+ Add a group** button in the **Set Group List** section to add a new group. The **Group Details** dialog loads.
5. Enter a **Group Name**, a **Description**, and select a **Role** for the group.
6. If **Node User** role is selected, the **Restrict accessible Serial Ports** checkbox and **Serial Ports range** appear.
7. Use the checkbox to restrict access and specify as port or range of ports in the **Serial Ports range** text box.
8. Click **Apply**.
9. Click the **+ Add a user** button in the **Set User List** section to add new users. The **User Details** dialog displays.
10. Enter a **Username**, a **Description**, and a **Password** for the user. Type the password again in the **Confirm Password** text box.

11. Optionally, click checkboxes next to the groups this user should belong to. Only groups from this template are available.
12. Click **Apply**.
13. Continue adding new groups and users until finished.
14. Click **Save Template**.

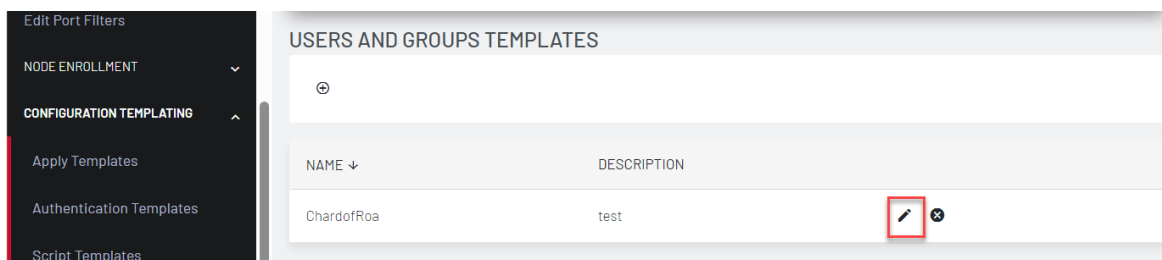
Note:When a users and groups template is pushed to a node, all custom groups on that node are replaced by groups defined in the template. If no users are in the new template, existing users will remain on the node. To push users, the selected nodes need to be running firmware version 4.3.0 or later.

MODIFYING EXISTING USERS AND GROUPS TEMPLATES

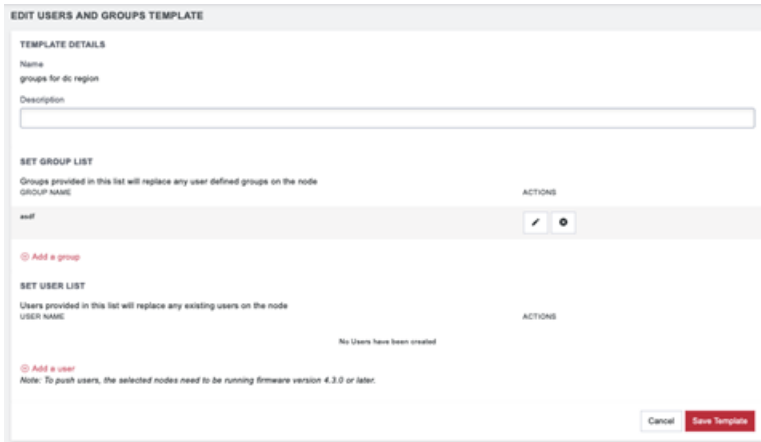
Use the **Edit Users and Groups Template** dialog to modify a template's **Description, Group List, and User List**.

To modify a template:

1. Select **CONFIGURE > CONFIGURATION TEMPLATING > Users and Groups Templates**



2. Click **Edit button** next to the template to be modified. The **Edit Users and Groups Template** dialog displays



3. Make changes to the template's details, group list, or Individual user list as required.
4. Click the **x** button under **Actions** next to any groups or users which need to be removed.
5. Click **Save Template**.

DELETING USERS OR GROUPS FROM A TEMPLATE

To delete users or groups from a template:

1. Select **CONFIGURE > CONFIGURATION TEMPLATING > Users and Groups Templates**.
2. Click the **Edit** button in the **Actions** section of the template.
3. Click the **x** button under **Actions** next to any groups or users which need to be removed.
4. Click **Save Template** to save the changes.

DELETING USERS AND GROUPS TEMPLATES

To delete a template:

1. Select **CONFIGURE > CONFIGURATION TEMPLATING > Users and Groups Templates**.
2. Click the **Delete** button next to the template to be removed. The **Confirmation** dialog displays.
3. Click **Yes** in the **Confirmation** dialog.

The template is deleted.

CREATE AUTHENTICATION TEMPLATES

Only users assigned to the *Lighthouse Administrator* role can access **CONFIGURE > CONFIGURATION TEMPLATING > Authentication Templates** and create authentication templates.

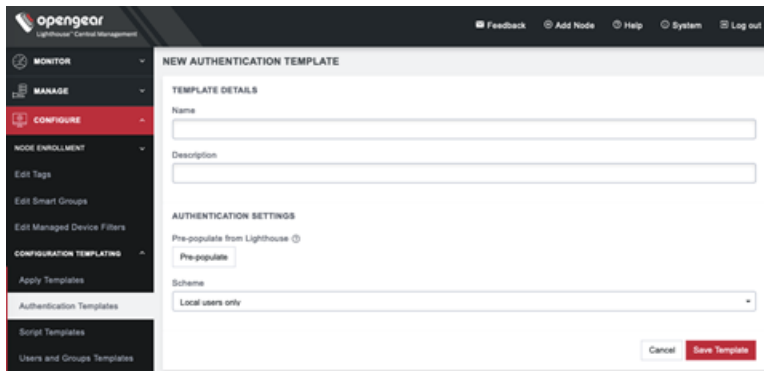
CREATING NEW AUTHENTICATION TEMPLATES

Only users assigned to the *Lighthouse Administrator* role can access **CONFIGURE > CONFIGURATION TEMPLATING > Authentication Templates** and create authentication templates.

The supported modes are **Local**, **Radius**, **TACACS+**, and **LDAP**. For example, if an authentication template is configured to use **RADIUS** as an authentication source, that corresponds to **RADIUSDownLocal** with **Use Remote Groups** ticked on the downstream node.

To create a new authentication template:

1. Select **CONFIGURE > CONFIGURATION TEMPLATING > Authentication Templates**.
2. Click the **+** button. The **New Authentication Template** page loads.



3. Enter a **Name** and **Description** for a template in the **Template Details** section.
4. Select a desired **Scheme** or click **Pre-populate** to pre-populate a template with the current Lighthouse remote authentication configuration.
5. Enter or update authentication settings if required. See 8.10 Configuring AAA for an example.
6. Click **Save Template**.

Note:When an authentication template is pushed to a node, the authentication settings at that node are replaced by the those defined in the authentication template.

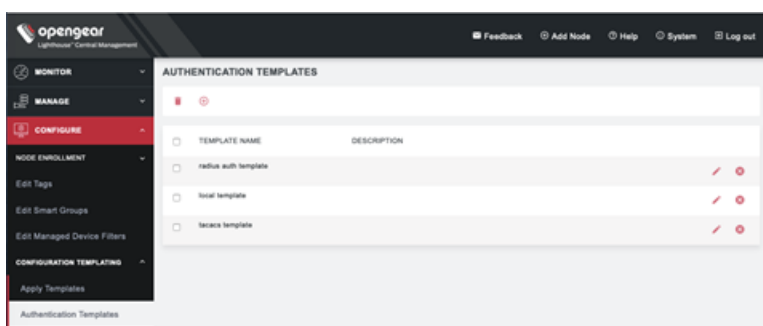
Note:The authentication templates do not support the full list of settings that the Opengear console servers support. However, templates can be applied, and then additional settings configured manually.

MODIFYING EXISTING AUTHENTICATION TEMPLATES

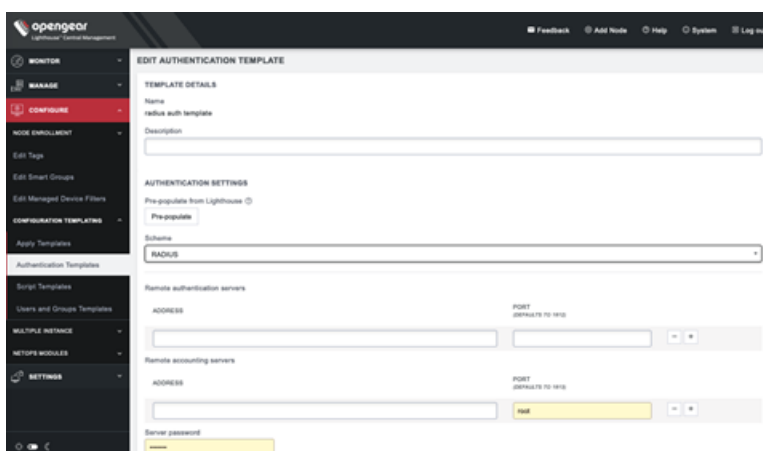
The **Edit Authentication Template** dialog allows the template's **Description** and **Authentication Settings** to be set and changed.

To modify an existing authentication template:

1. Select **CONFIGURE > CONFIGURATION TEMPLATING > Authentication Templates**.



2. Click **Edit** next to the template to be modified. The **Edit Authentication Template** dialog displays.



3. Make required changes.
4. Click **Save Template**.

DELETING AUTHENTICATION TEMPLATES

To delete an authentication template:

1. Select **CONFIGURE > CONFIGURATION TEMPLATING > Authentication Templates**.
2. Click **Delete** next to the template to be removed. The **Confirmation** dialog displays.
3. Click **Yes** in the **Confirmation** dialog.

The authentication template is deleted.

CREATE SCRIPT TEMPLATES

Script Templates allow the user to upload arbitrary shell scripts to be run on a node. For example, a script may set additional configuration settings not available in other templates or store additional files onto the node such as certificates.

The uploaded script must have:

- a .sh extension and
- can't be more than 1MB in size.

Other than those, there are no other restrictions on the script file to be uploaded.

Once saved, the template stores the size and SHA1 checksum of the script. This can be used to verify the script contents of the template once saved.

To apply script templates, the selected nodes need to be running firmware version 4.1.1 or later.

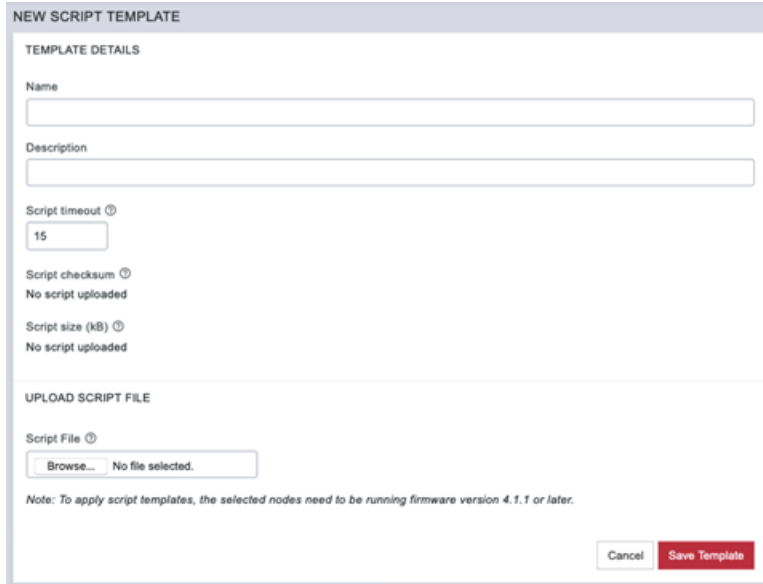
CREATING NEW SCRIPT TEMPLATES

Script Templates allow the user to upload arbitrary shell scripts to be run on a node. A script may set additional configuration settings not available in other templates or store additional files onto the node such as certificates, for example. The uploaded script must have a .sh extension and can't be more than 1MB in size. Other than those, there are no other restrictions on the script file to be uploaded. Once saved, the template stores the size and SHA1 checksum of the script. This can be used to verify the script contents of the template once saved. To apply script templates, the selected nodes need to be running firmware version 4.1.1 or later.

Lighthouse Administrators can create script templates via **CONFIGURE > CONFIGURATION TEMPLATING > Script Templates**

To create a new script template:

1. Select **CONFIGURE > CONFIGURATION TEMPLATING > Script Templates**.
2. Click the **+** button. The **New Script Template** dialog loads.



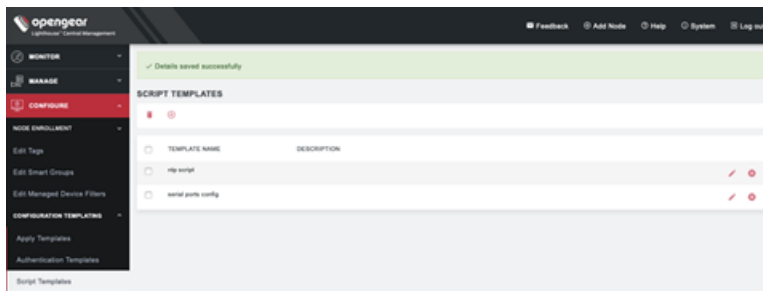
3. Enter a **Name** and **Description** for a template in the **Template Details** section.
4. To select a script to upload, click **Choose file**.
5. Click **Save Template**.

Script checksum and **Script size** are displayed after the template with uploaded script is saved.

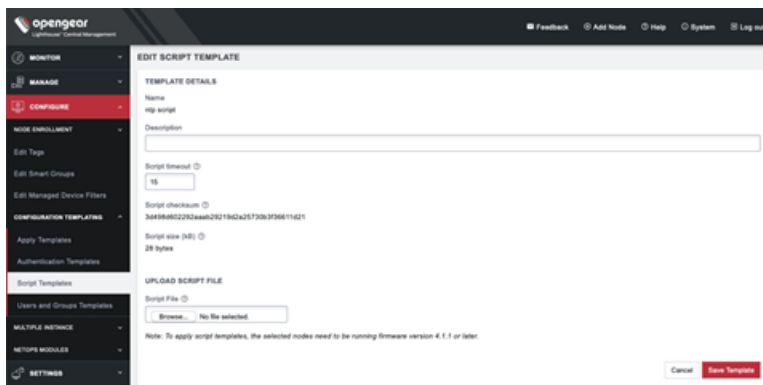
MODIFYING EXISTING SCRIPT TEMPLATES

The **Edit Script Template** dialog allows the template's **Description**, **Script timeout**, and **Script File** to be uploaded. To modify an existing script template:

1. Select **CONFIGURE > CONFIGURATION TEMPLATING > Script Templates**.



2. Click **Edit** next to the template to be modified. The **Edit Script Template** dialog displays.



3. Make the required changes.
4. Click **Save Template**.

DELETING SCRIPT TEMPLATES

To delete a script template completely:

1. Select **CONFIGURE > CONFIGURATION TEMPLATING > Script Templates**.
2. Click **Delete** next to the template to be removed. The **Confirmation** dialog displays.
3. Click **Yes** in the **Confirmation** dialog.

The script template is deleted.

USE TEMPLATES

Users with **Lighthouse Administrator** privileges (that is, users with the Lighthouse Administrator role or users who are members of groups with the Lighthouse Administrator role) can access **CONFIGURE > CONFIGURATION TEMPLATING > Apply Templates** and execute templates affecting any node.

Users with Node Administrator privileges (i.e. users with the Node Administrator role or users who are members of groups with the Node Administrator role) can access **CONFIGURE > CONFIGURATION TEMPLATING > Apply Templates** and execute templates affecting nodes in Smart Groups linked to their role.

APPLY TEMPLATES

Users with Node Administrator privileges (that is, users with the Node Administrator role or users who are members of groups with the Node Administrator role) can access **CONFIGURE > CONFIGURATION TEMPLATING > Apply Templates** and execute templates affecting nodes in Smart Groups linked to their role.

The following types of templates can be applied to selected nodes

- Authentication
- Users and Groups
- Script
- Netops Module Activation
- Port Logging

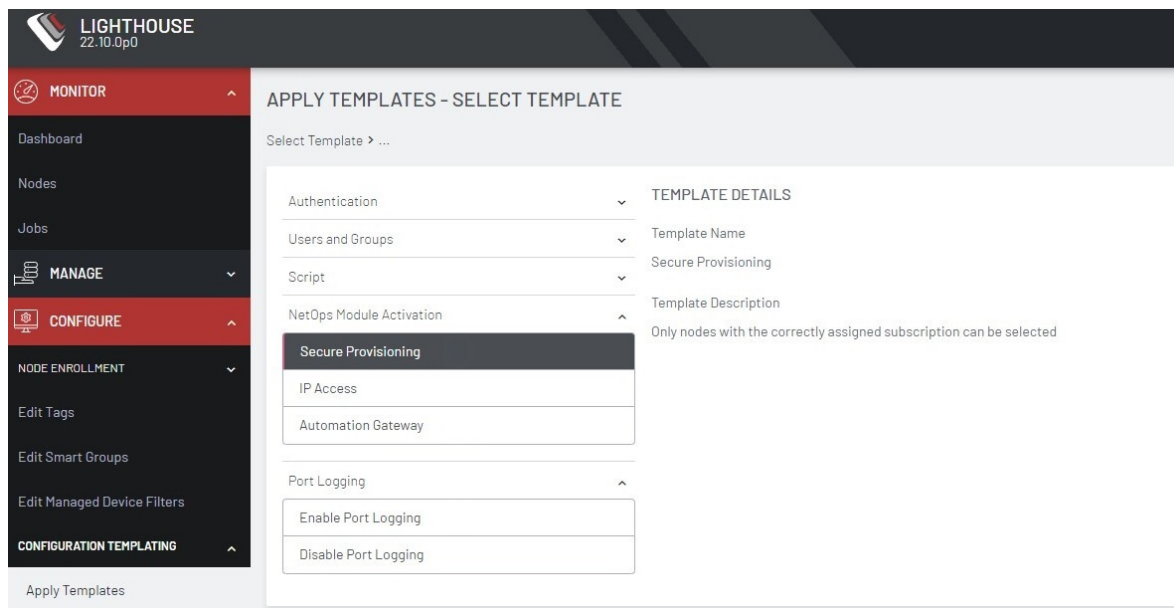
Apply Templates consists of four stages, each one a step in the overall wizard. The steps are:

1. Select Template.
2. Select Nodes.
3. Preflight. This test run simulates what happens if the template is pushed to the selected nodes.
4. Execution.

To apply a template:


1. Select **CONFIGURE > CONFIGURATION TEMPLATING > Apply Templates**.

2. Select a template from the existing template tree. **Template Details** populates with details from the selected template.




3. Click **Next — Select Nodes**. The **Select Nodes** stage loads.
4. Select nodes from the list of enrolled nodes. **Smart Group Filtering** and **Free Text Search Filtering** can be used to narrow down the results.

Note: Third-party nodes are not supported for template execution.

5. Scroll to the bottom of the page and click **Next — Preflight**. The **Preflight** stage loads. To retrieve updated Preflight results and details, click the  Update icon above the table.

After all nodes finish preflight, a success message displays and the **Next — Push Configuration** button becomes active.

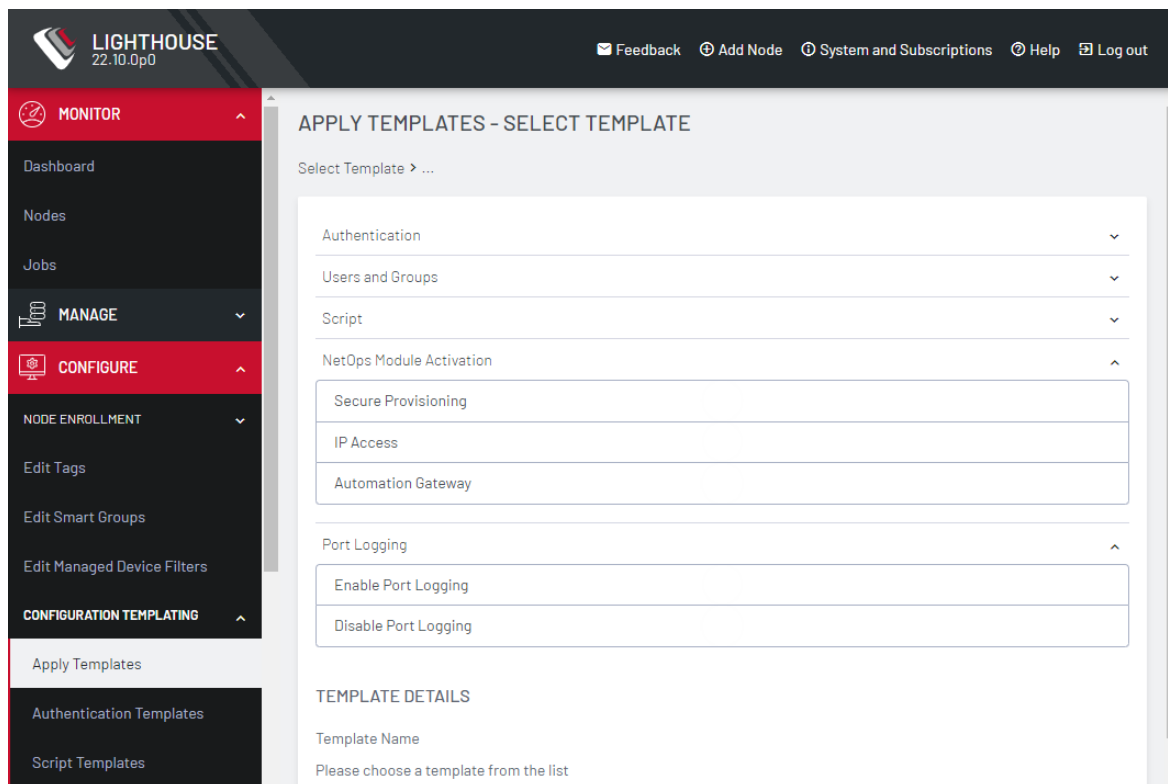
6. Select desired nodes for template execution and click **Next — Push Configuration**. The **Configuration Status** stage loads. To retrieve Push results and details, click the  Update icon above the table.

After all nodes finish the template push, a success message displays.


MANUALLY ACTIVATE NETOPS MODULES VIA TEMPLATE

Lighthouse Administrators can manually apply the Secure Provisioning, Automation Gateway, or IP Access to the suitable Opengear Console Server node.

1. Select **CONFIGURE > CONFIGURATION TEMPLATING > Apply Templates**
2. Click **Secure Provisioning** or **IP Access** or **Automation Gateway** under **NetOps Module Activation**.



The screenshot displays the Lighthouse web interface. The top navigation bar includes the Lighthouse logo, version 22.10.0p0, and links for Feedback, Add Node, System and Subscriptions, Help, and Log out. The left sidebar is divided into sections: MONITOR, MANAGE, CONFIGURE, and CONFIGURATION TEMPLATING. The CONFIGURE section is highlighted in red. Under CONFIGURATION TEMPLATING, the 'Apply Templates' option is selected. The main content area is titled 'APPLY TEMPLATES - SELECT TEMPLATE' and shows a 'Select Template > ...' dropdown menu. The menu is expanded to show several categories: Authentication, Users and Groups, Script, NetOps Module Activation, and Port Logging. Under 'NetOps Module Activation', there are three sub-options: Secure Provisioning, IP Access, and Automation Gateway. Below this, there are options for 'Enable Port Logging' and 'Disable Port Logging'. The 'TEMPLATE DETAILS' section at the bottom indicates that the user should choose a template from the list.

3. Click **Next – Select Nodes**
4. Choose the desired **NetOps Console Server** nodes by clicking the check boxes next to them.
Note: Only applicable Console Servers for the module display during this node selection step.
5. Click **Next – Preflight**. To ensure the preflight check has succeeded click the  *Update* icon above the table.
6. When preflight is complete, click **Next - Push Configuration**.

CONFIGURATION & TECHNICAL SUPPORT REPORTS

Lighthouse can generate a technical support report that includes Lighthouse configuration information and the current system log for the Lighthouse VM.

The support technician may ask for this report if you contact Opendgear Technical Support.

GENERATE A SUPPORT REPORT VIA THE LIGHTHOUSE INTERFACE

To generate a complete configuration and status report regarding a given Lighthouse VM:

1. Select **Help > Technical Support Report**

Lighthouse generates this support report on demand and the report includes the current system log. This process can take several minutes.

2. Click **Download support report**.

This downloads a PKZip archive to the local system. The archive's filename is structured as follows:

```
support-[host-name]-[iso-8601-order-date-and-time-stamp].zip
```

It contains two files:

- `system.txt` — the configuration information also presented in the Technical Support Report window.
- `messages` — the current Lighthouse VM system log.

The two files are also presented in the Support Report text box below the Download support report link. Because the report includes the current system log, this is a long but scrollable presentation and is searchable using the web browser's built-in search function.

GENERATE A SUPPORT REPORT VIA THE LOCAL TERMINAL

To generate a complete configuration and status report regarding a given Lighthouse VM:

1. Select **MANAGE > LIGHTHOUSE > Local Terminal**.
2. At the `[hostname]` login: prompt, enter an administrator username and press Return.
3. At the password: prompt, enter the administrator's password and press Return.
4. At the bash shell prompt, enter

```
support-report -z > /tmp/support.zip  
and press Return
```

The `-z` switch generates the same combined file produced by the Download support report link noted in the Lighthouse UI-specific procedure.

Note: In the example above, the redirect saves the generated PKZip file to `/tmp/support.zip`. However, be aware that the `/tmp` directory is deleted during a reboot, so the file might be saved to a different location.

Here are two options for copying the file from Lighthouse:

- Use SCP from a Mac or Windows client. As `scp` only requires ssh access, no additional configuration is required on Lighthouse for this to work.

```
$ scp root@192.168.0.2:/tmp/support.zip .
root@192.168.0.2's password:
support.zip 100% 321 604.0KB/s 00:00
```

For Windows users, WinSCP on Win10 also works.

- Use the FTP client on Lighthouse to copy the file to an FTP server. Passive mode must be used for this to work. Example:

```
root@LH5-UK-Lab:/tmp# ftp ftp> open 192.168.0.216
Connected to 192.168.0.216.
220 im7200-demo-uk FTP server (GNU inetutils 1.4.1) ready. Name
(192.168.0.216:root): fred
331 Password required for fred. Password:
230- *** Opengear UK Demo IM7216 ***
230 User fred logged in. Remote system type is UNIX.
Using binary mode to transfer files. ftp> passive
```

```
Passive mode on. ftp> bin
200 Type set to I. ftp> put support.zip
227 Entering Passive Mode (192,168,0,216,208,166)
150 Opening BINARY mode data connection for 'support.zip'.
226 Transfer complete.
4132664 bytes sent in 0.128 seconds (32262492 bytes/s) ftp> quit
221 Goodbye.
```

LIGHTHOUSE CLI, SERIAL PORT AND REST API LOGGING

Lighthouse offers command line interface (CLI) and REST API logs.

Note: Logging is disabled by default.

Once enabled, CLI and REST API logs can be found in `/var/log/messages`. All passwords are masked in the logs so that sensitive information is not stored in plain text or leaked.

When you enable logging, you do not need to restart or log out and in again. There are a few caveats:

- CLI logging only works for interactive (human-controlled) terminals. Commands generated by automated scripts will be not be logged.
- Commands such as `ssh` or `telnet` do not produce logs for the commands sent over the connection.
- Requests can be logged for all endpoints, however, only endpoints implemented in Lipy can have responses logged.

Note: These logs are not intended to be used as a definitive record of all commands that have ever been run. A malicious user with full root access can circumvent anything.

For more details see:

<https://ftp.opengear.com/download/documentation/api/lighthouse/og-rest-api-specification-v3-7.html>

USING OGCONFIG-CLI TO ENABLE LOGGING

Logging should be enabled using `ogconfig-cli`. Use the following commands in a Lighthouse terminal to view, enable or disable logging:

- `system.logging_cli_enabled` - Enable/disable logging commands entered in the Lighthouse Terminal.
- `system.logging_rest_enabled` - Enable/disable basic logging for the REST API. These logs report the following information about every REST API call:
 - Time
 - Request type (GET/POST/PUT/DELETE)
 - HTTP status code
 - Username
 - Source IP Address
 - Endpoint

`system.logging_rest_request_enabled` - Enable/disable request logging for every REST API call. In addition to the basic logging, also logs the request body that was provided by the client, if any.

Requires `system.logging_rest_enabled` to be enabled.

CONFIG SEARCHES USING OGCONFIG-CLI

Simple `config` searches can be performed from inside `ogconfig-cli` with the `find` command.

Note: The element being searched must be a list, otherwise the command returns an error.

The syntax is:

```
find <path of list to search> <element to search for> <value to search for>
```

For example, to find enabled users use:

```
ogcfg > find users enabled true
```

Or to find the enabled ports on a particular node set:

```
ogcfg> find nodes[0].ports mode 'ConsoleServer'
```

ADD NODE AND PORT TO LIGHTHOUSE LOGS

Node and port logs will log all access to nodes via Lighthouse using the **pmshell** function, including which console, and which port was accessed by the user when logged in.

When system logging is enabled, user and node selection and user and Port selection is logged. To enable node and port logging on Lighthouse:

1. Navigate to Lighthouse > Manage > Lighthouse > Local Terminal.
2. Login to a user that has rights to use CLI and ogconfig-cli.
3. Node and port logging can only be enabled through ogconfig-cli as follows

```
Oncroot@lighthouse:~# ogconfig-cli
ogcfg> set system.logging_cli_enabled true
root-1-system_logging_cli_enabled: Integer <True> ogcfg> push
OK
ogcfg> exit
```

After node and port logging is enabled, you can view any logs recorded in your Lighthouse's syslog, located at `/var/log/messages`.

EXAMPLE LOGS

Here is an example of logs without request or response logging:

```
2020-03-17 15:29:37,237 INFO [root:117][waitress] POST 400 (root |
192.168.1.1) - /api/v3.4/system/licenses/file
2020-03-17 15:30:23,034 INFO [root:117][waitress] GET 200 (root |
192.168.1.1) - /api/v3.4/users?page=1&per_page=10
```

Here is an example of logs with request or response logging

Note: These logs differ slightly due to being logged with different systems:

```
2020-05-11T05:45:09.567214+00:00 lighthouse rest_api_log[2465]: PUT
200 (root | fd07:2218:1350:4b:a438:f8ff:fe4f:65fc) -
/api/v3.4/system/cli_session_timeout REQUEST={"system_cli_session_
timeout":{"timeout":0}}
2020-05-11 05:45:18,999 INFO [lipy.logging.rest_api:62][waitress] GET
200 (root | fd07:2218:1350:4b:a438:f8ff:fe4f:65fc) -
/api/v3.4/users?page=1&per_page=10 RESPONSE={'users': [{'username':
'root', 'description': 'System wide SuperUser account', 'enabled':
True, 'id': 'users-1', 'no_password': False, 'expired': False,
'locked_out': False, 'rights': {'delete': True, 'modify': True},
'groups': ['groups-2']}], 'meta': {'total_pages': 1}}
```

ENABLE LOGGING

To enable logging, run these commands on the Lighthouse local terminal:

```
root@lighthouse:~# ogconfig-cli
ogcfg> set <value> true
root-1-<value>: Integer <True>
ogcfg> push
OK
ogcfg> exit
```

Replace `<value>` with the desired setting:

- `system.logging_cli_enabled`
- `system.logging_rest_enabled`

- `system.logging_rest_request_enabled` (requires `system.logging_rest_enabled`)
- `system.logging_rest_response_enabled` (requires `system.logging_rest_enabled`)

- **To check if logging is enabled:**

To establish if logging is enabled run these commands on the Lighthouse local terminal:

```
root@lighthouse:~# ogconfig-cli ogcfg> print system
```

This will produce output with Boolean values:

```
system.logging_cli_enabled (bool): false
```

- `system.logging_rest_enabled (bool): false`
- `system.logging_rest_request_enabled (bool): false`
- `system.logging_rest_response_enabled (bool): false`

DISABLE LOGGING

```
root@lighthouse:~# ogconfig-cli ogcfg> set <value> false
root-1-<value>: Integer <False>
ogcfg> push OK
ogcfg> exit
```

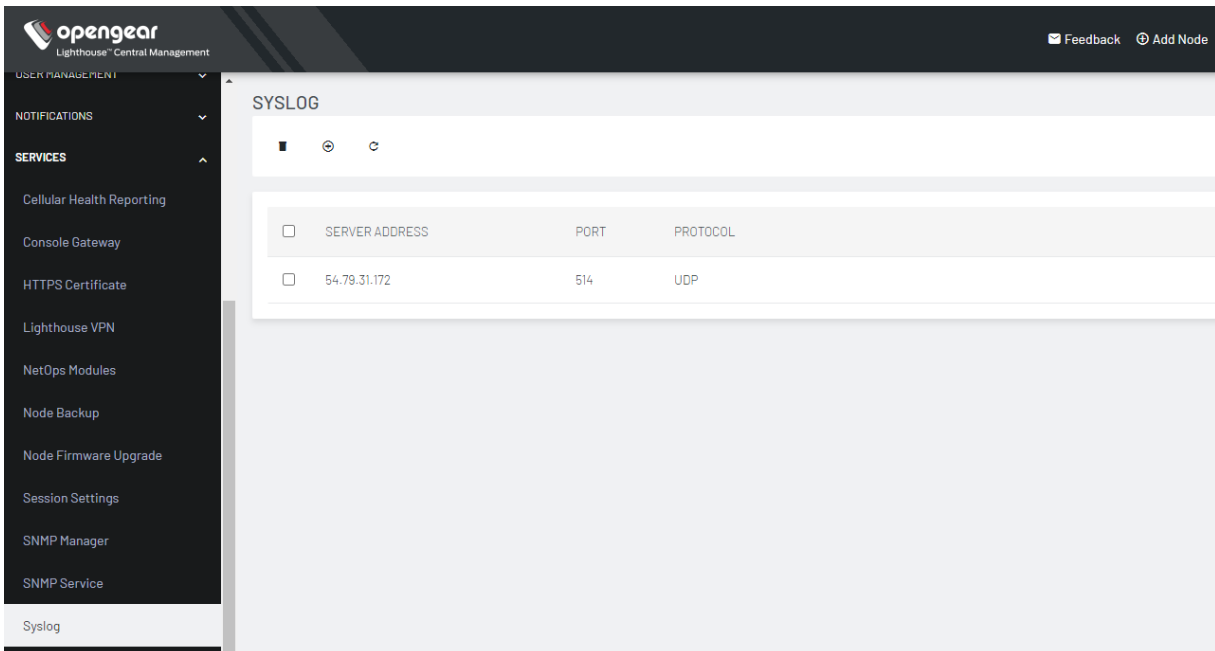
Replace `<value>` with the desired setting:

- `system.logging_cli_enabled`
- `system.logging_rest_enabled`
- `system.logging_rest_request_enabled`
- `system.logging_rest_response_enabled`

SYSLOG EXPORT

Administrative users can specify multiple external servers to export the syslog to via TCP or UDP.

Select **SETTINGS > SERVICES > Syslog**.



The screenshot shows the Lighthouse Central Management interface. The left sidebar contains a navigation menu with the following items: USER MANAGEMENT, NOTIFICATIONS, SERVICES (expanded), Cellular Health Reporting, Console Gateway, HTTPS Certificate, Lighthouse VPN, NetOps Modules, Node Backup, Node Firmware Upgrade, Session Settings, SNMP Manager, SNMP Service, and Syslog (selected). The main content area is titled 'SYSLOG' and features a table with the following columns: SERVER ADDRESS, PORT, and PROTOCOL. A single entry is visible in the table:

<input type="checkbox"/>	SERVER ADDRESS	PORT	PROTOCOL
<input type="checkbox"/>	54.79.31.172	514	UDP

The Syslog page lists any previously added external syslog servers. To add a new one,

1. Click the + symbol. The **Add External Syslog Server** dialog displays.

ADD EXTERNAL SYSLOG SERVER

Server Address 

Protocol 

Port 

Cancel

Apply

2. Enter the **Server Address**.
3. Enter the **Protocol**, either UDP or TCP.
4. Enter the correct **Port**. If no port is entered, UDP defaults to port 514 and TCP defaults to 601.
5. Click **Apply**.

To edit an existing syslog server, click the **Edit** button . Delete a server by clicking the **x** button.

- Mirrors all network traffic over the encrypted OpenVPN tunnel between Lighthouse and the Opengear supported appliances, and forwards all network traffic as decrypted packets to a configurable endpoint. The endpoint is expected to be a “gateway” IP address of an external device that is routable from Lighthouse.
- Preserves the original UDP and TCP/IP header information while mirroring (so that the IDS can reassemble TCP streams and inspect the payload).

Note:Traffic mirroring is only supported on TCP and UDP.

- Provides an option to add a configurable VLAN tag to the Ethernet header.
- Works with multiple instances.

Only users with `sudo` access on the primary Lighthouse CLI (for example, via the admin group) can enable or disable traffic mirroring.

Users must:

- Ensure that the traffic is routed to the required destination in their enterprise network
- Ensure that their firewall rules allow traffic mirroring.

Note:All functionality is available only via the Lighthouse CLI. There is no UI or REST API interface for network traffic mirroring feature. For detailed CLI usage see `traffic_mirroring --help`.

CONFIGURING NETWORK TRAFFIC MIRRORING FOR MULTIPLE INSTANCES

Network traffic mirroring can be configured for multiple instances of Lighthouse. It can mirror traffic between Lighthouses, and between a node and a dependent Lighthouse.

If new dependent Lighthouses are added to a network that is mirroring traffic, they must be re-configured for network traffic mirroring.

Note:All CLI configuration, including enabling and disabling, must be run on the primary Lighthouse. A dependent Lighthouse can only run the `--test` and `--status` arguments.

Users can specify different settings for each Lighthouse. For example:

- A dependent Lighthouse can have a different VLAN ID (or no VLAN ID), and a different destination IP
- A dependent Lighthouse can be set to only mirror node traffic, and not multi-instance traffic. This is useful because the primary is already mirroring that traffic
- You can enable or disable network traffic mirroring per instance.

Note:All newly enrolled secondary Lighthouse instances have network traffic mirroring disabled by default.

TROUBLESHOOTING NETWORK TRAFFIC MIRRORING

It is possible that there may be momentary periods of up to a few seconds where traffic is not being mirrored. For example mirroring outages of a few seconds can occur during:

- Configuration if changes are being made to the VPN subnet or firewall
- The Lighthouse boot process.

To ensure that traffic monitoring is uninterrupted, avoid rapid changes to configuration and repeated reboots of Lighthouse.

MANAGING LIGHTHOUSE USERS

Lighthouse supports locally defined users, and remote users who are authenticated and authorized by Authentication Authorization Accounting (AAA) systems such as LDAP, Radius and TACACs+.

Role Description

Users must be members of one or more groups. Each group has a role assigned to it which controls the level of access that group members have to the system. These roles are:

Role	Description
Lighthouse Administrator	The Lighthouse Administrator role is assigned to groups whose members need to manage and maintain the Lighthouse appliance. Members have access to all data on the Lighthouse system
Node Administrator	The Node Administrator role is assigned to groups that need to manage and maintain a set of Nodes. Each group with the Node Administrator role must have an associated Smart Group which is evaluated to define the set of nodes that the group members have access to.
Node User	The Node User role is assigned to groups that need to access a set of nodes. Each group with the Node User role must have an associated Smart

Group which is evaluated to define the set of nodes that the group members have access to. Optionally, access to the managed devices can be limited by associating the saved **Managed Device Filter** with the Node User role.

Group membership can either be defined locally for local users or defined on the AAA server. Groups that are assigned by the AAA servers must still exist locally.

WORK WITH GROUPS

User groups are used to organize user accounts and their associated privileges. A user group is associated with a set of nodes, its managed devices and ports, and users who are members of the group will have access to those devices through Lighthouse.

For example, administrators can configure port access, and ensure that devices are only accessible to users with the appropriate permissions.

A group may also be associated with one or more roles, which provide permissions to access operational features in Lighthouse.

A user may be a member of multiple groups.

ABOUT GROUPS

THE `NETGRP` GROUP

The `netgrp` group exists as a convenient way to set the permissions of all users that only exist on the [AAA] server rather than having to manage the permissions of every remote-only user.

Below are some points on how the `netgrp` group operates:

- The `netgrp` group exists on all lighthouses but is disabled by default
- Do not enable the `netgrp` group before configuring its permissions because it provides admin privileges by default.
- If a user authenticates remotely using a [AAA] server and that user doesn't yet exist locally on the lighthouse, then the user is automatically added to the `netgrp` group. Note, that a user can exist in the Lighthouse Linux system but not in the Lighthouse config

There is no hard requirement for a remotely authenticated user to be a member of the `netgrp` group when logging in. However, if the `netgrp` group is the only way the user gains the required permissions to log in, then they do need to be a member of the `netgrp` group and the group needs to be enabled.

REMOTE GROUPS

When a user authenticates using a [AAA] server, any groups that the server returns are added to a list of groups that the user becomes a member of. If any of those groups match a local group on the Lighthouse, then the user becomes a member of that group and gains any permissions provided by that group.

For example, if a user authenticates remotely and the [AAA] server returns the following groups:

- my_group1
- my_group2

If the lighthouse has a group called my_group1 but it does not have a group my_group2 then the authenticated user will gain the privileges provided by my_group1 and the remote group my_group2 will simply be ignored.

Note: If the user is a member of any other groups locally on the lighthouse, the user will also gain any permissions provided by those groups.

To summarise, a user will be a member of

- the local groups that the user is locally configured to be a member of AND
- any remote groups returned by the [AAA] server that match groups on the lighthouse.

If the authenticated user doesn't yet exist on the lighthouse, the user will be:

- a member of any remote groups that match groups on the Lighthouse AND
- a member of the `netgrp` group,

Note: The `netgrp` group is disabled by default.

If a group is disabled, the user does not get the permissions from that group.

REMOTE GROUP NAME CONVERSION

To further align Lighthouse remote authentication with legacy console servers such as ACM 7000, remote groups from the [AAA] server are applied as they are returned but in addition, the remote groups are converted such that:

- uppercase characters are converted to lowercase
- any character that is not a number, a letter, an underscore or a hyphen is converted to an underscore
- These converted group names are added to the unconverted group names

Some legacy console servers only use the converted group names but Lighthouse uses both the unconverted and converted remote group names.

If a converted group name is the same as the unconverted group name, the converted group name is simply ignored.

Below are examples of a remote group name and its corresponding converted group name:

My Group : my_group

My-Group# : my-group_

my@group: my_group

my#odd@\$group : my_odd__group

CREATING NEW GROUPS AND ROLES

User groups and roles allow you to control access to nodes, managed devices and ports by creating filters that specify permissions.

CREATE A NEW GROUP

1. Select **SETTINGS > USER MANAGEMENT > Groups and Roles**. Select the **User Groups** tab.
2. Click **+ Add User Group**. The **New Group** page opens.
3. Click **Enabled** to enable group.

4. Enter a **Group Name** and **Group Description**.

Note: **Group Name** is case sensitive. It can contain numbers and some alphanumeric characters. When using remote authentication, characters from a user's remote groups that are not allowed on Lighthouse are converted to underscores during authentication. Local groups can be created that take that into account, allowing the authentication to continue.

5. If desired, you can select a **Linked Port Filter** and **Linked Smart Group** to associate with this group.

The Linked Port Filter can be used to restrict groups and users to only view ports that are explicitly tagged for their use.

6. The **CLI Permissions** section displays Command Line Interface (CLI) permissions based on the roles you have assigned to this group. To change the permissions, you can edit or add new roles with the desired CLI Permissions. See ["Create a new Role" on page 239](#).
7. Add one or more roles by clicking **Add Role** and checking the desired roles. Each role has specific operation permissions associated with it and **CLI (Command Line Interface)** access levels for **console shell**, **shell**, and **PM shell**. Click view details to see the information for each group.

8. You can also control the new group's permissions independently of the roles you add to your group. Scroll to the bottom of the page to specify Full Access, Read Only, or Deny. Click to the right of each Operation row to see all options.

Note: See [Available Operations Permissions](#) for a list of all options.

9. Click **Save Group**.

AVAILABLE ROLES:

- **Lighthouse Administrator:** Members of groups with this role have **Full** access to all nodes and managed devices.
- **NodeAdmin:** Has no shell access. Has **Read Only** access to Netops Modules, all Nodes & Configuration Operations, Cell Health, Smart Groups, Tags, and Jobs.
- **NodeUser:** Has **PM Shell** access. Has **Read Only** access to Nodes & Devices (Base) and Tags.
- **Lighthouse Reporter:** Has no shell access. Has **Read Only** access to all Operations.

You can also create a custom role that allows you to modify **CLI Permissions** and **Operations Permissions** by clicking "[Create a new Role](#)" on page 239 on the New Group page.

A new role can also be based on an existing role with the **Use as template** link on the upper right of a role's detail page.

AVAILABLE OPERATIONS PERMISSIONS:

- **Logging**

Port Logging – Manage port logging settings.

Syslog – Manage system syslog settings.

- **Netops**

Netops Modules

- **Nodes & Configuration**

Nodes & Devices (Base) – Access to dashboard, nodes, managed devices, node Enrollment, console gateway, and Node web UI.

Nodes & Devices (Advanced) – Access to jobs, pending nodes, smart groups, and managed device filters.

Nodes Firmware Management

Template Push – Manage templates and push templates to nodes.

- **Service Settings**

LHVPN

Cell Health

Console Gateway

Date & Time

HTTPS

Netops – Install Netops modules and manage local Netops repositories.

Node Backup

Session Settings. Check if this will cause any conflicts with Multiple instance permissions.

SNMP

SSH

Syslog

- **Smartgroups & Tags**

Bundles – Manage and use bundles.

Smart Groups – Manage and use smart groups.

Tags – Manage and use tags.

- **System**

Admin & Licensing – Manage access settings for Lighthouse and license settings.

Backup & Restore

Jobs

Multi-instance – Manage multi-instance settings and control state of instances.

Network Interfaces – Manage network interface settings.

System Upgrade & Reset

- **Users & Permissions**

Authentication – Manage authentication settings including methods, policies, and restrictions.

Groups & Roles – Create and edit groups and roles. May not assign them to users.

Users – View, manage, create, and delete users.

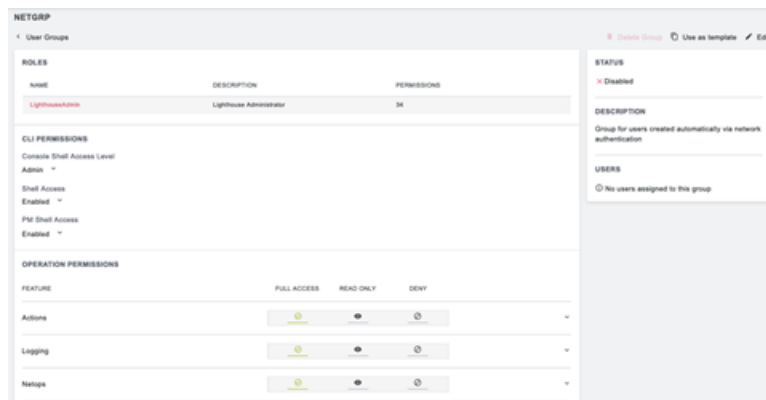
Note:When a new group is given the **Lighthouse Administrator** role, members of the group have access to the `sudo` command. Groups or users with the **Lighthouse Administrator** role are added to the admin group, which is

in the list of allowed `sudoers`. On first boot of a new Lighthouse instance, the `root` user is the only member of the admin group and the only user with `sudo` access.

MODIFYING EXISTING GROUPS

To modify an existing group:

1. Select **SETTINGS > Groups and Roles**. If necessary, click on the **USER GROUPS** tab.
2. Click the name of the group to be modified.
3. Click the **Edit** icon on the upper right and make desired changes.
4. Click **Save Group**.



The group details page allows the group's **Description**, **Access Controls**, **Roles**, **Linked Smart Group**, and **Port Filter** to be set and changed.

If a Group's **Role** is **Lighthouse Administrator**, the group's **Smart Group** is **All Nodes** and **Port Filter** is **All Ports**. This cannot be changed. If a Group has a **Smart Group** other than **All Nodes** or a **Port Filter** other than **All Ports**, the group's Role cannot be set to **Lighthouse Administrator**.

The **Groups** page also allows you to delete groups. All users who were members of the deleted group lose any access and administrative rights inherited from the group.

Note:The **netgrp** group is inherited as the primary group for all remote AAA users who are not defined locally on Lighthouse. By default, **netgrp** has the **Lighthouse Administrator** role and is disabled - it must be enabled to take effect for remote AAA users.

USE AN EXISTING GROUP AS A TEMPLATE FOR A NEW GROUP

To use an existing group as a template for a new group:

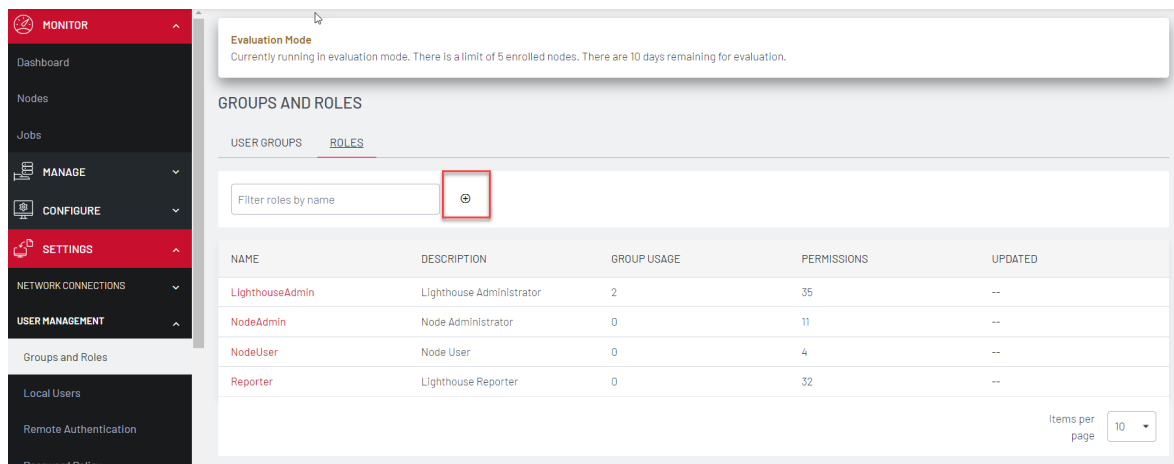
1. Select **SETTINGS > USER MANAGEMENT > Groups and Roles**. If necessary, click on the **USER GROUPS** tab.
2. Click the name of the group to be used as a template.
3. Click the **Use as Template** icon on the upper right. This opens a new group page with the settings from the group you selected as a template.
4. Change the **Group Name** and make and other desired changes.
5. Click **Save Group**.

CREATE A NEW ROLE

You can create a new role in two ways, either from the Roles tab or by using an existing role as a template.

To create a new role from the Roles tab:


1. Select **SETTINGS > USER MANAGEMENT > Groups and Roles**.
2. Click the **ROLES** tab.



Evaluation Mode
Currently running in evaluation mode. There is a limit of 5 enrolled nodes. There are 10 days remaining for evaluation.

GROUPS AND ROLES

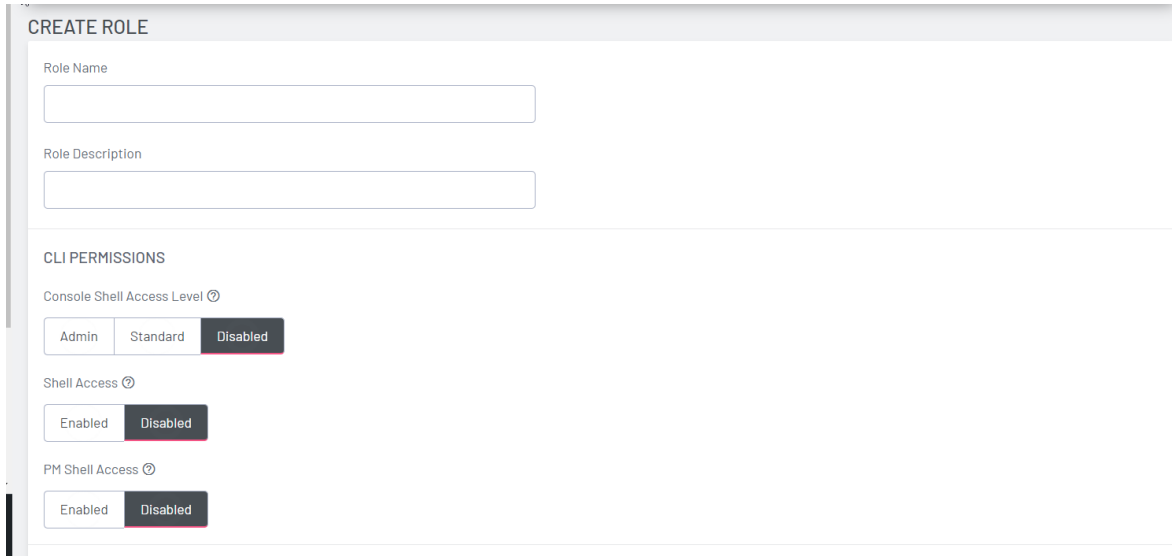
USER GROUPS **ROLES**

Filter roles by name 

NAME	DESCRIPTION	GROUP USAGE	PERMISSIONS	UPDATED
LighthouseAdmin	Lighthouse Administrator	2	35	--
NodeAdmin	Node Administrator	0	11	--
NodeUser	Node User	0	4	--
Reporter	Lighthouse Reporter	0	32	--

Items per page 10

3. Click **+** button. The **Create Role** page opens



4. Enter a **Role Name** and **Role Description**.
5. Modify the **CLI Permissions** for as desired.
Console Shell Access: Ability to connect to nodes' command lines via Lighthouse's SSH.
Shell Access: Ability to access Lighthouse's command line as administrator.
PM Shell Access: Ability to connect to serial ports via SSH.
6. You can also control the **Operation Permissions** for the new role independently. Specify
Full Access,
Read Only, or
Deny.
Click to the right of each Operation row to see all options.

Note: See [Available Operations Permissions](#) for a list of all options.

7. Click **Save Role**.

To create a new role from an existing role:

A new role can also be based on an existing role with the **Use as template** link on the upper right of a role's detail page.

1. Select **SETTINGS > USER MANAGEMENT > Groups and Roles**.
2. Click the **ROLES** tab.
3. Select the role you wish to copy from the list.
4. Click **Use as template**. The Create Role tab displays with all the settings of the existing role. Make changes if necessary.
5. Click **Save Role** to create the new role.

WORK WITH USERS

You can create new users, edit existing users, delete users and alter groups and permissions. Users can be either local users or remote users, in both instances you must understand how users must be authenticated. Lighthouse allows users to use the following authentication modes:

- LDAP
- RADIUS
- TACAS

The root user can be authenticated by AAA but it will always try local auth for the root user first.

AAA MODE COMPARISON

Name	Password And Group Source	Extra Notes
Local	Authentication: Local only Groups: Local	All users must exist locally before they can log in.
[AAA] (Radius, Tacacs+, Ldap)	Authentication: the user-name/password provided by the user is ONLY tested against the [AAA] server. Groups: Union of the user's local groups and their [AAA] groups. If the user didn't exist locally and successfully authenticated via [AAA], the user is also added to the <code>netgrp</code> group.	If there is a local user with the same username as the [AAA] user and that user tries to login with the local password, login will be denied UNLESS the local password is the SAME as the remote password, that is, the remote password is used to login. If the [AAA] server is unreachable, the only user that can authenticate locally is <code>root</code> .

Name	Password And Group Source	Extra Notes
Local[AAA] (LocalRadius, LocalTacacs+, LocalLdap)	<p>Authentication: The username/password provided by the user is first tested locally and if local authentication fails then the [AAA] server is used.</p> <p>Groups: Union of the user's local groups and their [AAA] groups. If the user didn't exist locally and successfully authenticated via [AAA], then the user is also added to the netgrp group.</p>	<p>Basically, the user can log in with either their local password (if the user exists locally) or their [AAA] password (if the user exists in the [AAA] server). The main point is that the username/password is tested locally first and if it fails, [AAA] auth is attempted with the same username and password.</p>
[AAA]Local (RadiusLocal, Tacacs+Local, LdapLocal)	<p>Authentication: The username/password provided by the user is first tested by the [AAA] server and if [AAA] authentication fails then the credentials are tested locally. Groups: Union of the user's local</p>	<p>Basically, the user can log in with either their local password (if the user exists locally) or their [AAA] password (if the user exists in the [AAA] server).</p>

Name	Password And Group Source	Extra Notes
	<p>groups and their [AAA] groups.</p> <p>If the user didn't exist locally and successfully authenticated via [AAA], then the user is also added to the netgrp group.</p>	<p>The main point is that the username/password is tested by [AAA] first and if it fails, local auth is attempted with the same username and password.</p>
<p>[AAA]DownLocal (RadiusDownLocal, Tacacs+DownLocal, LdapDownLocal)</p>	<p>Authentication: Local authentication is ONLY used if the [AAA] server is unreachable. Otherwise [AAA] authentication is always used. Groups: Union of the user's local groups and their [AAA] groups. If the user didn't exist locally and successfully authenticated via [AAA], then the user is also added to the netgrp group.</p>	<p>This should behave exactly the same as the [AAA] mode until the [AAA] server is unreachable at which point, local authentication is attempted.</p>

ABOUT NON-SYSTEM USERS

There are two main types of non-system users in Lighthouse (non-system users include users other than root and users that exist for the purpose of providing services on the Lighthouse):

1. Users added via the UI/REST API or Lighthouse config: These users are added by using the UI or the REST API (or even the `ogadduser` CLI command).
 - These users exist in the Lighthouse config/database and are visible in the UI and REST API
 - The users are added as standard Linux users and can be seen in `/etc/passwd` and `/etc/shadow`
2. Users added via [AAA] authentication: These users are created in the Lighthouse Linux system when the user doesn't already exist locally and the user has successfully authenticated remotely via [AAA]
 - These users are simply added to the Linux OS and can be seen in `/etc/passwd`.
 - These users are NOT visible in the Lighthouse config/database or UI and REST API

LOCAL USERS ADDED BY AAA AUTHENTICATION

If a user does not exist locally on the Lighthouse when the user authenticates remotely via [AAA], then the user is added to the linux system but NOT into the lighthouse configuration/database. This means:

- These users are not visible in the UI or config/database
- These users are visible in `/etc/passwd`

Also, a user that is created locally after authenticating via [AAA] is automatically added to the `netgrp` group, even though that group may be disabled (which it is by default). ["About Groups" on page 229](#).

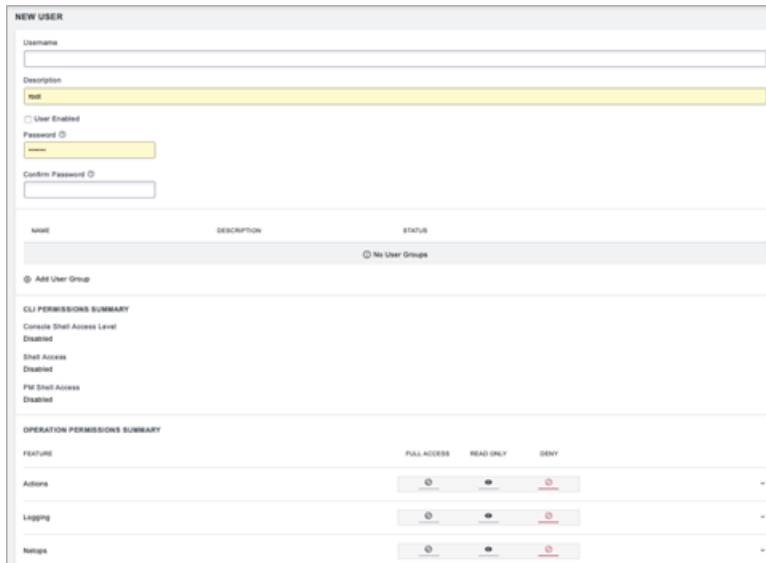
CREATING NEW LOCAL USERS

To create a new local user:

1. Select **SETTINGS > USER MANAGEMENT > LOCAL USERS**.

By default, the root user is the only user listed.

2. Click the **+** button. The **New User** page displays



NAME	DESCRIPTION	STATUS
No User Groups		

FEATURE	FULL ACCESS	READ ONLY	DENY
Actions	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Logging	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Netsys	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

3. Enter a **Username**, **Description**, and **Password**.
4. Re-enter the **Password** in the **Confirm Password** field.
5. Select the **User Enabled** checkbox.
6. Click on **Add User Group** to add this user to any existing User Groups.
7. Choose which **CLI** options this user should have.

8. Select any **Operation Permissions** this user should have. See "[Create a new group](#)"
9. Click **Save User**.

Note:When a new user is created, an entry is added to the syslog, indicating the new user's name, the user that performed the operation, database queries, and the time that it occurred:

```
2020-05-22T16:22:46.490627+01:00 localhost rest_api_log[62]: GET 200
(root | 192.168.1.230) - /api/v3.5/users?page=1&per_page=10 RESPONSE=
{'users': [{'username': 'root', 'description': 'System wide SuperUser
account', 'enabled': True, 'id': 'users-1', 'no_password': False,
'expired': False, 'locked_out': False, 'rights': {'delete': True,
'modify': True}, 'groups': ['groups-2']}, {'username': 'fred',
'description': 'fred', 'enabled': True, 'id': 'users-2', 'no_
password': False, 'expired': False, 'locked_out': False, 'rights':
{'delete': True, 'modify': True}, 'groups': ['groups-2']}], 'meta':
{'total_pages': 1}}
```

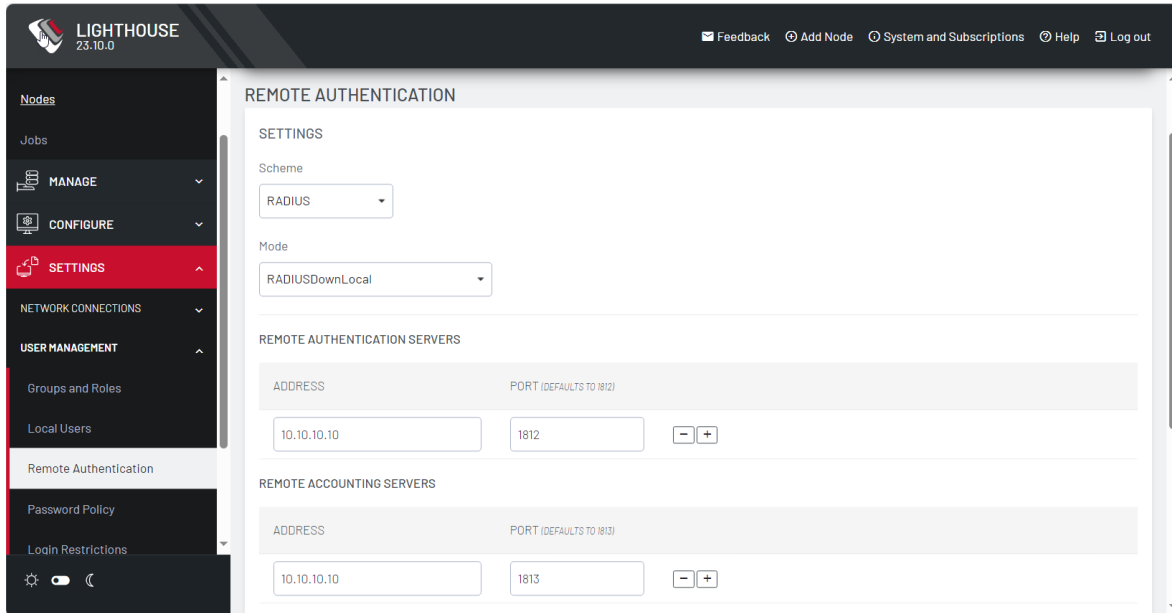
If the created user is set to disabled, the `configurator_users` message does not appear as they have not been added to the passwords file.

The syslog can be accessed from Lighthouse by clicking Help > Technical Support Report.

CREATE NEW LOCAL USERS FOR REMOTE AUTHENTICATION

To create a new user without a password which causes them to fail back to remote authentication:

1. Select **SETTINGS > USER MANAGEMENT > Remote Authentication**

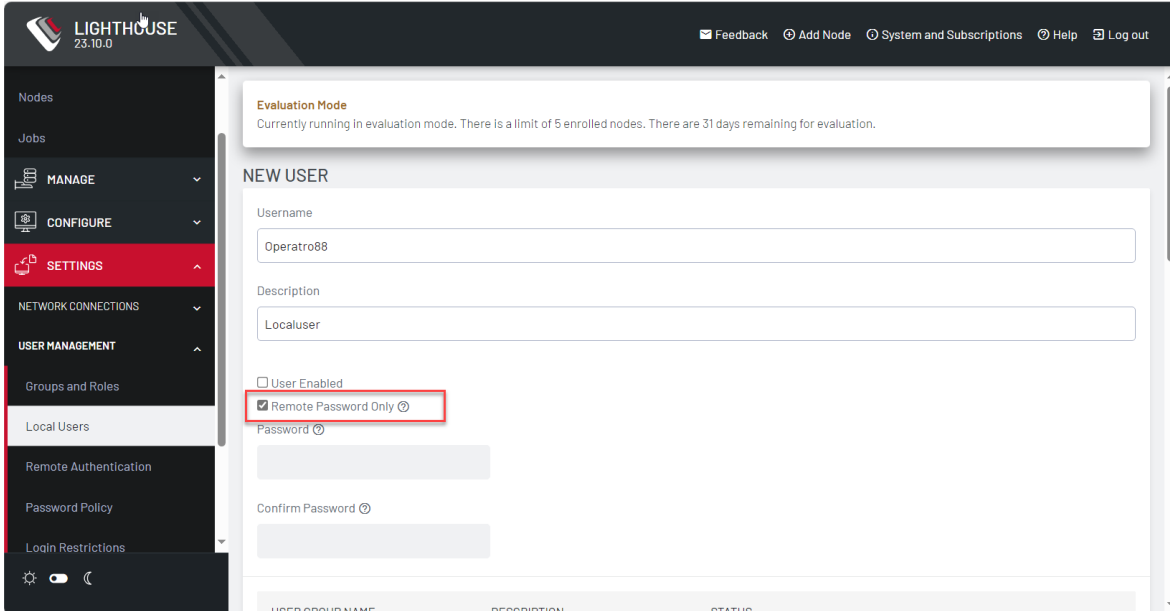


The screenshot displays the Lighthouse web interface for configuring Remote Authentication. The left sidebar shows the navigation menu with 'SETTINGS' selected. The main panel is titled 'REMOTE AUTHENTICATION' and includes the following sections:

- SETTINGS**:
 - Scheme: RADIUS
 - Mode: RADIUSDownLocal
- REMOTE AUTHENTICATION SERVERS**:
 - ADDRESS: 10.10.10.10
 - PORT (DEFAULTS TO 1812): 1812
- REMOTE ACCOUNTING SERVERS**:
 - ADDRESS: 10.10.10.10
 - PORT (DEFAULTS TO 1813): 1813

2. Choose a remote Authentication **Scheme** and enter appropriate settings.
3. Click **Apply**.
4. Select **SETTINGS > USER MANAGEMENT > Local Users**

- Click the **+** button. The **New User** dialog loads.



LIGHTHOUSE 23.10.0

Feedback Add Node System and Subscriptions Help Log out

NEW USER

Username
Operatro88

Description
Localuser

User Enabled
 Remote Password Only

Password
Confirm Password

USER GROUP NAME	DESCRIPTION	STATUS
-----------------	-------------	--------

- Enter a **Username** and **Description**.
- Select the **Remote Password Only** checkbox. The **Remote Password Only** checkbox only displays if you set up the Scheme correctly in Step 2.
- Select the **Enabled** checkbox. The Password and Confirm Password fields are disabled.
- Select the **Remote Password Only** checkbox. The Password and Confirm Password fields are disabled.
- Click **Save User**.

Note: When a new user is created, an entry is added to the syslog, indicating the new user's name, the user that performed the operation, database queries, and the time that it occurred:

```
2020-05-22T16:22:46.490627+01:00 localhost rest_api_log[62]: GET 200
(root | 192.168.1.230) - /api/v3.5/users?page=1&per_page=10 RESPONSE=
{'users': [{'username': 'root', 'description': 'System wide SuperUser
account', 'enabled': True, 'id': 'users-1', 'no_password': False,
'expired': False, 'locked_out': False, 'rights': {'delete': True,
'modify': True}, 'groups': ['groups-2']}, {'username': 'fred',
'description': 'fred', 'enabled': True, 'id': 'users-2', 'no_
password': False, 'expired': False, 'locked_out': False, 'rights':
{'delete': True, 'modify': True}, 'groups': ['groups-2']}], 'meta':
{'total_pages': 1}}
```

If the created user is set to disabled, the `configurator_users` message does not appear as they have not been added to the passwords file.

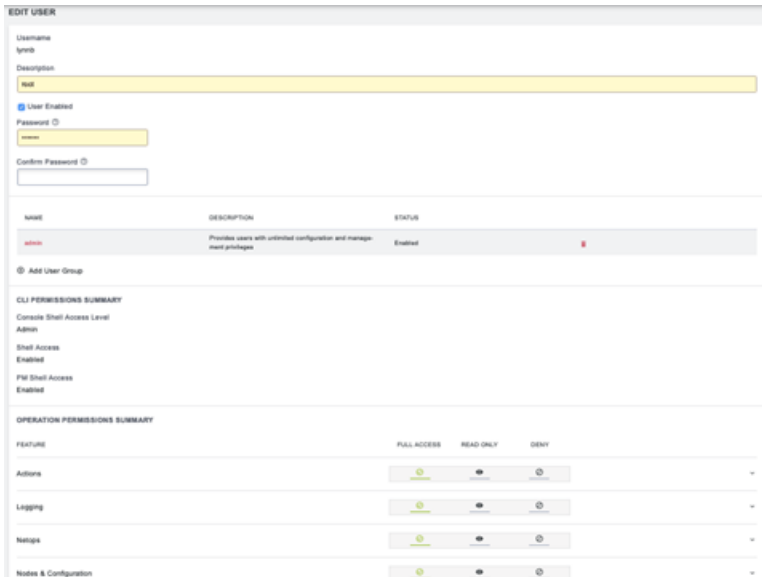
The syslog can be accessed from Lighthouse by clicking Help > Technical Support Report.

MODIFY EXISTING USERS

To edit settings for an existing user:

1. Select **SETTINGS > USER MANAGEMENT > Local Users**
2. Click the **name** of the user to **edit** this user and make desired changes. You may change CLI access and specific access to operations. You may also control which groups this user is a member of.

3. Click **Save User**.



EDIT USER

Username
 admin

Description
 Provides users with unfiltered configuration and management privileges

User Enabled

Password
 Confirm Password

NAME	DESCRIPTION	STATUS
admin	Provides users with unfiltered configuration and management privileges	Enabled

CLI PERMISSIONS SUMMARY

Console Shell Access Level
 Admin

Shell Access
 Enabled

PIB Shell Access
 Enabled

OPERATOR PERMISSIONS SUMMARY

FEATURE	FULL ACCESS	READ-ONLY	DENY
Actions	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Logging	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Notifs	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Notifs & Configuration	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

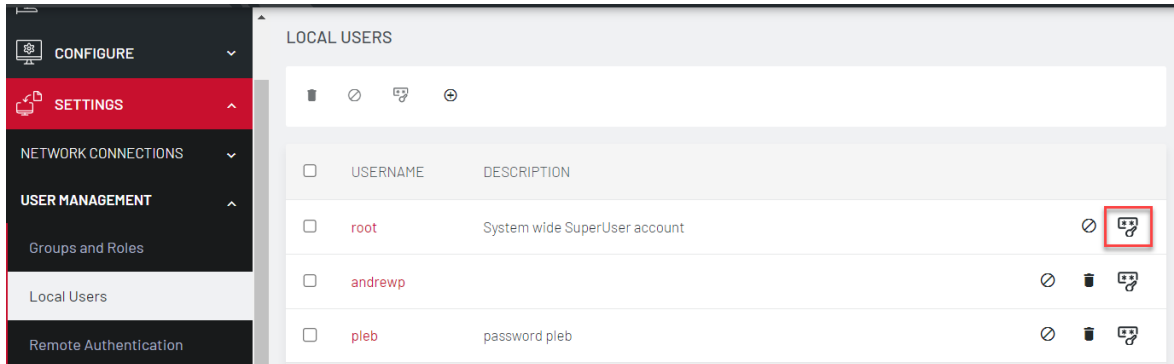
The **Edit Users** dialog also allows the user's **Description** to be changed and the user's **Password** to be reset. The username cannot be changed. To disable a user, uncheck the **Enabled** checkbox.

Note: Disabled users cannot login to Lighthouse using either the Web-based interface or via shell-based logins (that is `sshusername-disabled@lighthouse-name-or-ip`). The user and the `/home/username-disabled` directory still exist in the Lighthouse VM file system.

EXPIRE USER PASSWORD

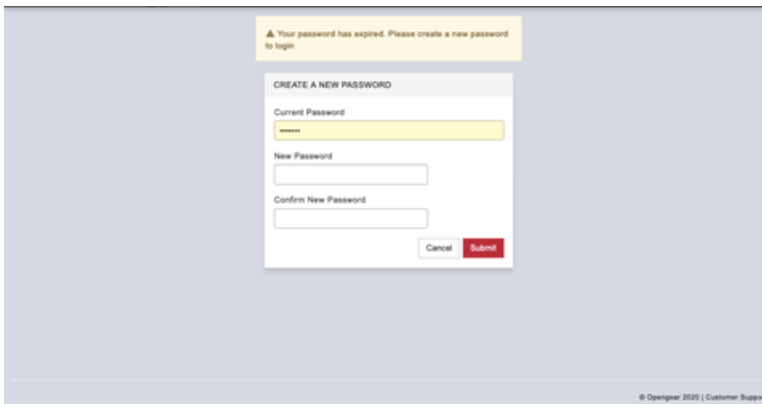
You can set user passwords to expire. To ensure a user's password is set to expire:

1. Select **SETTINGS > USER MANAGEMENT > Local Users**.
2. Click the **Expire Password** button in the Actions section of the user to be deleted.



3. Click **Yes** in the Confirmation dialog.

The next time this user logs in, the user will be required to change the password.

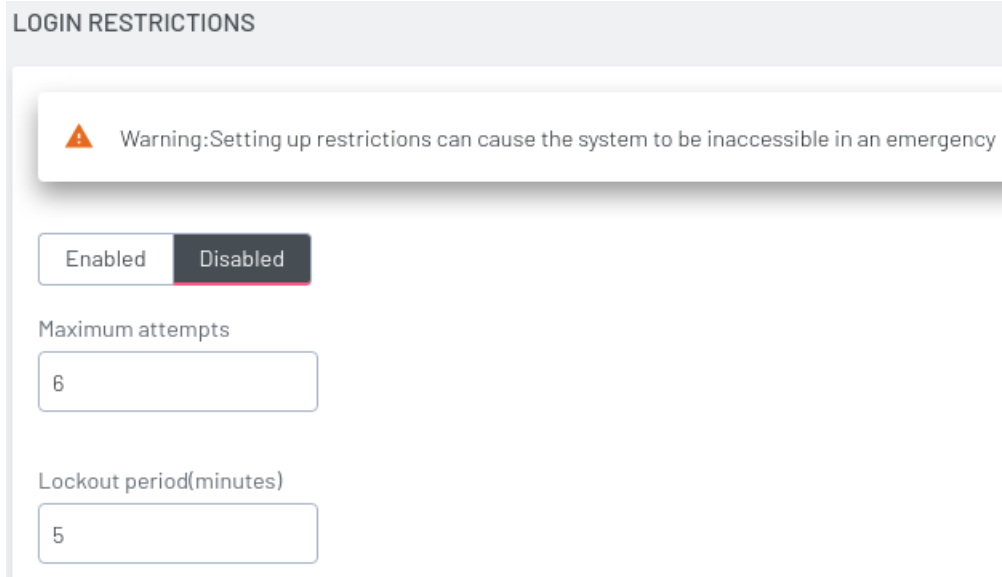


SETTING LOGIN RESTRICTIONS

Login restrictions can be applied by administrator users to prevent unauthorized login attempts via the UI and REST API.

Note: This does not affect SSH or Console logins.

1. Select **SETTINGS > USER MANAGEMENT > Login Restrictions**.



LOGIN RESTRICTIONS

Warning: Setting up restrictions can cause the system to be inaccessible in an emergency

Enabled Disabled

Maximum attempts

6

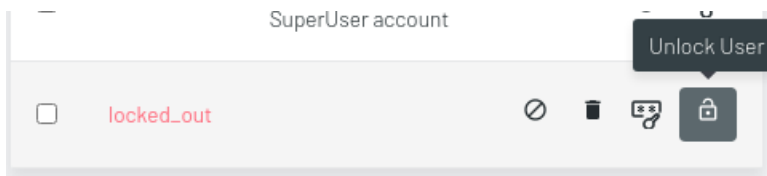
Lockout period(minutes)

5

2. Enter a value for either or both of the following:
 - **Maximum attempts** – choose a number of attempts a user can enter an incorrect password before being locked out.
 - **Lockout period** – enter a number of minutes until a user can try to login again after reaching maximum incorrect login attempts.

After a user has been locked out, an administrator can unlock the account.

1. Go to **SETTINGS > USER MANAGEMENT > Local Users**.
2. Click the **Unlock** button associated with the locked out user's row in the User table.



DISABLING A LIGHTHOUSE ROOT USER

To disable a root user:

1. Make sure that another user exists that is in a group that has the **Lighthouse Administrator** role.
2. Select **SETTINGS > USER MANAGEMENT > Local Users**
3. Click **Disable** in the **Actions** section of the root user.
4. Click **Yes** in the **Confirmation** dialog.

To re- enable the root user, login as another user with Lighthouse Administrator role and enable access for root user from Actions section on Users page

An Identity Provider (IdP) stores and manages users' digital identities An IdP may check user identities via username-password combinations and other factors, or it may simply provide a list of user identities that another service provider (like an SSO) checks. An IdP can authenticate any entity connected to a network or a system, including computers and other devices.

DELETE AND DISABLE USERS

You can delete users and disable root users.

To delete a user:

1. Select **SETTINGS > USER MANAGEMENT > Local Users**
2. Click the **Delete** button in the **Actions** section of the user to be deleted.
3. Click **Yes** in the **Confirmation** dialog.

Disabling a Lighthouse root user

To disable a root user:

Make sure that another user exists that is in a group that has the Lighthouse Administrator role.

1. Select **SETTINGS > USER MANAGEMENT > Local Users**
2. Click **Disable** in the **Actions** section of the root user.
3. Click **Yes** in the **Confirmation** dialog.

To re-enable root user:

1. Log in with an existing user id that is in a group with the Lighthouse Administrator role.
2. Click **Enable** in the **Actions** section of the root user.

An Identity Provider (IdP) stores and manages users' digital identities. An IdP may check user identities via username-password combinations and other factors, or it may simply provide a list of user identities that another service provider (like an SSO) checks. An IdP can authenticate any entity connected to a network or a system, including computers and other devices.

SAML CONFIG FOR SSO

SAML is the framework used to integrate applications with identity providers for single sign-on (SSO). This is mostly (if not completely) reflected when a user logs in and authenticates with their IdP or is already logged in (if they have already authenticated with their identity provider prior to accessing Lighthouse).

Lighthouse supports the independent, concurrent use of both SAML and AAA authentication. SAML authentication is independent of, and does not interact with, other authentication methods.

Note: For release 2023.10 SAML is only supported for authentication to the lighthouse Web GUI.

When SAML is configured and enabled, users can authenticate to the Lighthouse Web GUI either through SAML or another configured authentication mechanism such as Local or AAA. Users can SSH only via the other configured authentication mechanism (Local or AAA) if Remote Authentication is configured.

The default authentication is Local, with Lighthouse using locally defined users and groups. If AAA (TACACS, RADIUS or LDAP) Remote Authentication is configured, this will be used for Web GUI and SSH login authentication to Lighthouse (except for root which is always locally authenticated). Users are authenticated against AAA server(s) with group membership returned to Lighthouse, which is used to determine user roles and permissions. AAA Remote Authentication can support 2FA/MFA, depending on the AAA server capabilities.

Lighthouse's SAML integrates with the following identity providers:

- OKTA
- Azure Active Directory (Azure AD)
- One Login
- Auth0

Note: In the following instructions, any text in braces {} for example, {main lighthouse address} needs to be substituted with the value for your environment.

Common values you will need are:

{main lighthouse address} - The address (without the protocol or path) most users use to connect to your primary lighthouse's web interface. e.g.

lighthouse.example.com or 192.168.1.10

{provider} - Each IdP implements the spec slightly differently lighthouse needs to know which style to expect to handle these differences. If your IdP is not one of our officially supported IdPs, try configuring lighthouse using the `generic provider` option as the most widely applicable. (You could also try using our other explicit IdP options but these often expect provider specific intricacies).

Please also review the "[Limitations of SAML Configuration](#)" on page 277.

GENERIC IDP SETUP

This section describes how to integrate Lighthouse with your Generic Identity Provider (IdP) Application.

In case Lighthouse's supported IdPs doesn't include your identity provider, use the Generic IdP setup. This has been made as general as possible to meet expectations of all IdPs in the market today.

Note: You must have your user groups setup in Lighthouse prior creating & assigning them via the IdP. See the example in step 6 of the Okta configuration later in this topic.

Note: The `{provider}` in the steps must exactly match one of our provider strings that is, `generic`, `okta`, `azure_ad`, `onelogin`.

1. Create an application integration for "Lighthouse" in your IdP
2. Set ACS or consumer URL as `https://{main lighthouse address}/api/v3.7/sessions/saml/sso/{provider}`
3. Set the **Allowed SSO URLs** or **Allowed redirect URLs** or **ACS URL Validator** to include or match the `/saml/sso/` URL for each address of each of your Lighthouses that you want users to be able to login from.

Example:

```
https://{main lighthouse address}/api/v3.7/sessions/saml/sso/  
{provider}  
https://{main lighthouse ip address}/api/v3.7/sessions/saml/sso/  
{provider}  
https://{secondary lighthouse address}/api/v3.7/sessions/saml/sso/  
{provider}
```

Depending on your IdP you may need to include the `/saml/sp_init/` URLs.

```
https://{main lighthouse address}/api/v3.7/sessions/saml/sso/  
{provider}  
https://{main lighthouse address}/api/v3.7/sessions/saml/sp_init/
```

```
{provider}
https://{main lighthouse ip address}/api/v3.7/sessions/saml/sso/
{provider}
https://{main lighthouse ip address}/api/v3.7/sessions/saml/sp_init/
{provider}
https://{secondary lighthouse address}/api/v3.7/sessions/saml/sso/
{provider}
https://{secondary lighthouse address}/api/v3.7/sessions/saml/sp_
init/{provider}
```

4. Set the Service Provider EntityID or Audience as `lighthouse-{provider}`
5. If your service provider requires you to configure the Recipient
 - And only allows a single value
 - And you run multiple Lighthouses or access Lighthouse via multiple addresses

Then either:

- Set the recipient as `lighthouse-{provider}` and use the onelogin option as your provider configuration.
 - Or if you only access each via a single address you could create a separate application integration per lighthouse.
6. If your IdP has the option then set the initiator to the `Service Provider`
 7. Set your IdP to sign the **Assertion** for SAML

GENERIC IDP SAML ATTRIBUTE

You will also need to configure your IdP to send an additional attribute `LH_Groups` as part of the SAML response.

In most IdPs this is done by adding an Attribute Statement or Parameter configuration in your application integration. This parameter should be set as a multi-value parameter, that is, multiple values should be provided by multiple duplicative either Attribute Value tags or Attribute tags in the SAML assertion.

We recommend setting the value of this attribute to be populated with the names of the user's Roles (or Groups) in your IdP. This method allows you to create roles in your IdP with the same names as the user groups on your lighthouse that can be assigned in your IdP to grant users that level of access to lighthouse.

Alternatively, you can populate the `LH_Groups` attribute with the names of the lighthouse user groups the user should be granted by any other mechanism that your IdP provides, that is, custom user properties

Note: Your IdP can populate the `LH_Groups` attribute to place users in any Lighthouse user group except Lighthouse's default admin group. You can allow users to login with admin privileges by simply creating another user group in lighthouse with the admin role and assigning the matching role/group in your IdP to the user (that is, populate `LH_Groups` to include its value).

LIGHTHOUSE SETUP

You will need to export an IdP metadata `xml` file for your Lighthouse application integration from your IdP. If your IdP requires that requests be signed by the Service Provider then you will also need to provide an x509 certificate & private key in `.pem` format (either exported from your IdP or created locally then configured in your IdP).

1. Upload your IdP metadata XML (and if required certificate & private key) to your primary Lighthouse i.e. `scp`
2. Use the `saml-idp-metadata` command to configure each lighthouse individually. Each Lighthouse is configured individually with the same or a different metadata xml (and certificate + key).

Note:Note: the commands to configure each Lighthouse individually, all must be run from your primary Lighthouse.

```
# Example: Configuring a Multi-Instance Lighthouse for Okta IdP
# List initial lighthouse configurations (i.e. none)
saml-idp-metadata list

# Configure Primary lighthouse
saml-idp-metadata create \
--metadata metadata.xml \
--provider okta \
--lh-id 1

#Configure Secondary lighthouse
saml-idp-metadata create \
--metadata metadata.xml \
--provider okta \
```

```
--lh-id 2  
# List lighthouse configurations (i.e. both lighthouses configured)  
saml-idp-metadata list
```

Specific examples of IdP setups are available, The following are examples of how you could configure officially supported IdPs. They are based on the above generic step and the IdP's configuration options as of 10/2021.

EXAMPLES OF SPECIFIC IDP SETUPS

The following are examples of how you could configure officially supported IdPs. They are based on the above generic step and the IdP's configuration options as of 10/2021.

OKTA

CREATE AN APPLICATION

You need to create an application that Okta will be doing authentication on behalf of.

Note: You'll need to know what the addresses of your Lighthouses before creating the application.

1. In the Okta web console go to **Applications - > Applications**
 - a. Click **Create App Integration**
 - b. Select **SAML 2.0**
2. Give the application a name: for example, Lighthouse and click **Next**
3. For the **Single sign on URL** enter
`https://{main lighthouse address}/api/v3.7/sessions/saml/sso/okta`
 - a. Select:
 - i. Use this for Recipient URL and Destination URL
 - b. Fill out the **Other Requestable SSO URLs** with the SSO URLs for every lighthouse address you want to be able to sign in with. i.e. IP addresses and DNS address for both your primary and secondary lighthouses.

Example:

```
https://{main lighthouse ip}/api/v3.7/sessions/saml/sso/okta
https://{dependent lighthouse
address}/api/v3.7/sessions/saml/sso/okta
https://{dependent lighthouse
ip}/api/v3.7/sessions/saml/sso/okta
```

4. For the **Audience URI (SP Entity ID)** enter `lighthouse-okta`
5. Set **Name ID format** to email.
6. Set to email.

7. There are many ways you could configure Okta to populate the `LH_Groups` attribute, our recommended way is to populate it from and manage it via the user's Okta groups:
 - a. Add a Group Attribute Statement
 - i. **Name:** `LH_Groups`
 - ii. **Name Format:** `Basic`
 - iii. **Filter:** `Matches Regex .*`
8. Click **Next** and finish.

IdP Metadata

1. Open your Onelogin application.
2. Go to More Actions > SAML Metadata. This is the metadata xml file that you will need to configure lighthouse.

Configure Lighthouse

1. Copy the Identity Provider metadata XML to your primary lighthouse.
2. Using `saml-idp-metadata` on your primary lighthouse, configure each of your lighthouses to use your IdP

For example:

```
saml-idp-metadata -p {root password} create -m /path/to/okta_
metadata.xml -P okta -n "My Okta display name" -l {LH id number}
```

Groups setup

After this initial setup, you will be able to login as a SAML user.

If you do not already have your own **User groups** setup in lighthouse:

1. Login to Lighthouse as a local user (or any non-SAML user) i.e. root
2. Create the User groups with the Roles and permission that you desire. See [""Creating new user and group templates" on page 198"](#).
3. In Okta go to **Directory > Groups**.
4. Click **Add Group**.
5. Enter the Group name that matches a Group name on lighthouse.
6. Open your new group.
7. Go to **Manage Apps**.
8. Search for your lighthouse app and click **Assign**.
9. Click **Done**.
10. Go to **Manage People**
11. Search for and click on the users you wish to add to the group.

The assigned users are now able to login to lighthouse with the permission levels which that group grants them.

ONELOGIN

Create an Application. You need to create an application that Onelogin will be doing authentication on behalf of.

1. Go to **Applications > Add App > Search for and choose SAML Custom Connector (Advanced)**
2. Name your connector, that is, Lighthouse.
3. In the Configuration tab for your new app

- a. Set Audience (EntityID) to `lighthouse-onelogin`
 - b. Set Recipient to `lighthouse-onelogin`
 - c. Set ACS (Consumer) URL to: `https://{main lighthouse address}/api/v3.7/sessions/saml/sso/onelogin`
 - d. Set **ACS (Consumer) URL Validator** to a regex expression that matches only all your lighthouses' SSO addresses (IP & DNS for Primary & Secondary lighthouses).
 - i. Ensure it begins with `^` and ends with `$` to match the whole url.
 - ii. Recommended pattern:

```
^https:\\\\ {lighthouse addresses}
\\/api\\/v3\\.7\\/sessions\\/saml\\/sso\\/onelogin$
```
 - iii. For example to allow Onelogin login for lighthouse addresses `192.168.1.10` and `lighthouse.example.com`, you could use the following: (note the additional `()` around your hostnames and the `|` separating them).

```
^https:\\\\
(192\\.168\\.1\\.10|lighthouse\\.example\\.com)\\/api\\/v3\\.7\\
\\/sessions\\/saml\\/sso\\/onelogin$
```
 - e. Set **Login URL** to `https://{main lighthouse address}/api/v3.7/sessions/saml/sp_init/onelogin`
 - f. Set **SAML initiator** to `Service Provider`
 - g. Set **SAML signature element** to `Assertion`
4. The recommended method to populate `LH_Groups` is with Onelogin Roles.

- a. Go to **Parameters** then click Add.
 - b. Set **Field Name** to `LH_Groups`
 - c. Check `Include` in SAML assertion
 - d. Check `Multi-value` parameter
 - e. Click **Save**.
 - f. Set Default value to `User Roles`
 - g. If you intend on filtering the Roles that are sent to lighthouse (using a Rule) set `no transform` otherwise set `semicolon delimited`.
 - An example Rule to filter roles:
 - “Set `LH_Groups` in”
 - `for each role`
 - with a value that matches `LH_.*`
 - h. Save the parameter.
5. Save the connector.

IdP Metadata

1. Open your Onelogin application.
2. Go to **More Actions > SAML Metadata**. This is the metadata xml file that you will need to configure lighthouse.

Configure Lighthouse

1. Copy the metadata xml to your primary lighthouse.
2. Using `saml-idp-metadata` on your primary lighthouse, configure each of your lighthouses to use your IdP., For example
`saml-idp-metadata -p {root password} create -m`

```
/path/to/metadata.xml -P onelogin -n "My Onelogin display  
name" -l {LH id number}
```

Roles Setup

After this initial setup, you will be able to login as a SAML user.

If you do not already have your own **Usergroups** setup in lighthouse:

1. Login to Lighthouse as a local user (or any non-SAML user) for example, root.
2. Create the Usergroups with the Roles and permission that you desire. See ["Creating New Groups and Roles" on page 232](#).
3. In Onelogin Go to **Users > Roles**
4. Click **New Role**.
 - a. Set the Role's name to match the lighthouse group you want it to map to.
 - b. Select your Lighthouse app to associate the role with.
 - c. Click Save.
5. Open the newly created role.
6. Go to the **Users** tab on the left.
7. Search for and add your users or create a mapping to automatically add multiple users.
8. Click **Save**.
 - a. If you used a mapping then go to **Users > Mappings and run Reapply All Mappings**.
9. Click **Done**

The assigned users are now able to login to lighthouse with the permission levels that the Onelogin Role/Lighthouse group grants them.

AZURE ACTIVE DIRECTORY

Lighthouse can be added as an **Enterprise application** to Azure Active Directory. This example uses “App roles” to grant users permissions.

To create an Application (Enterprise applications)

1. Go to **Azure Active Directory**.
2. Go to **Enterprise applications**.
3. Click **New Application**.
4. Click **Create your own application**.
5. Select **Integrate any other application you don't find in the gallery (Non-gallery)**.
6. Name your Application, for example, Lighthouse, then click **Create**.
7. Click **Properties**
 - a. Set Assignment required to Yes.
 - b. Set Enabled for users to sign-in to Yes.
 - c. Click Save.
8. Go to **Single sign-on**
 - a. Select SAML
 - b. Edit Basic Configuration

- i. Add an Entity Id `lighthouse-azure_ad` and set it as default.
- ii. In Reply URL (Assertion Consumer Service URL) add the SSO URL for each address of each lighthouse that you want to be able to sign in on. i.e. IP addresses and DNS address for both your primary and secondary lighthouses.

```
https://{primary lighthouse  
address}/api/v3.7/sessions/saml/sso/azure_ad https://  
{primary lighthouse IP  
address}/api/v3.7/sessions/saml/sso/azure_ad https://  
{secondary lighthouse  
address}/api/v3.7/sessions/saml/sso/azure_ad https://  
{secondary lighthouse IP  
address}/api/v3.7/sessions/saml/sso/azure_ad
```

- iii. Set **Sign on URL** to `https://{main lighthouse
address}/api/v3.7/sessions/saml/sp_init/azure_ad`

- iv. Click **Save**.

c. Edit Attributes & Claims

- i. Remove the default claims from **Additional claims**.
- ii. Click **Add new claim** and Enter:
 - **Name:** `LH_Groups`
 - **Source Attributes:** `user.assignedroles`

IdP Metadata

1. Go to the **Azure Active Directory**.
2. Go to **Enterprise applications** and open your application.

3. Go to **Single sign-on**.
4. Navigate to **3. SAML Signing Certificate** and find and download `Federation Metadata XML`.

Configure Lighthouse

1. Copy the Federation metadata XML to your primary lighthouse.
2. Using `saml-idp-metadata` on your primary lighthouse, configure each of your lighthouses to use your IdP as follows:

For example, `saml-idp-metadata -p {root password} create -m /path/to/metadata.xml -P azure_ad -n "My Azure display name" -l {LH id number}`

App Roles Setup

After this initial setup, you will be able to login as a SAML user. If you do not already have your own Usergroups setup in Lighthouse, you can set them up as follows:

1. Login to Lighthouse as a local user (or any non-SAML user) i.e. root
2. Create the Usergroups with the Roles and permission required. See "[Creating New Groups and Roles](#)" on page 232.

See ***Add app roles and get them from a token - Microsoft identity platform*** for up to date documentation on how to create and assign App Roles.

1. Go to **Azure Active Directory**.
2. Go to **App registrations**.
3. Open your app (Use the **All Applications** tab to see Enterprise apps).
4. Go to **App Roles**.
5. Click **Create App Role**.

- a. Set the **value** to match your usergroup on Lighthouse.
 - b. Set **Allowed member types** to `Both (Users/Groups + Applications)`.
 - c. Set the other fields as required.
6. Go to **Azure Active Directory**.
 7. Go to **Enterprise applications**.
 8. Open your App, that is, Lighthouse.
 9. Go to **Users and groups**.
 10. Click **Add user/group**.
 11. Select a user and one of your App roles then click **Assign**.

The assigned users are now able to login to lighthouse with the permission levels which that App Role/Lighthouse group grants them.

CONFIGURE AUTH0 FOR IDP

Lighthouse can be added as an **Enterprise application** to AUTH0. This example uses “App roles” to grant users permissions.

CREATE AN APPLICATION (ENTERPRISE APPLICATIONS)

1. Go to **Auth0**.
2. Go to **Applications > Application**.
3. Click **Create application**.

- a. Select **Regular Web Application**.
 - b. Name the application, for example, Lighthouse.
4. Go to **Settingstab**.
- a. Select **SAML**.
 - b. Set Application Login URI to

```
https://{main lighthouse address}/api/v3.7/sessions/saml/sp_
init/auth0
```

- c. In **Allowed Callback URLs** add each address for each lighthouse that you wish to allow users to sign-in via. (that is, IP, hostname, dns for both primary and dependent).

```
https://{primary lighthouse
address}/api/v3.7/sessions/saml/sso/auth0
https://{primary lighthouse IP
address}/api/v3.7/sessions/saml/sso/auth0
https://{secondary lighthouse
address}/api/v3.7/sessions/saml/sso/auth0
https://{secondary lighthouse IP
address}/api/v3.7/sessions/saml/sso/auth0
```

- d. Click **Save**.
5. Go to the **Addons** tab:
- a. Click **SAML2**.
 - b. Go to the **SAML settings** tab.

c. Set the Settings json to

```
{
  "audience": "lighthouse-auth0",
  "mappings": {
    "roles": "LH_Groups"
  },
  "passthroughClaimsWithNoMapping": true,
  "mapUnknownClaimsAsIs": true,
  "nameIdentifierFormat": "urn:oasis:names:tc:SAML:1.1:nameid-
format:emailAddress",
  "nameIdentifierProbes": [
    "http://schemas.xmlsoap.org/ws/2005/05/identity/claims/emailaddres
s"
  ]
}
```

d. Click either **Enable** or **Save**.

6. Go to **Auth Pipeline**.

7. Go to **Rules**.

8. Click **Create**.

a. Select empty rule template.

b. Name it appropriately, for example, Map roles to SAML user property.

c. Set the script to

```
function mapSamlAttributes(user, context, callback) {  
  user.roles = (context.authorization || {}).roles;  
  callback(null, user, context);  
}
```

9. Click **Save**.

CONFIGURE AUTH0 METADATA FOR IDP

To setup the IDP metadata:

1. Go to **Auth0**.
2. Go to **Application > Applications**.
3. Open your Lighthouse application.
4. Go to **Addons**.
5. Go to **SAML**.
6. Go to **Usage**.
7. Click the **Identity Provider Metadata** download.

A file named `metadata.xml` downloads to your preferred directory

CONFIGURE LIGHTHOUSES FOR AUTH0 FOR IDP

In this step you will use the downloaded file to configure each of your lighthouses to use your Auth0 IdP.

1. Copy the downloaded metadata.XML file to your primary lighthouse. See ["Configure AUTH0 Metadata for IdP" above](#).

2. Use the `saml-idp-metadata` file on your primary lighthouse, configure each of your lighthouses to use your IdP with this command:

```
saml-idp-metadata -p {root password} create -m  
/path/to/metadata.xml -P auth0 -n "My Auth0 display name" -  
l {LH id number}
```

See "[SAML Config for SSO](#)" on page 255

CONFIGURE AUTH0 FOR IDP

After you have added Lighthouse as an **Enterprise application** to AUTH0, you need to use the App roles feature to grant users permissions to use IdP.

After this initial setup, you will be able to login as a SAML user.

1. If you do not already have your own Usergroups setup in Lighthouse:
 - a. Login to Lighthouse as a local user (or any non-SAML user) for example, root.
 - b. Create the Usergroups with the required Roles and permission.
2. Go to **Auth0**.
3. Go to **User Management**.
4. Go to **Roles**.
5. Click **Create Role**.
6. Enter the Role name that matches a Lighthouse group name.
7. Open your Role.
8. Go to the **Users** tab.
9. Click **Add Users**.

- a. Assign the role to the appropriate users.
10. The assigned users are now able to login to Lighthouse with the permission levels granted by the Auth0 Role/Lighthouse group.

LIMITATIONS OF SAML CONFIGURATION

IDP METADATA CERTIFICATE EXPIRY

The Identity Provider (IdP) metadata XML file that you exported to configure Lighthouse contains a certificate that is used to authenticate that the SAML response came from your IdP.

Different IdPs have different expiry periods for these certificates, consult your IdP's documentation to find their expiry period. When your IdP's certificate expires you will need to regenerate it then re-export your IdP metadata and update your Lighthouse configurations. If your IdP supports sending expiry notifications to your admin, we recommend you enable these notifications.

MAKING CHANGES TO USER PERMISSIONS

When you change the permissions assigned to a Lighthouse user in your IdP (via **LH_Groups** SAML attribute), the changes will not take effect until the user logs out and back into Lighthouse.

If you need to quickly restrict a user's access, consider altering the permissions of or deleting that user's usergroups on Lighthouse, see ["Modifying existing groups" on page 237](#). You can also set a low Web Session Timeout. See Examine or modify Lighthouse Session Settings.

SAML SSO USERGROUPS

The **LH_Groups** attribute can be used to place SSO users in any Lighthouse usergroup except Lighthouse's default admin group. You can allow users to login with admin privileges by simply creating another usergroup in Lighthouse with the admin role and assigning the matching role/group in your IdP to the user (i.e. populate **LH_Groups** to include its value).

SAML SSO USERS

SAML Users can only be managed in your IdP and will not appear under Lighthouse User Management.

Note: SAML users have no access to either Web terminal or SSH functionality via the Lighthouse web interface.

CONFIGURING AAA

Lighthouse supports three Authentication Authorization and Accounting (AAA) systems:

- LDAP (Active Directory and OpenLDAP)
- RADIUS
- TACACS+

Authentication works much the same with each, but group membership retrieval varies. The following sections detail the configuration settings for each provider and explain how group membership retrieval works.

LDAP CONFIGURATION

To begin, select **SETTINGS > USER MANAGEMENT > Remote Authentication**.

REMOTE AUTHENTICATION

SETTINGS

Schema

Mode

Remote authentication servers

ADDRESS	PORT <small>(DEFAULTS TO LDAP/LDAPS STANDARD PORTS)</small>
<input type="text"/>	<input type="text"/> <input type="button" value="-"/> <input type="button" value="+"/>

LDAP base DN

LDAP bind DN

Bind DN password

Confirm password

LDAP username attribute

LDAP group membership attribute

Ignore referrals

SSL

Server protocol

Ignore SSL certificate errors

CA certificate

1. Select **LDAP** from the **Scheme** drop-down menu.
2. Choose the desired **Mode** from the drop-down menu.
 - LDAPDownLocal
 - LDAP: Default behavior
 - LDAP/Local
 - Local/LDAP

Note: See the Glossary for more information about these modes.

3. Add the **Address** and optionally the **Port** of the LDAP server to query.
4. Add the **LDAP Base DN** that corresponds to the LDAP system being queried.
For example, if a user's distinguished name is **cn=John Doe,dc=Users,dc=ACME,dc=com**, the **LDAP Base DN** is **dc=ACME,dc=com**
5. Add the **LDAP Bind DN**. This is the distinguished name of a user with privileges on the LDAP system to perform the lookups required for retrieving the username of the users, and a list of the groups they are members of.
6. Add and confirm a password for the binding user.
7. Add the **LDAP username** attribute. This depends on the underlying LDAP system. Use **sAMAccountName** for Active Directory systems, and **uid** for OpenLDAP based systems.
8. Add the **LDAP group membership** attribute. This is only needed for Active Directory and is generally **memberOf**.
9. If desired, check **Ignore referrals** option. When checked, LDAP will not follow referrals to other remote authentication servers when logging users in to

Lighthouse. If multiple remote authentication servers exist on the network, checking this option may improve login times.

10. Under the **SSL** section, choose the desired **Server protocol**.
 - a. **LDAP over SSL preferred**: this will attempt LDAPS before trying LDAP without SSL
 - b. **LDAP (no SSL) only**: non-SSL LDAP is always used
 - c. **LDAP over SSL only**: LDAP over SSL is always used
11. If desired, check **Ignore SSL certificate** errors to ignore any SSL certificate errors.
12. **CA Certificate** is used to upload an SSL Certificate which will verify any LDAP servers you specify on the page.

Note:The certificate will be uploaded but will not be used if you've chosen to ignore certificate errors.

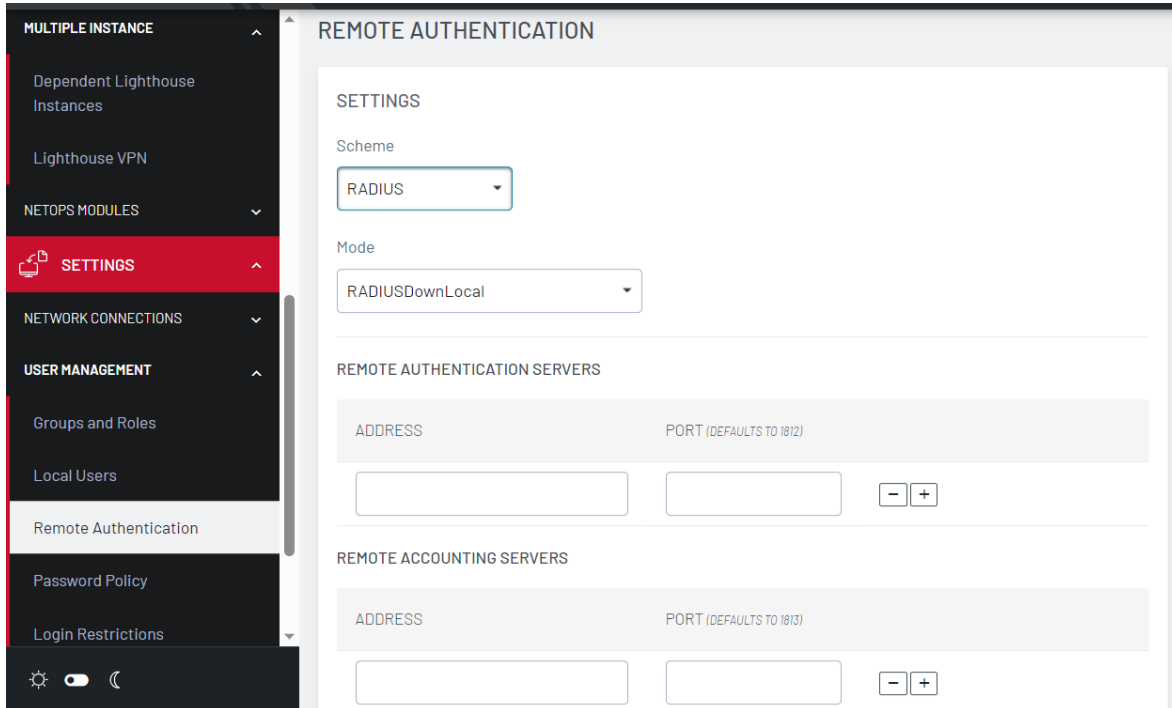
13. Install the **CA certificate** by clicking the **Browse...** button and locating the appropriate file.
14. Click **Apply**.

Note:Multiple servers can be added. The LDAP subsystem queries them in a round-robin fashion.

RADIUS CONFIGURATION

To configure RADIUS:

1. Select **SETTINGS > USER MANAGEMENT > Remote Authentication**.



1. In the **Settings** section, select **RADIUS** from the **Scheme** drop-down menu.
2. Choose the desired **Mode** from the drop-down menu.
 - RADIUSDownLocal
 - Radius
 - RADIUS/Local
 - Local/RADIUS

Note: See the Glossary for more information about these modes.

3. Add the **Address** and optionally the **Port** of the RADIUS authentication server to query.

4. Add the **Address** and optionally the **Port** of the RADIUS accounting server to send accounting information to.
5. Add the **Server password**, also known as the RADIUS Secret.

Note: Multiple servers can be added. The RADIUS subsystem queries them in a round-robin fashion.

To provide group membership, RADIUS needs to be configured to provide a list of group names via the Framed-Filter-Id attribute. The following configuration snippet shows how this can be configured for FreeRADIUS:

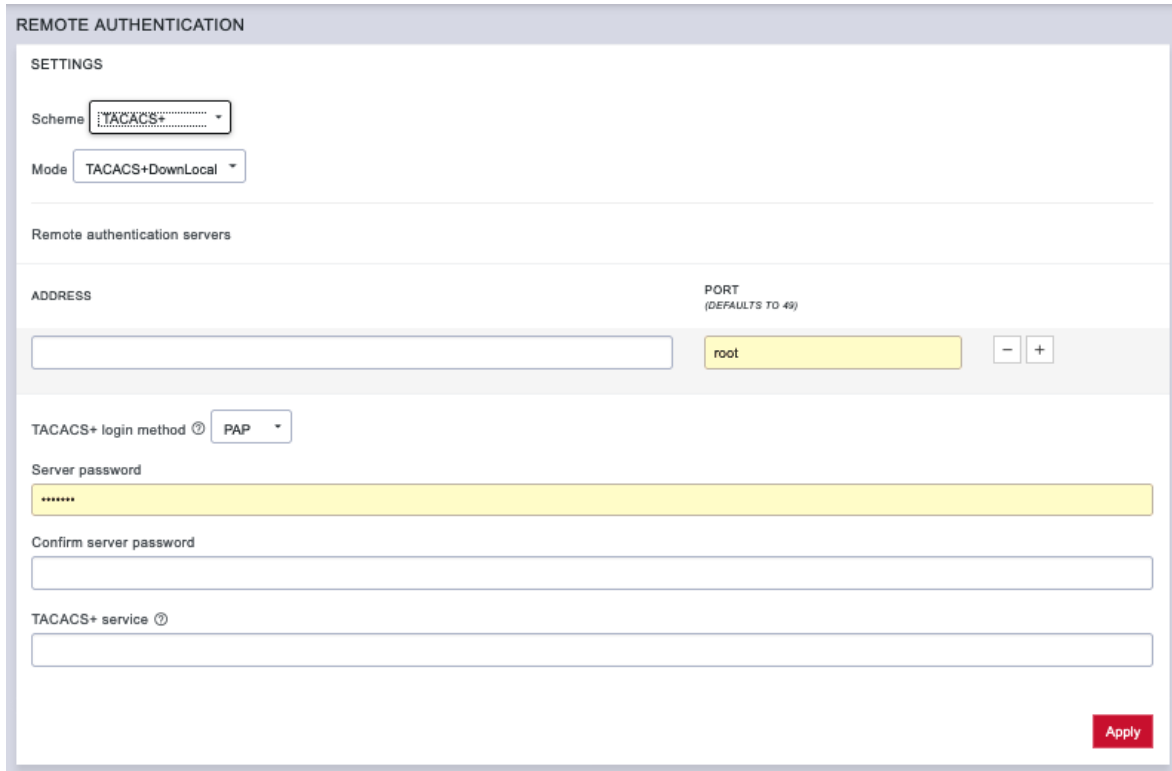
```
operator1 Auth-Type := System Framed-Filter-ID = ":group_
name=west_coast_admin,east_coast_user:"
```

Note: The **Framed-Filter-ID** attribute must be delimited by the colon character.

TACACS+ CONFIGURATION

To configure TACACS+:

1. Select **SETTINGS > USER MANAGEMENT > Remote Authentication**.



The screenshot shows the 'REMOTE AUTHENTICATION' configuration page. It includes a 'SETTINGS' section with a 'Scheme' dropdown menu set to 'TACACS+' and a 'Mode' dropdown menu set to 'TACACS+DownLocal'. Below this is a 'Remote authentication servers' section with a table for adding servers. The table has columns for 'ADDRESS' and 'PORT (DEFAULTS TO 49)'. A server entry is shown with 'root' in the port field. Below the table is a 'TACACS+ login method' dropdown set to 'PAP', a 'Server password' field with masked characters, a 'Confirm server password' field, and a 'TACACS+ service' field. An 'Apply' button is located at the bottom right.

2. Select **TACACS+** from the **Scheme** drop-down menu.
3. Choose the required **Mode** from the drop-down menu.
 - TACACSDownLocal:
 - TACACS: Default behavior
 - TACACS/Local
 - Local/TACACS

Note: See the Glossary for more information about these modes.

4. Add the **Address** and optionally the **Port** of the TACACS+ authentication server to query.
5. Select the **Login Method**. **PAP** is the default method. However, if the server uses DES-encrypted passwords, select **Login**.
6. Add the **Server password**, also known as the TACACS+ Secret.
7. Add the **Service**. This determines the set of attributes sent back by the TACACS+ server

Note: Multiple servers can be added. The TACACS+ subsystem queries them in a round-robin fashion.

To provide group membership, TACACS+ needs to be configured to provide a list of group names This following configuration snippet shows how this can be configured for a `tac_plus` server:

```
user = operator1 {  
  service = raccess {  
    groupname = west_coast_admin, east_cost_user  
  }  
}
```

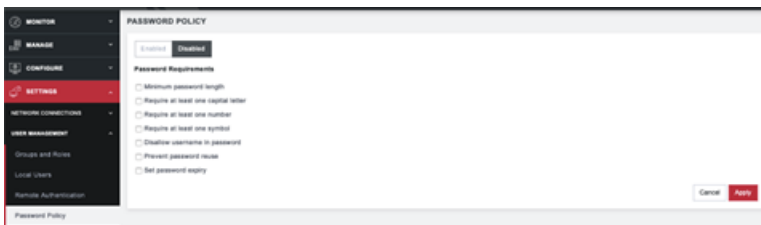
To do this with Cisco ACS, see [Setting up permissions with Cisco ACS 5 and TACACS+ on the Opendebug Help Desk](#).

SETTING PASSWORD POLICY

An Identity Provider (IdP) stores and manages users' digital identities. An IdP may check user identities via username-password combinations and other factors, or it may simply provide a list of user identities that another service provider (like an SSO) checks. An IdP can authenticate any entity connected to a network or a system, including computers and other devices. Lighthouse Administrators can set Password Policies to ensure that users set secure passwords.

To set a password policy:

1. Select **SETTINGS > USER MANAGEMENT > Login Restrictions**,
2. Choose **Enabled**, and
3. Click **Save**. Click **Password Policy**.



Choose one or more options from the following:

- Minimum password length – from 1 to 128
- Require at least one capital letter
- Require at least one number
- Require at least one symbol
- Disallow username in password
- Prevent password reuse – choose a number of days or select Always

- Set password expiry – select a number of days until passwords expire. At next login, the user will need to reset the password.

PASSWORD FIELDS IN LIGHTHOUSE

All password fields in Lighthouse are write-only. They accept data from the clipboard or pasteboard but do not pass data out.

ENABLING ADVANCED FUNCTIONALITY

This section describes how to use the advanced functionality that the Netops modules of IP Access, Secure Provisioning and Automation Gateway modules provide.

INTRODUCTION

NetOps modules leverage Opengear's remote presence and proximity to infrastructure by allowing software applications to run directly on top of the out-of-band management fabric. The NetOps modules enable automation of the configuration and operation of network infrastructure in data center and remote edge locations.

The platform comprises the following:

- **Opengear Lighthouse** software: The central management interface and automation controller.
- **Managed Devices:** Target infrastructure, for example, network switches from Cisco or Cumulus.
- **Opengear Nodes:** OM, CM, ACM and IM appliances, connected to managed device management NICs via Ethernet (and optionally managed device consoles via RS-232 or USB serial).
- **NetOps Modules:** Software components that enable automation of specific operational scenarios (for example, network device provisioning), deployed as Docker containers – modules become active on Lighthouse when a module

license is installed, they can then be manually or automatically activated on nodes.

ABOUT NETOPS

NetOps modules require a Lighthouse with appropriate licensing and modules to be uploaded and active. You will also need at least one node enrolled and able to use these modules.

Lighthouse Enterprise contains the IP Access module, whereas, Lighthouse Enterprise: Automation Edition contains IP Access, Secure Provisioning and Automation Gateway.

The NetOps modules are built as Docker containers and accessed through the Lighthouse GUI.

NETOPS PLATFORM SECURITY

The NetOps Automation platform uses a combination of advanced hardware and software security features to provide end-to-end security and resilience against network breach, fault or failure.

All communications between Lighthouse and nodes are tunneled inside Lighthouse VPN, using strong ciphers and automated certificate authentication and revocation.

Nodes such as the OM and CM8100 contain a TPM chip, which verifies the authenticity of the OM system software, its configuration, and NetOps Module code

and data – any unauthorized tampering will render the appliance inoperable. These nodes are physically hardened to resist tampering – attempts to physically to access storage media will render the appliance inoperable

With a built-in cellular capability nodes with the TPM chip provide a secure WAN uplink in the event of network outage, DOS, or during initial network turn-up at a remote location.

CHANGING DOCKER IP RANGES

Docker powers the NetOps platform within Lighthouse. By default, Docker and NetOps utilize the 172.17.0.0/16 and 172.18.0.0/16 subnets. This has the potential to cause collisions inside of some networks.

To avoid this, you can change these settings.

To update Docker's subnet, you need to alter 2 parameters, Docker's default subnet and the NetOps modules subnet. To do so:

Login to the Lighthouse shell CLI as a Lighthouse Administrator or the root user

Ascertain the number of running containers to ensure you select an appropriate subnet size

```
sudo docker ps -q | wc -l
```

Open a config CLI session on the Lighthouse Server and run the following to enter configuration management

```
ogconfig-cli
```

Set the IP Range of the Docker subnet in CIDR format

```
set services.nom.default_subnet "10.123.17.1/24"
```

Set the IP Range of the NetOps subnet in CIDR format

```
set services.nom.netops_subnet "10.123.18.0/24"
```

Push the config to become the running config

```
push
```

Exit the configuration management

```
exit
```

Restart Docker

```
sudo /etc/init.d/docker.init restart
```

Restart the NetOps Module(s)

```
sudo /etc/init.d/docker.init reset
```

Note: The network mask selected for these subnets limits the maximum number of containers that can run on Lighthouse. NetOps currently runs up to approximately 10 containers.

NETOPS MODULE MANAGEMENT

The NetOps modules, IP Access and Secure Provisioning, Automation Gateway, are stored in a private repository. Periodically, module updates and new modules may become available.

Note: You can upgrade NetOps Modules without upgrading Lighthouse software.

UPGRADE MODULES FROM THE UI

1. Launch an HTTPS browser session to Lighthouse Login using root and the secure password set earlier.
2. You may also log in as a Lighthouse Administrator user, if you have configured one.
3. From the menu, select **SETTINGS -> Services -> NetOps Modules**.
4. Click the **Synchronize** widget.
5. From the menu, select **CONFIGURE -> NetOps Modules -> Manage Modules**.
6. Click the **Redeploy** icon.

UPGRADE MODULES FROM THE CLI

Log in to the Lighthouse CLI as root.

Or

Log in as a Lighthouse Administrator and become root with: `sudo -i`

Replace default with your root password and run:

PROCEDURE for Lighthouse CLI

Replace **root** and **default** with a Lighthouse Administrator or root credentials, then run the following:

```
USERNAME=root
PASSWORD=default
/etc/scripts/netops_sync_handler
token=$(curl -k -L -d '{
"username":"'$USERNAME'", "password":"'$PASSWORD'"}'
"https://127.0.0.1/api/v3.0/sessions/" | python -c 'import sys, json;
print json.load(sys.stdin)["session"]')
curl -k -L -H "Content-Type: application/json" -H "Authorization:
Token $token"
"https://127.0.0.1/api/v3.0/netops/modules/dop/redeploy"
```

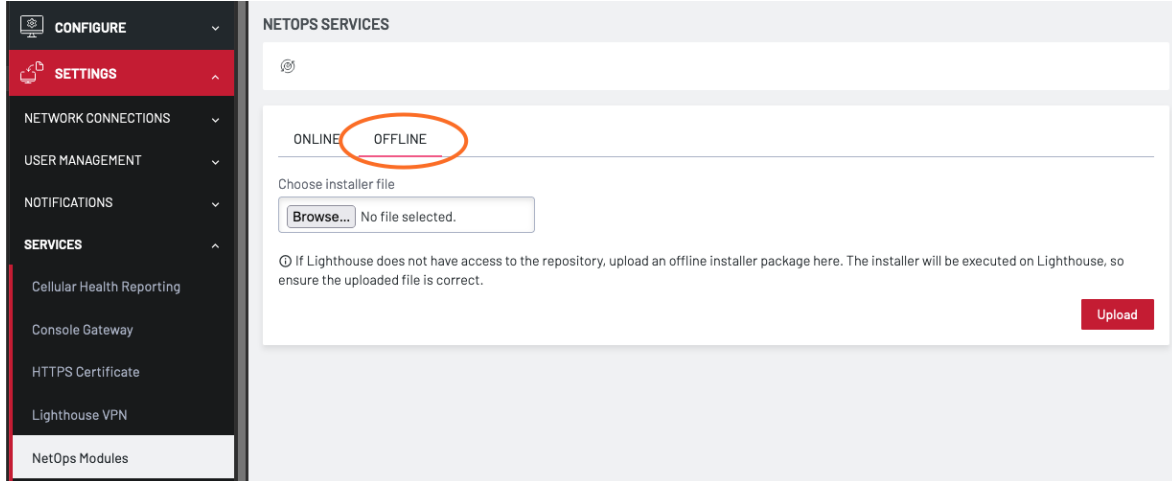
UPDATE NETOPS MODULES WITHOUT DOCKER ACCESS

If Lighthouse is deployed on a network where outbound access to the Docker Hub repository is not permitted or not available, use the NetOps offline installer script. This script has a built-in payload with everything required to update NetOps Modules on Lighthouse.

USE A PRE-BUILT OFFLINE INSTALLER (VIA GUI)

1. Download the offline installer file (*named netops_modules_*.tar.gz*) from this link:
[offline installer file](#)

2. Browse to **Settings > Services > NetOps Modules** and click **Offline**.



3. Click **Browse** and select the downloaded file.
4. Click **Upload**.

Note: This process can take up to 15 minutes. There are notifications detailing the process steps in the lower right hand corner as well as log entries in the system log.

USE A PRE-BUILT OFFLINE INSTALLER (VIA CLI)

1. Download the offline installer file (*named netops_modules_*.tar.gz*) from this link: [offline installer file](#).
2. Copy the offline installer to Lighthouse using scp, WinScp or similar, into the **/mnt/nvram** directory.
3. Log in to Lighthouse shell CLI as a Lighthouse Administrator and run:

```
gzip -d </mnt/nvram/netops_modules_*.tar.gz | nom update && rm  
/mnt/nvram/netops_modules_*.tar.gz
```

4. Deploy the upgrade to nodes:
 - a. Log in to the Lighthouse web UI as a Lighthouse Administrator or the root user
 - b. From the menu, select **CONFIGURE NODES > NetOps Modules > Manage Modules**.
 - c. In the **Status** column, confirm the module versions now match the latest release versions.
 - d. Click the **Redeploy** icon.

Note:Note: Using the offline install requires 8GB of free space in the **/mnt/data** partition.

UPGRADE NETOPS MODULES

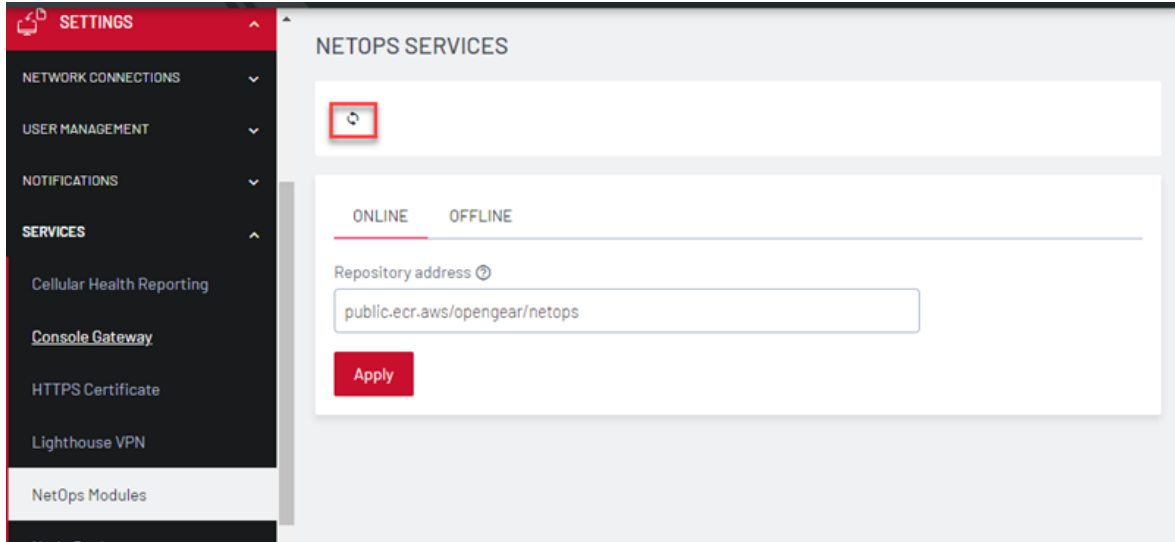
NetOps Modules are released independently of Lighthouse software or Operations Manager firmware.

NetOps releases are uploaded to Opendgear's file server, where they can be fetched by Lighthouse then deployed to all activated nodes by Lighthouse.

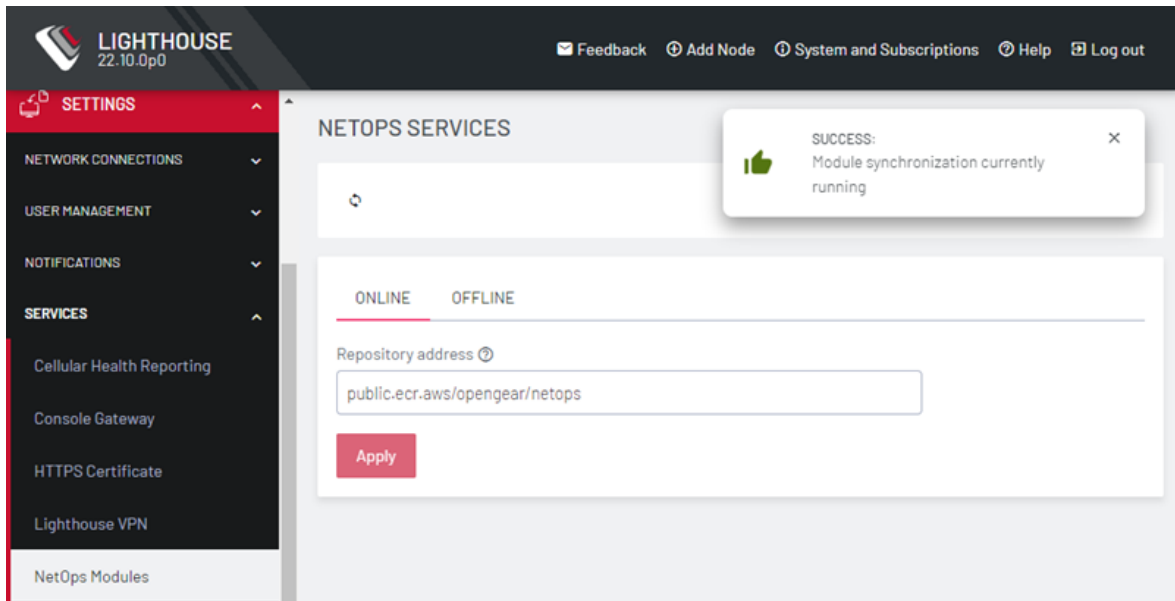
Node upgrades may be carried out through either the Lighthouse UI or the CLI.

PROCEDURE for Lighthouse UI

1. Log in to the Lighthouse web UI as a Lighthouse Administrator or the root user.
2. From the menu, select **SETTINGS > Services > NetOps Modules**. Select either Online or Offline.



3. Click the  **Synchronize** icon. A message displays with the status.



4. From the menu, select **CONFIGURE NODES > NetOps Modules > Manage Modules**.
5. Click the **Redeploy** icon.

PROCEDURE for Lighthouse CLI

Replace **root** and **default** with a Lighthouse Administrator or root credentials, then run the following:

```
USERNAME=root
PASSWORD=default
/etc/scripts/netops_sync_handler
token=$(curl -k -L -d '{
"username":"'$USERNAME'", "password":"'$PASSWORD'"}'
"https://127.0.0.1/api/v3.0/sessions/" | python -c 'import sys, json;
print json.load(sys.stdin)["session"]')
curl -k -L -H "Content-Type: application/json" -H "Authorization:
Token $token"
"https://127.0.0.1/api/v3.0/netops/modules/dop/redeploy"
```

ACTIVATE A NETOPS MODULE

IP Access is activated for both Enterprise Edition and Automation Editions.

Secure Provisioning and Automation Gateway are activated from the Automation Edition license.

The NetOps module license is installed on Lighthouse and contains a preset number of available node activations. Each supported node that is activated for the NetOps module provisioning, consumes an available activation; Lighthouse itself does not consume an activation.

Installing the NetOps module license automatically activates the module on Lighthouse, at which point the NetOps Automation platform deploys the central module software components, including the module's UI, to Lighthouse.

The process of automatically or manually activating a NetOps Module on a node deploys the remote module software components to that node, securely over Lighthouse VPN.

ACTIVATE THE NETOPS MODULE ON LIGHTHOUSE


PREPARATION

1. Install the Lighthouse VM and ensure it is running.
2. Login to the Lighthouse web UI as root or a Lighthouse Administrator.
3. Install the Lighthouse node subscription (SKU OGLH) under **SETTINGS > System > Subscriptions**.

PROCEDURE

1. Ensure you have a valid NetOps Module licence installed under **SETTINGS > System > Subscriptions**.

Note: The Enterprise Edition license includes the IP Access module. The Automation Edition license includes IP Access, Secure Provisioning, and Automation Gateway.

2. It will take a few minutes for the module to activate on Lighthouse, view progress under **CONFIGURE NODES > NetOps Modules > Manage Modules**.
3. Click the  *Update* icon and note new module-specific menu items are now available under **CONFIGURE NODES**, for example, **Secure Provisioning** or **IP Access**.

Nodes may now be automatically activated for the module as they enroll, or manually activated after enrollment.

'ALWAYS ACTIVATE' MODE ON ALL NODES (AUTOMATIC)

In the Always Activate mode, NetOps automatically activates the NetOps Module on all nodes, provided a license is present and activations are available. All nodes are activated for the module as they enroll.

PROCEDURE

1. Check and apply **CONFIGURE NODES > NetOps Modules > Manage Modules > Module Name > Always Activate**.
2. To activate a new node, enroll the node into Lighthouse, , see "[Activate the Secure Provisioning Module on Lighthouse](#)" on page 341

ACTIVATE NETOPS ON SELECTED NODES (AUTOMATIC)

You may selectively activate the module on a subset of nodes using Enrollment Bundles. Only nodes enrolling using one of these bundles will be automatically activated.

PROCEDURE



1. Navigate to **CONFIGURE NODES > NetOps Modules > Manage Modules > *Module Name* > Always Activate**.
2. Uncheck **Always Activate**.
3. Click **Apply**.
4. Select **CONFIGURE NODES > Node Enrollment > Enrollment Bundles** and add a new bundle (you may also edit an existing bundle).
5. Enter a bundle **Name** and **Token**, and choose whether or not to **Auto-Approve** enrollment, see ["Activate a NetOps Module" on page 297](#).
6. Scroll down to **NetOps Modules** and add the **Module Name**.
7. Enroll the node to Lighthouse, specifying the **Enrollment Bundle Name** and **Token**.

Note: Lighthouse-initiated manual enrollment (for example, clicking the **Add Node** button in the Lighthouse web UI) does not support bundles, you must use a node-initiated enrollment method.

ACTIVATE THE NETOPS MODULE ON NODES (MANUAL)

PROCEDURE

To activate nodes manually after enrollment, use the following steps:

1. Ensure **CONFIGURE NODES > NetOps Modules > Manage Modules > Module Name > Always Activate** is unchecked and applied.
2. Select **CONFIGURE NODES > Configuration Templating > Apply Templates**.
3. Under **NetOps Module Activation**, choose the **Module Name** and click **Next**.
4. Select the nodes to activate, then click **Next**.
5. To ensure the preflight check has succeeded click the  *Update* icon above the table, then click **Next**.
6. Click the  *Update* icon to ensure activation is successful.

Note: Under the NetOps *licensing* arrangement, once a node is activated for the NetOps Module, the activation is consumed by and locked to that node. Unenrolling the node returns the activation to the available pool. Under NetOps *subscription* arrangements, it would be counted towards the node assignment of the subscription.

DEACTIVATE (REMOVE) A NETOPS MODULE

To deactivate and remove a NetOps Module from a given node, use the following API call to Lighthouse:

```
DELETE /api/v3/netops/modules/module_id/nodes/node_id
```

where `module_id` is one of `dop` (Secure Provisioning), `IP Access`, or `ag` (Automation Gateway), and `node_id` is the internal node ID, for example, `nodes-1`.

Follow the procedure below to remove NetOps Modules from a given node:

1. Log in to the Lighthouse CLI shell as root or a Lighthouse Administrator user.
2. Determine the node's node ID by running:

```
node-info --list
```

3. Update the highlighted fields with your username, password, the node ID and modules to deactivate, then run the following:

```
LH_USERNAME="root"
LH_PASSWORD="default"
NODE_ID="nodes-1"
MODULES_TO_DEACTIVATE="dop ag sdi"

token=$(curl -k -L -d '{"username":"'${LH_USERNAME}',"password":"'${LH_
PASSWORD}'"}' https://127.0.0.1/api/v1/sessions/ | cut -f10 -d'')

for module_id in $MODULES_TO_DEACTIVATE; do
    curl -k -L -X DELETE -H "Authorization: Token $token"
    https://127.0.0.1/api/v3/netops/modules/${module_id}/nodes/$NODE_ID
done
```

AUTOMATION GATEWAY

Opengear allows you to set up your network using automation tools.

Automation Gateway allows Lighthouse users and automation code to discover and manage IP-based management interfaces via the Opengear management system, with the same level of simplicity and efficiency as if they were serial consoles.

Managed devices like firewalls and servers may present an IP-based management interface in addition to (or sometimes instead of) the traditional serial or USB console port. This interface may serve a web-based GUI, VNC or RDP based KVM, SSH-based CLI and/or a programmable network API like RESTful HTTPS. The device itself may be physical or virtual.

By their nature, the IP-based management interfaces are more dynamic (for example, they may change IP address), varied (for example, protocols vary from device to device) and harder to reach (for example, on an un-routable private network).

The Automation Gateway module addresses the challenges of discovering, auditing and connecting to IP-based management services in a distributed, heterogeneous network. It is available on Operations Manager product lines, OM120x and OM22xx.

DIFFERENCES BETWEEN IP ACCESS AND AUTOMATION GATEWAY

The **IP Access** module provides the **IP Access** feature and the **Automation Gateway** module provides the **Automation Gateway** feature.

These two features are similar in that they both allow Lighthouse users to access network services on remote managed devices, however they accomplish this in different ways. One way to think about it is that **IP Access** transports the user to the remote network, whereas **Automation Gateway** transports a specific remote network service to user.

IP ACCESS

Using **IP Access**, the user must establish a VPN tunnel from their computer to Lighthouse, which then provides them with a routed connection to the entire network (s) connected to the remote node. Once the tunnel is up, the user can access any network service on any network device by their standard management IP addresses.

AUTOMATION GATEWAY

Using the Automation Gateway feature, the user clicks through their existing Lighthouse browser session to access HTTP/HTTPS web GUI services of specific devices that have been discovered by the remote node. Access is limited to these services only, and the connections are proxied via Lighthouse's central address – so no client or network reconfiguration is required.

HOW TO USE AUTOMATION GATEWAY

Using Automation Gateway, Lighthouse users can connect to the web UI of a remote physical & virtual managed device such as a firewall, lights-out server or SD-WAN appliance.

Access is proxied via Lighthouse VPN via a remote node, allowing simply, point & click access to what may be an otherwise unreachable remote device.

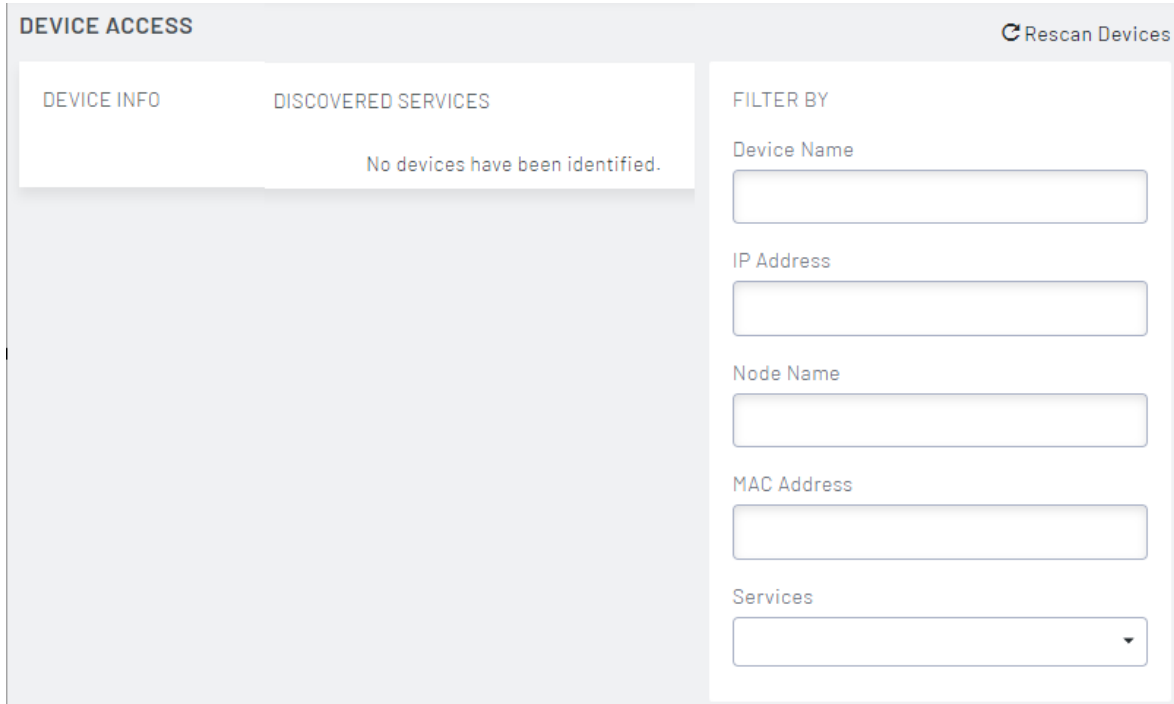
PROCEDURE

The basic steps to setup and use this feature are as follows:

1. Activate the **Automation Gateway** NetOps Module on an enrolled node, that is on the same network as the remote device that you wish to reach.
2. Log in to the Lighthouse web UI as a user with at least **NetOps Modules: Read Only** permission, and at least **Nodes & Devices (Base): Read Only** permission for the activated node.
3. Click **CONFIGURE > AUTOMATION GATEWAY > Devices**.
4. In the **FILTER BY** menu, select *HTTPS* or *HTTP* from the **Services** drop down.
5. Locate the remote device by hostname or IP address.

Tip: If many remote devices have been discovered, use the FILTER BY menu to search by full or partial device hostname or IP address.

- To initiate an Automation Gateway session, click the device's web UI icon.



DEVICE ACCESS Rescan Devices

DEVICE INFO DISCOVERED SERVICES

No devices have been identified.

FILTER BY

Device Name

IP Address

Node Name

MAC Address

Services

- You are now connected the web UI of the remote device

Note: While an Automation Gateway session is active, all new browser tabs and windows that connect to Lighthouse are proxied through to the remote device web UI.

- To close the Automation Gateway session, click the link at the bottom of the device web UI:

This system is being accessed via Lighthouse - [click here to return to Lighthouse](#)

CONNECT WITH REST/HTTP/HTTPS APIS

Automation Gateway allows central automation code to reach the HTTP/S API services running on devices on remote networks.

For more details see:

<https://ftp.opengear.com/download/documentation/api/lighthouse/og-rest-api-specification-v3-7.html>

This is accomplished by modifying the request to add the X-IP-Access-Auth HTTP header to your API request, and substituting the device's remote IP with Lighthouse's central IP. Requests containing the header are reverse proxied via Lighthouse then via an Operations Manager node that is local to the remote device.

The example Python (3.5+) code below illustrates this. Note that this code is primarily for illustrative purposes with no error handling or modularity, for clarity & brevity.

The device being accessed in this example is an HP ILO's Redfish REST API service.

```
#!/usr/bin/env python3

# Example code showing how to reach a remote device REST API via Opengear
# Lighthouse Automation Gateway -> Operations Manager node -> device
#
# This code is primarily for illustrative purposes with no error handling
# or modularity, for clarity & brevity
```

```
import requests

import json

import base64

# Authenticate to Lighthouse

lighthouse_address = '192.168.67.20'

lighthouse_account = 'root'

lighthouse_password = 'default'

data = { 'username': lighthouse_account, 'password': lighthouse_password }

r = requests.post('https://%s/api/v3.7/sessions/' %

    lighthouse_address, data=json.dumps(data), verify=False)

lh_token = json.loads(r.text)['session']

print('Authenticated to Lighthouse, token %s' % lh_token)

lh_headers = { 'Authorization': 'Token ' + lh_token }

# Find the node that is local to the remote device's API service

device_address = '10.0.0.71' # Equivalent to the UI fields under CONFIGURE >

device_service = 'https' # AUTOMATION GATEWAY > Devices > Filter By

r = requests.get('https://%s/api/v3.7/nom/ag/devices?ip=%s&service=%s' %

    (lighthouse_address, device_address, device_service),

    headers=lh_headers, verify=False)
```



```
j = json.loads(r.text)

print(json.dumps(j, indent=4))

for _device in j['devices']:
    for _host in _device['hosts']:
        for _service in _host['services']:
            if _service['nmap']['name'] != device_service:
                continue

            for _avail in _service['availability']:
                node_id = _avail['id']
                print('Service available via %s' % node_id)
                break

# Generate Automation Gateway token

data = { 'session': lh_token, 'request_type': 'new',
        'url': 'https://%s' % device_address, 'node': node_id }
r = requests.post('https://%s/api/v3.7/nom/ag/auth_tokens' %
                 lighthouse_address, data=json.dumps(data), headers=lh_headers,
                 verify=False)
j = json.loads(r.text)
ag_token = j['token']

print('Automation Gateway token is %s' % ag_token)

ag_headers = { 'X-Ip-Access-Auth': ag_token }
```

```
# Now we can query the device API using the Lighthouse address, by including
# the access token in the request headers

# The remaining code is specific to the device being accessed. this example
# hits a Redfish-compliant REST API

device_username = 'baz'
device_password = 'foobarfoobar'
device_auth = base64.b64encode('%s:%s' %
    (device_username, device_password)).encode('utf-8').decode('utf-8')
device_headers = { 'Authorization': 'Basic %s' %
    device_auth, 'Content-Type': 'application/json' }

# Add the access token to whatever headers you'd usually use to talk to the
# device's native API -- this header will be stripped by Automation Gateway

_headers = { **ag_headers, **device_headers }

r = requests.get('https://%s/redfish/v1/systems/1/' %
    lighthouse_address, headers=_headers, verify=False)
j = json.loads(r.text)
print(json.dumps(j, indent=4))
```

AUTOMATION GATEWAY SERVICE DISCOVERY

Automation Gateway discovery process can take varied amount of time to complete, entirely based on the size of your scannable network.

Services discovered by Automation Gateway are listed in the Lighthouse web UI, under **CONFIGURE > Automation Gateway > Devices**. The discovery process can be restarted using the "Rescan" button on the **Automation Gateway > Devices** page.

When an HTTP or HTTPS service has been discovered, it may also be accessed via this page.

When a node has been activated for Automation Gateway, it begins to discover remote services. The discovery process is initiated by Lighthouse, and runs every 10 minutes.

Each time the discovery process is initiated, the node runs an nmap script scan against all IPv4 connections belonging to the node's LAN firewall zone.

Note: Large logical networks with address space larger than 254 hosts (i.e. with a minimum netmask of /24 or 255.255.255.0) are excluded from the scan.

The nmap scan runs the *default* (non-intrusive) suite of nmap NSE scripts. These can be listed by running the following command on a node that has been activated for Automation Gateway:

```
sudo docker exec ag-remote cat /usr/share/nmap/scripts/script.db |  
awk -F\" '/'"default"/ { print $2 }'
```

IP ACCESS

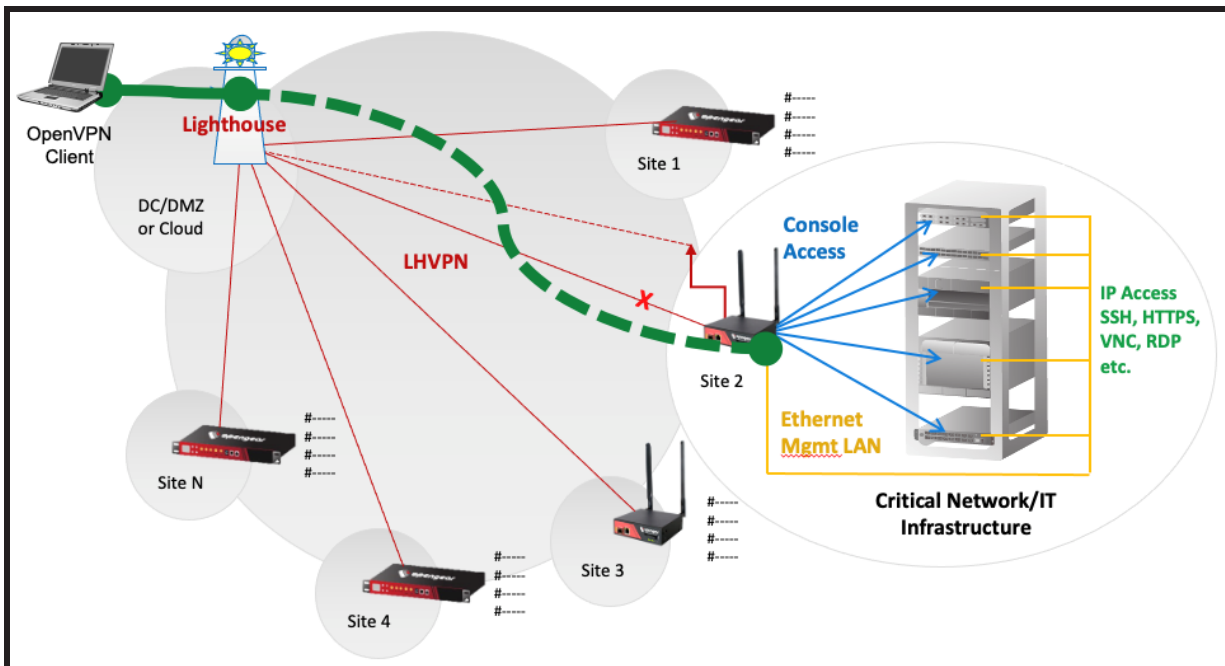
The Lighthouse IP Access feature allows an engineer to reach hosts on a remote site via an OpenVPN client through Lighthouse, over the Lighthouse VPN fabric, without physically traveling to the site. If IP Access is enabled for Lighthouse, it can be managed from using the **Configure > IP Access** menu option on the Lighthouse web UI.

IP Access adds client VPN capability to Lighthouse. Network engineers, firewall and server administrators can launch a VPN client connection to Lighthouse, be authenticated, then automatically connected to the remote site management network. The client PC has a secure VPN tunnel to the remote equipment the user needs to work on, providing the same TCP/IP access they would get if they traveled to the site and plugged into the management LAN.

The client can then access target devices on the remote network directly by their usual IP addresses and network ports. Requests from the client are masqueraded behind the node's IP address, so no additional routing configuration is required on the target devices.

CONNECTIVITY

By default, IP Access connects the client to the Management LAN of the Opengear appliance, or the interfaces in the LAN zone for the OM Series. A route for the directly attached subnet, plus any static routes configured on that interface (but never the default route) are also pushed automatically to the OpenVPN client.



In the diagram, the client PC has a virtual tunnel interface with a route to the yellow management network, and the user can access any target IP devices on the yellow network using their real IP addresses.

The basic configuration of this feature is:

- Activate the IP Access NetOps module – this starts the OpenVPN service in a Docker container on Lighthouse.
- Activate the IP Access NetOps module on each node you wish to use for IP Access – this installs a remote connector service to allow the IP Access bridge to be created.
- Generate a certificate and export an associated OpenVPN client configuration file.
- Import the configuration into your preferred OpenVPN client.

The basic operation of this feature is:

- Connect the tunnel – this starts a connection to Lighthouse on UDP port 8194.
- Authenticate when prompted using your Lighthouse credentials, appending the node name to your Lighthouse username – client certificate authentication is automatic, this is a second factor of authentication.
- Wait a moment for the connection to complete – this builds the GRE bridge between the client and pushes routes to the node's remote network(s).

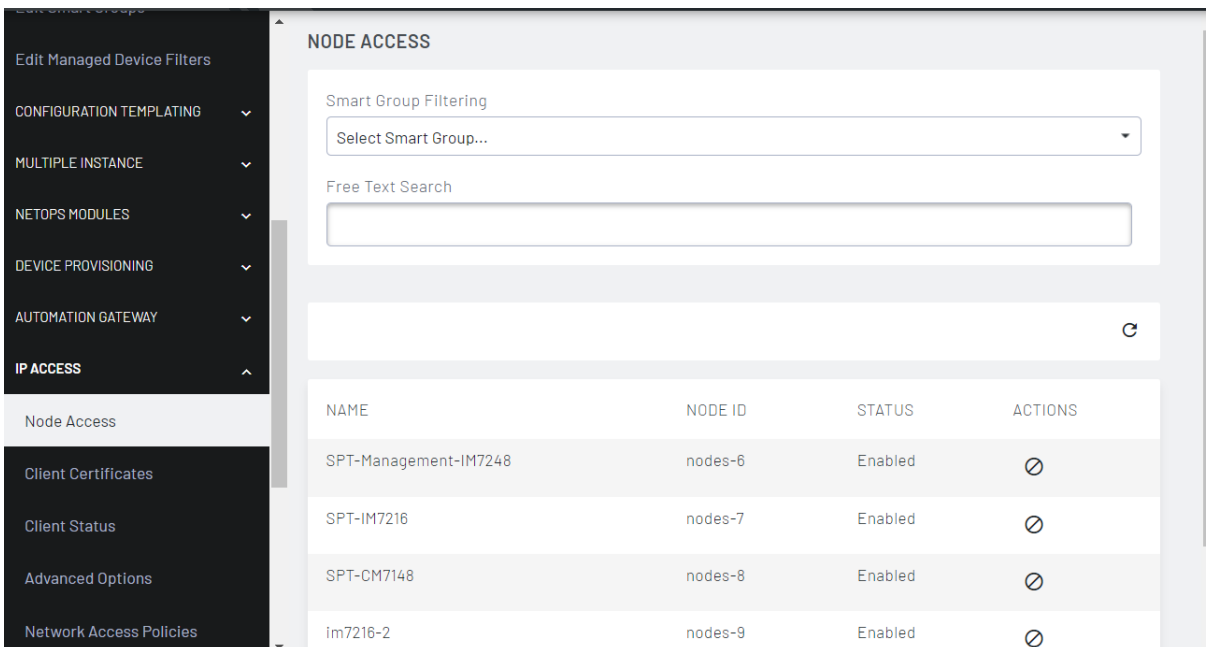
While connected, the client can access IP addresses on the node's remote network (s) LAN directly, for example, by using the ping command or by typing them into the browser address bar.

NODES SUPPORTED BY IP ACCESS

Opengear OM1200, OM2200, CM8100, ACM7000 and IM7200 nodes may be activated as IP Access nodes, to allow IP Access to their directly connected remote networks via Lighthouse.

Other vendors/models are not currently supported.

Select **Configure > IP Access** to view the available nodes in Lighthouse. The **Node Access** page displays.



NAME	NODE ID	STATUS	ACTIONS
SPT-Management-IM7248	nodes-6	Enabled	⊘
SPT-IM7216	nodes-7	Enabled	⊘
SPT-CM7148	nodes-8	Enabled	⊘
im7216-2	nodes-9	Enabled	⊘

ENABLE IP ACCESS IN LIGHTHOUSE

This topic walks through the steps required to activate and enable the IP Access feature.

ENABLE NETOPS AUTOMATION

After deploying the Lighthouse, sync the latest NetOps Modules from Docker Hub:

1. Log in to the Lighthouse web UI as a Lighthouse Administrator or the root user.
2. From the menu, select **SETTINGS > Services > NetOps Modules**.
3. Click the **Synchronize** icon.


Note: If Lighthouse cannot contact the Docker Hub, you may be able to use the offline installer.

ACTIVATE THE IP ACCESS MODULE

NetOps Modules must be activated on Lighthouse and a per-node basis.

1. Log in to the Lighthouse web UI as root or a Lighthouse Administrator, and upload the Enterprise Edition or Enterprise Automation Edition licence file under **SETTINGS > System > Subscriptions > Add**.
2. Click **CONFIGURE > NetOps Modules > Manage Modules** and wait until Lighthouse activation is complete.

To activate on the node you wish to access IP networks via, use the following steps:

1. Ensure **CONFIGURE > NetOps Modules > Manage Modules > IP Access > Always Activate** is unchecked and applied.
2. Select **CONFIGURE > Configuration Templating > Apply Templates**.
3. Under **NetOps Module Activation** select **IP Access** and click **Next**.
4. Select the nodes to to activate and click **Next**.
5. To ensure the preflight check has succeeded click the  *Update* icon above the table, then click **Next**.

Note: Any locally attached subnet and any static routes configured on the Management LAN (OGCS) or interfaces in the LAN zone will get pushed to the client.

See also: ["Activate a NetOps Module" on page 297](#).

NETWORK PORTS USED FOR IP ACCESS

IP Access OpenVPN clients connect on UDP port 8194, inbound to Lighthouse.

The remainder of the connection is bridged over the existing Lighthouse VPN between the node and Lighthouse, therefore no additional ports are utilized.

GENERATE A CERTIFICATE AND EXPORT CLIENT CONFIGURATION

Clients connect to Lighthouse via an OpenVPN client, which in turn connects them to the Management LAN network of a particular node. IP Access provides a convenient means to configure the OpenVPN client by generating the configuration files that may be imported directly into your OpenVPN client of choice.

1. Log in to the Lighthouse web UI as root or a Lighthouse Administrator, and click **CONFIGURE > IP Access > Client Certificates**. Enter a **Certificate Name** and click **Create**.
2. When the certificate is created, download an associated OpenVPN client configuration by clicking **Export**.

Note:Deleting a client configuration file from Lighthouse revokes that client certificate and any associated client configurations using that certificate will no longer be permitted to connect.

CONNECT THE VPN CLIENT

The final step is to establish the VPN connection that allows IP Access to the Management LAN (and optionally other networks) behind a node.

1. Import the client configuration from the previous step into your preferred OpenVPN client and start the VPN connection.

2. When prompted to authenticate the VPN connection, you must also specify your Lighthouse credentials and the node that you want to establish IP access via.
3. Specify the node by adding *:node-name* to your Lighthouse username, for example, authenticating with the username *james:my-acm7004-5* will authenticate as Lighthouse user *james* and connect the VPN to the IP network(s) behind *my-acm7004-5*.

Note:To be permitted connection, the Lighthouse user must have at least Node User rights for the specified node.

Note:The IP Access NetOps module creates a Layer 2 TAP mode tunnel which is not supported by Android or iOS operating systems.

PASSWORD AUTHENTICATION DURING VPN CONNECTION

During VPN connection, the client is prompted to enter a username and password. These credentials are used to authenticate the user, and also to specify the remote node to establish IP access through.

Specify the node by adding *:node-name* to your Lighthouse username, for example, authenticating with the username *james:my-acm7004-5* will authenticate as Lighthouse user *james* and connect the VPN to the IP network(s) behind *my-acm7004-5*.

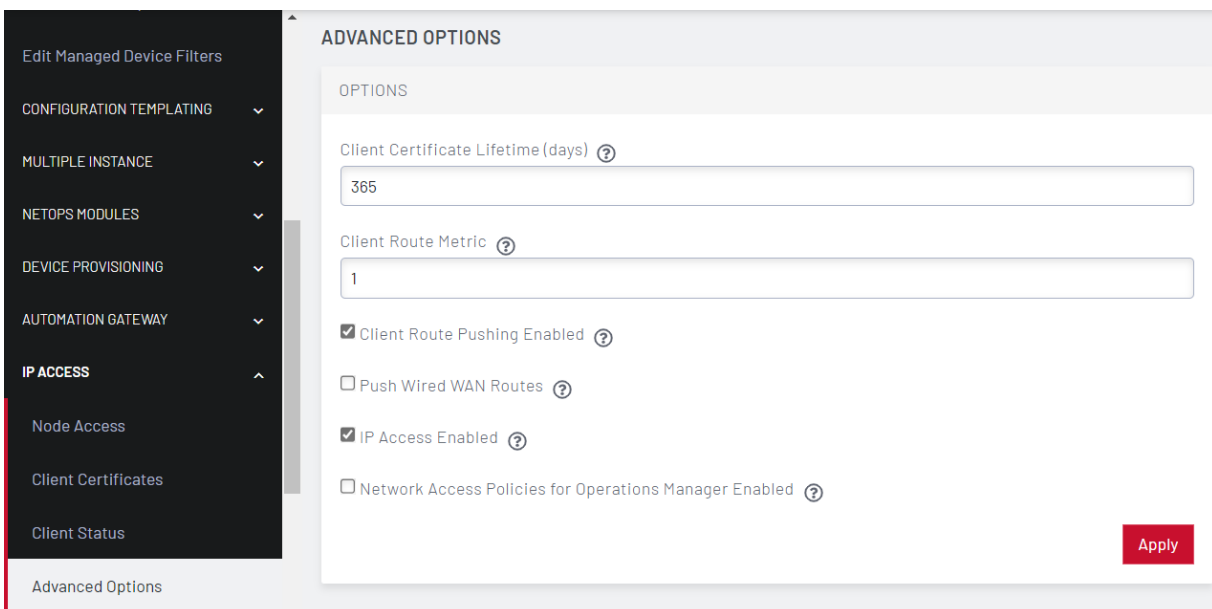
For authentication to succeed, the Lighthouse user must be one of:

- Lighthouse Administrator role, or root
- Node Administrator role with access to the node you are connecting through
- Node User role with access to the node you are connecting through

ADVANCED OPTIONS

The Advanced options of the IP Access page enable you to set a number of features, including setting expiry of certificates lifetime, changing default connection routes and enabling policies.

IP Access connects the client to the Management LAN or LAN zone by default, which is intended for deployments where the target devices are connected to those interfaces. If the Opengear appliances are deployed into a different or more complex network environment, then there are some advanced options that the Lighthouse administrator can use to control the IP Access connectivity, and these are described below.



The screenshot shows the 'ADVANCED OPTIONS' configuration page for IP Access. On the left is a dark sidebar with a menu. The 'IP ACCESS' section is expanded, showing 'Node Access', 'Client Certificates', 'Client Status', and 'Advanced Options' (which is highlighted). The main content area is titled 'ADVANCED OPTIONS' and contains a section labeled 'OPTIONS'. This section includes four configuration items:

- Client Certificate Lifetime (days)**: A text input field containing the value '365'.
- Client Route Metric**: A text input field containing the value '1'.
- Client Route Pushing Enabled**: A checkbox that is checked.
- Push Wired WAN Routes**: An unchecked checkbox.
- IP Access Enabled**: A checkbox that is checked.
- Network Access Policies for Operations Manager Enabled**: An unchecked checkbox.

An 'Apply' button is located in the bottom right corner of the configuration area.

CONNECTING TO WAN ZONE

By default, IP access connects the client to the management LAN zone.

If IP Access is required for the WAN zone, select **Configure > IP ACCESS > Advanced Options > Push Wired WAN Routes**. This is a global configuration, and will affect all node that are enabled for IP Access.

In this case, the customer must have deployed Opengear appliances with the Network Interface (NET1) connected to the management network or facing target devices, and it results in IP Access connecting the client to the WAN (NET1) interface on OGCS.

NETWORK ACCESS POLICIES FOR OPERATIONS MANAGER

In a more complex deployment, Opengear appliances may be connected to multiple networks or virtual networks (VLANs), and in these cases it is often important to be able to control which of these networks each authenticated IP Access user is able to access.

This feature is only supported on Operations Manager or OM Series appliances, which support the zone-based firewall, designed to work with multiple VLANs and the optional built-in Ethernet switch with layer-3 capable ports. This flexibility and control is very useful, especially for customers who have a number of separate management networks (or VLANs) for different administrative teams.

The Network Access Policy mechanism on Lighthouse provides a way to dynamically map IP Access users, based on their group membership, to the firewall zone(s) that they can access on the Nodes. Each firewall zone is a collection of

network interfaces which is configured on each OpenGear appliance or Node. Firewall zones are used to provide policy abstraction by logical zone names – the physical or virtual interfaces on each Node may vary by site, but the zone names must stay consistent. It is recommended that zones and names are planned out in advance of implementation.

A firewall zone is a collection of network interfaces which is configured on each OpenGear appliance or Node in Lighthouse terminology. The Network Access Policy mechanism on Lighthouse provides a way to map users, based on their group membership, to the firewall zone(s) that they can access on the Nodes.

UNDERSTANDING ACCESS POLICIES

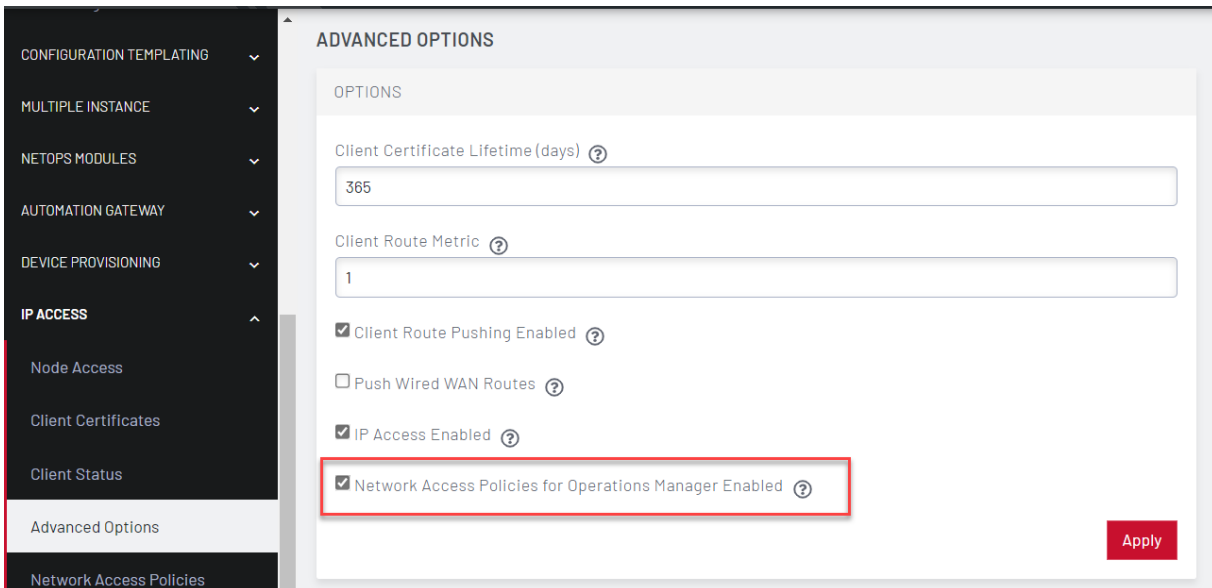
Putting it all together, when a user authenticates to Lighthouse, they are mapped into one or more group(s), which map into firewall zone(s), which allow authenticated users to reach the appropriate network interface(s), including switch ports or VLANs, via IP Access.

For example, users who belong to the security group may get mapped into the secops (security operations) zone. On each OM appliance, the appropriate switch port(s) and/or VLAN(s) for security operations should be configured to be in the secops zone.

Similarly, users in the server group may get mapped into the serverops zone, and again on the OM appliances the appropriate interfaces can be configured to be part of that zone. The result is that members of the security group get IP Access to the networks in the secops zone, and members of the server group get IP Access to the networks in the serverops zone, for each Node that they connect to.

SETTING UP NETWORK ACCESS POLICIES

To enable this feature, go to **IP Access > Advanced Options** and select “Network Access Policies for Operations Manager Enabled”, then hit **Apply**.



CONFIGURATION TEMPLATING ▾
MULTIPLE INSTANCE ▾
NETOPS MODULES ▾
AUTOMATION GATEWAY ▾
DEVICE PROVISIONING ▾
IP ACCESS ▴
Node Access
Client Certificates
Client Status
Advanced Options
Network Access Policies

ADVANCED OPTIONS

OPTIONS

Client Certificate Lifetime (days) ⓘ
365

Client Route Metric ⓘ
1

Client Route Pushing Enabled ⓘ

Push Wired WAN Routes ⓘ

IP Access Enabled ⓘ

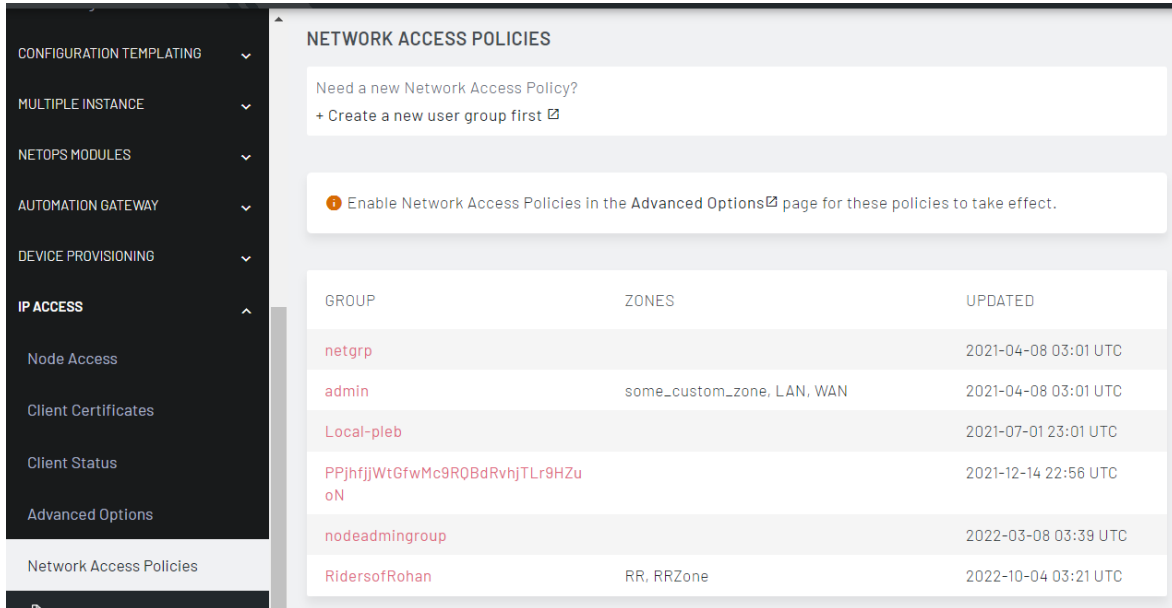
Network Access Policies for Operations Manager Enabled ⓘ

Apply

TO SET ACCESS POLICIES

A policy must be configured for each group whose members will use IP Access.

1. Select **Configure > IP Access > Network Access Policies**. The **Network Access Policies** page displays. The group to zone mapping column names **ZONES** is empty by default.



GROUP	ZONES	UPDATED
netgrp		2021-04-08 03:01 UTC
admin	some_custom_zone, LAN, WAN	2021-04-08 03:01 UTC
Local-pleb		2021-07-01 23:01 UTC
PPjhjjWtGfwMc9R0BdRvhjTLr9HZu oN		2021-12-14 22:56 UTC
nodeadmingroup		2022-03-08 03:39 UTC
RidersofRohan	RR, RRZone	2022-10-04 03:21 UTC

2. Click on the group name to edit the group policy.
3. Click on **+ Add Zone** to add one or more firewall zones for this group.
4. Select the firewall zone and click Add.

ADD FIREWALL ZONE

NAME	NODES	
<input type="checkbox"/> LAN	1	View details
<input type="checkbox"/> Lighthouse VPN	1	View details
<input type="checkbox"/> WAN	1	View details
<input type="checkbox"/> Cellular	0	View details
<input type="checkbox"/> RR	0	View details
<input type="checkbox"/> RRZone	0	View details

+ Manually specify zone

5. The Network Access Policies page now displays the group with the Firewall zone.

ACCESSING MULTIPLE VLANS OR PORTS

There are several ways a user can access multiple target networks, virtual networks (VLANs) or physical ports.

GROUP MEMBERSHIPS

A user may belong to multiple groups, in which case they will have access to the sum of the zones mapped to those groups, in the same way port access works for Console Gateway and Smart Group matching. Note that this works regardless of Local or Remote user authentication on Lighthouse; user authorization (which determines access to Nodes and managed devices, and now firewall zones) is always derived from group membership.

FIREWALL ZONES

In the **IP Access Network Access Policy** settings, each group can be configured to have access to one or more firewall zones. Some groups can be configured to have access to no zones, some to just one zone, and other groups to have access to multiple zones.

MULTIPLE LAYER 3 NETWORK CONNECTIONS

On each Node a layer 3 network connection or “conn” is required on the OM to communicate with other hosts on a network or VLAN. Multiple conns on each OM can be mapped into the same firewall zone. This may be used to provide access to multiple switch ports, though it is perhaps more likely that those switch ports would be configured in a bridge group if they are all part of the same LAN, and the bridge group only requires a single layer 3 conn. If multiple LANs or virtual LANs (VLANs) are managed by the same team, then it may make sense to combine them into the same firewall zone.

Warning: The supported appliance's firewall will allow traffic to pass between interfaces in the same firewall zone, so to maintain security, multiple “separate” management VLANs should not be configured in the same zone, but should each have its own zone. If required, one of the mechanisms above can be used to allow user access to multiple zones and therefore to multiple “separate” VLANs.

TROUBLESHOOTING IP ACCESS

The most effective way to troubleshoot IP Access is to view the logs.

VIEW THE DOCKER LOGS

run the following command on Lighthouse, either as root or with sudo (for non-root admins):

```
sudo docker logs -t central-sdi
```

The logs for the `central-sdi` Docker container, which controls client IP Access display.

```
2022-10-03T10:03:19.051579136Z INFO:root:[NetOps-SDI node="nodes-36"
username="maverick"] VPN client authenticated
2022-10-03T10:03:19.094313762Z 2.29.37.12:65437 TLS:
Username/Password authentication succeeded for username
'maverick123:OM1208-UK2'
2022-10-03T10:03:19.422971278Z 2.29.37.12:65437 Control Channel:
TLSv1.3, cipher TLSv1.3 TLS_AES_256_GCM_SHA384, peer certificate:
2048 bit RSA, signature: RSA-SHA256
2022-10-03T10:03:19.422999989Z 2.29.37.12:65437 [LH5-UK3-22] Peer
Connection Initiated with [AF_INET]2.29.37.12:65437
2022-10-03T10:03:22.000300953Z INFO:root:[NetOps-SDI node="nodes-36"
username="maverick123"] VPN client connected with IP 172.31.0.8
netmask 255.255.0.0
2022-10-03T10:03:22.084275387Z LH5-UK3-22/2.29.37.12:65437 OPTIONS
IMPORT: reading client specific options from: /tmp/openvpn_cc_
```

```
3aa5d19c3ea09b3bbac56f6bacf7b6e.tmp
2022-10-03T10:03:22.084324213Z LH5-UK3-22/2.29.37.12:65437 Data
Channel: using negotiated cipher 'AES-256-GCM'
2022-10-03T10:03:22.084332293Z LH5-UK3-22/2.29.37.12:65437 Outgoing
Data Channel: Cipher 'AES-256-GCM' initialized with 256 bit key
2022-10-03T10:03:22.084337215Z LH5-UK3-22/2.29.37.12:65437 Incoming
Data Channel: Cipher 'AES-256-GCM' initialized with 256 bit key
2022-10-03T10:03:22.084342034Z LH5-UK3-22/2.29.37.12:65437 SENT
CONTROL [LH5-UK3-22]: 'PUSH_REPLY,ping 10,ping-restart 120,route
192.168.2.0 255.255.255.0 172.31.0.1 1,ifconfig 172.31.0.8
255.255.0.0,peer-id 0,cipher AES-256-GCM' (status=1)
2022-10-03T10:03:22.084950386Z LH5-UK3-22/2.29.37.12:65437 PUSH:
Received control message: 'PUSH_REQUEST'
2022-10-03T10:03:22.085204467Z LH5-UK3-22/2.29.37.12:65437 PUSH:
Received control message: 'PUSH_REQUEST'
2022-10-03T10:03:22.085220316Z LH5-UK3-22/2.29.37.12:65437 PUSH:
Received control message: 'PUSH_REQUEST'
2022-10-03T10:03:22.432350278Z LH5-UK3-22/2.29.37.12:65437 PUSH:
Received control message: 'PUSH_REQUEST'
2022-10-03T10:03:23.120616769Z INFO:root:[NetOps-SDI node="nodes-36"
username="maverick"] VPN client identified by MAC c6:87:ca:4a:3b:2c
```

Note the PUSH_REPLY line above shows that the IP Access client has been pushed the route to the network 192.168.2.0/24 which in this case is the interface on this Node in the firewall zone that the user was mapped into. (Unfortunately, the firewall zones are not listed in this log output). If there are errors with authentication, then they will show up here.

USING THE ROUTING TABLE

When troubleshooting IP Access it is useful to look at the routing table on the target Node to make sure that routes to the target networks are installed. If the interface is down, for example, then the route is not present and will not be pushed to the client.

The following commands can be used to display the routing table on the target OM Series Node:

```
route
ip route
```

The Routing table displays:

```
root@OM1208-UK2:~# route
Kernel IP routing table
Destination Gateway Genmask Flags Metric Ref Use Iface
default _gateway 0.0.0.0 UG 110000001 0 0 net1
5.5.5.0 0.0.0.0 255.255.255.0 U 0 0 0 sw0p8
172.17.0.0 0.0.0.0 255.255.0.0 U 0 0 0 docker0
172.31.0.0 0.0.0.0 255.255.0.0 U 0 0 0 ipa-br0
192.168.0.0 0.0.0.0 255.255.255.0 U 0 0 0 net2
192.168.1.0 0.0.0.0 255.255.255.0 U 0 0 0 net1
192.168.2.0 0.0.0.0 255.255.255.0 U 0 0 0 sw0p2
192.168.128.0 0.0.0.0 255.255.224.0 U 0 0 0 tun0

root@OM1208-UK2:~#
root@OM1208-UK2:~# ip route
default via 192.168.1.1 dev net1 proto static metric 110000001
5.5.5.0/24 dev sw0p8 proto kernel scope link src 5.5.5.5
172.17.0.0/16 dev docker0 proto kernel scope link src 172.17.0.1
linkdown
172.31.0.0/16 dev ipa-br0 proto kernel scope link src 172.31.0.1
```

```
192.168.0.0/24 dev net2 proto kernel scope link src 192.168.0.48
192.168.1.0/24 dev net1 proto kernel scope link src 192.168.1.48
192.168.2.0/24 dev sw0p2 proto kernel scope link src 192.168.2.8
192.168.128.0/19 dev tun0 proto kernel scope link src 192.168.128.6
root@OM1208-UK2:~#
```

The `ip route` command output is useful as it shows the interface IP address of the OM, which should be reachable via IP Access as long as that interface is up.

Other standard network troubleshooting techniques can be used from the Node, for example testing the ability to ping a target device, or using `curl` if it has an `http` or `https` interface.

Examples

```
ping 192.168.2.4
curl -k https://192.168.2.4/
```

SECURE PROVISIONING

Secure Provisioning for NetOps is a configuration storage, distribution and provisioning system. It does not generate, test or validate device configuration. Instead, it is focused on provisioning remote managed devices with user-supplied configuration and device OS images – automatically, remotely and securely, no matter where those devices are and no matter what the state of the network is.

Using Secure Provisioning for NetOps, network turn up no longer requires network engineering staff to perform initial configuration tasks on site, even when there is no existing LAN or WAN in place. Remote hands rack, stack and cable the infrastructure, then Secure Provisioning for NetOps Automation automates the rest of the turn up process.

The Secure Provisioning module leverages these technologies:

- **ZTP** (Zero Touch Provisioning): The process by which managed devices in their unconfigured state request and are delivered initial setup resources over the local management network
- Human-readable **YAML** language: Provides simplified configuration of managed device ZTP configuration parameters
- **Git** source control: Managed Device resources such as initial configuration files and OS images are automatically stored in a versioned, auditable repository
- **Ansible** automation framework: Automatically propagates device resources and configures on-site ZTP services

The Secure Provisioning module combines a centrally orchestrated, vendor-neutral ZTP service with on-site node LAN and WAN connectivity, to automate the provisioning process end to end.

SECURE PROVISIONING CONFIGURATION MANAGEMENT

Secure Provisioning always applies device configuration in its entirety and does not support applying config patches or deltas to a provisioned device (for example, adding a few lines to running config, to enable a specific feature).

STATELESS FILE MANAGEMENT

Secure Provisioning supports a DevOps-style approach which collapses initial provisioning, disaster recovery and ongoing maintenance workflows into the one workflow:

Using this approach, the config patch is applied in Lighthouse to the central configuration template via git, which renders the configuration file in its entirety and pushes to the OM node. The device is factory reset and pulls the new configuration as if it were being provisioned for the first time.

Pros:

- Eliminates config drift
- Enforces config reproducibility
- Central audit trail of all configuration changes
- Disaster recovery becomes as simple as resetting all devices to reprovision

Cons:

- Requires a longer maintenance window as the device is reset and reboots
- Patches cannot be applied to running configuration

STATEFUL DEVICE MANAGEMENT GATEWAY

The NetOps Automation platform provides a management fabric from remote devices to your central management network via Lighthouse VPN and/or the cellular WWAN.

There are many tools and protocols purpose-built for stateful configuration management, such as Cisco NSO and SolarWinds NCM, and NETCONF and gRPC (OpenConfig).

NetOps can be leveraged by these tools as a secure, resilient management path – both extending their reach to the out-of-band management network, and ensuring reachability during outages.

HOW SECURE PROVISIONING WORKS

The Secure Provisioning feature centrally orchestrates the distribution of managed device configuration files and firmware images, and the node provisioning (ZTP) services required to deliver the files to managed devices.

Secure Provisioning is configured by defining the resources to provision managed devices with, and defining how these resources should be distributed around your network.

- **Device Resource Bundles** contain the files needed to provision one or many managed devices:
 - **Configuration File, Script File** and/or **Image Files**.
 - Each Resource Bundle has a defined **Device Type**.
 - When a Resource Bundle is distributed to a node, any ZTP request matching the Device Type are provisioned with the bundled resources.
 - This may be restricted to specific devices by specifying one or more device **MAC Addresses** (range and reverse match supported) or **Serial Numbers** (not supported by all vendors).

- **Resource Distribution** policies are defined by **Node Inventory Lists**:
 - A **Static Node Inventory List** - a predefined, static list of nodes to distribute to
 - A **Dynamic Node Inventory List** - evaluates a Smart Group each time resources are distributed.

Tip: The Dynamic Node Inventory List allows you automatically tag certain nodes with Enrollment Bundles, for example, by region or site class, to help automate resource distribution to newly enrolled nodes in that region.

Device Resource Bundle and Resource Distribution configuration are supplied to Lighthouse using the web UI or CLI (git) method. The Web UI configuration method creates an underlying YAML configuration the same as created using the git method, it is effectively a front end to the git method.

A *git push* to the Lighthouse repository or clicking the UI **Push Now/Push Resources** button triggers a resource push:

- A git post-commit hook triggers an Ansible playbook on Lighthouse.
- The playbook copies resources down to nodes, securely over Lighthouse VPN.
- The playbook start or restarts ZTP services on nodes.

SUPPORT FOR SECURE PROVISIONING

Opengear OM2200 and OM1200 nodes may be activated as Secure Provisioning nodes.

Opengear ACM7000 or IM7200 nodes may also be activated as provisioning nodes, however not all features are available and there are some caveats to be aware of.

Features that are not available of ACM7000/IM7200 nodes:

- Secure boot and physical tamper resistance.
- Encryption of device resource files at rest.
- Centralized ZTP status logging.
- Device configuration templating.
- Ordered provisioning.
- Post-provisioning scripts.

Other ACM7000/IM7200 caveats:

- Secure Provisioning takes control of node DHCP, NTP, DNS services and overwrites system configuration.
- Secure Provisioning overwrites node Management LAN configuration.

VENDOR MANAGED DEVICES SUPPORTED BY SECURE PROVISIONING

Secure Provisioning is vendor-neutral, with support for a broad range of network devices from multiple vendors.

The ZTP process used to provision devices is not standardized, and each vendor OS implements ZTP differently – for example, using differing DHCP options, or requiring an intermediary script to load files.

With Secure Provisioning, you upload configuration and/or firmware image files to create Resource Bundles, then select the vendor profile for that Resource Bundle. This automatically generates the vendor-appropriate ZTP configuration, simplifying the delivery of resources to target devices.

Secure Provisioning currently has built-in support for provisioning devices from these vendors:

- Cisco (IOS, IOS XR, IOS XE, NX-OS)
- Juniper
- Arista
- HPE/Aruba
- Huawei
- Cumulus
- Pica8
- Opendgear

Advanced users may add support for additional devices using custom DHCP configuration.

LOCAL NETWORK SERVICES PROVIDED BY NODES

In addition to zero touch provisioning (ZTP) services, the local node runs local services required to act as a bootstrap management LAN and secure WAN for managed devices, from day zero onwards.

When responding to a BOOTP/DHCP provisioning request from a device, the Operations Manager node hands out its own local address as:

DEFAULT GATEWAY

Devices trying to reach to destinations on the central LAN that Lighthouse resides on are securely routed over Lighthouse VPN. This allows devices to reach, for example, central NMS for monitoring, and central configuration systems for final service provisioning.

Requests to other remote destinations are masqueraded behind and routed out the node's built-in cellular WWAN, allowing devices to reach cloud provisioning services.

Note that device requests are masqueraded to Lighthouse's central IP and will appear to be originating from Lighthouse to hosts on the central LAN.

All traffic between remote node network and the central Lighthouse network is securely tunneled inside Lighthouse VPN.

DNS SERVER

DNS lookups from devices are securely proxied through Lighthouse VPN to the central DNS server(s) used by Lighthouse, allowing devices to resolve central hosts from day one.

NTP SERVER

The NTP Server allows devices to set accurate time on first boot, for example, for certificate verification and generation. By default, the node's NTP service uses its local hardware clock as time source.

SYSLOG SERVER

The Syslog Server relays messages to a central LogZilla instance (this is an optional extra module). This allows log collection from day zero, and analysis of the device ZTP process itself.

SECURE PROVISIONING CONFIGURATION

All system configuration is performed via Lighthouse. The configuration necessary to provision a device consists two elements. The basic steps to configure Secure Provisioning are:

- Create Device Resource Bundles and upload resource files (for example, configuration files or scripts, firmware images) to Lighthouse.
- Define Node Inventories to distribute the resources to specific nodes, where they will become available for devices to request for provisioning.

DEVICE RESOURCE BUNDLE

A Device Resource Bundle contains the resource files, such as, a configuration file and OS upgrade image, that are loaded via ZTP (DHCP + TFTP/HTTP) onto the managed device. This may be a full, final configuration, or a baseline configuration to allow the managed device to become managed by an upstream configuration service.

As each vendor's ZTP process is slightly different, Device Resource Bundles allow you to select the Device Type. This generates the appropriate ZTP server configuration (DHCP options), any necessary intermediary provisioning scripts and enables device-specific ZTP features, such as serial number matching.

By default, Device Resource Bundles are targeted to all managed devices of the selected Device Type. Bundles may be targeted to specific managed devices by specifying one or more device MAC addresses (including range and reverse match), or in some case by specifying one or more device serial numbers.

NODE INVENTORY

A Node Inventory is a static or dynamic list of nodes and a corresponding list of Device Resource Bundles. This defines how Device Resource Bundles are distributed around your network.

Resource Bundles may be distributed using one of two methods:

- Push to a static list of nodes, selected individually by node ID
- Push to a dynamic list of nodes, linked to a Lighthouse Smart Group of nodes

Note: You may combine distribution methods.

Topic continued on next page:

CREATE DEVICE CONFIGURATION

To provision a managed device, you must supply device resources. Device resources consist of an initial configuration file for the device to install, and optionally a operating system image for the device to upgrade itself with.

Device resource file formats are specific to the target vendor. Secure Provisioning for NetOps Automation provisions these files, but does not generate them.

For example, a trivial Arista initial configuration file may look like:

demo_arista.cfg

```
hostname nom-demo-switch
!
interface Management1
  description ZTP_Mgmt_Interface
  ip address 10.0.0.123/24
!
banner login
Welcome to $(hostname)!

      _
     / |
    __\\ \\
   (__) \.--.   Provisioned by
   (__)  | |    Opengear NetOps Automation
   (__)  | |
   (__)__.|_|

EOF
!
end
```

A trivial Cisco IOS XR initial configuration may look like:

Cisco IOS XR initial configuration:


```
!! IOS XR
!
hostname nom-demo-router
!
username admin
  group root-lr          I
  group cisco-support
  secret 5 $1$Qk9Y$x/GCXsUPrXYQw1s5GCdW30
!
interface MgmtEth0/RP0/CPU0/0
  description ZTP_Mgmt_Interface
  ip address 10.0.0.200 255.255.255.0
!
banner motd ^Welcome to $(hostname)!

      _
     / |
    __\ \
   (__) \---.          Provisioned by
   (__)  | |          Opendgear NetOps Automation
   (__)  | |
   (__)__·|_|
^
!
end
```


ACTIVATE THE SECURE PROVISIONING MODULE ON LIGHTHOUSE

The Secure Provisioning license is installed on Lighthouse and contains a preset number of available node activations. Each node activated for Secure Provisioning consumes an available activation; Lighthouse itself does not consume an activation.

Installing the Secure Provisioning license automatically activates Secure Provisioning on Lighthouse, at which point the NetOps Automation platform installs the central Secure Provisioning software components on Lighthouse.

1. Install the Enterprise Automation Edition license under **SETTINGS > System > Subscriptions**.
2. Install an applicable legacy license, or, apply an Automation Edition subscription, to enable Secure Provisioning under **SETTINGS > System > Subscriptions**.
 - It will take a few minutes for the Secure Provisioning to activate on Lighthouse, view progress under **CONFIGURE > NetOps Modules > Manage Modules**.
3. Click the  *Update* icon and note new menu items are now available under **CONFIGURE > Secure Provisioning**.

Secure Provisioning may now be selectively activated on nodes automatically as they enroll, or activated on nodes manually after enrollment.

INSTALL THE NODE

1. Connect the NET1 Ethernet to a network port via which node can reach the Lighthouse VM Connect power to the node.
2. By default, the node requests a DHCP address and has a static address of 192.168.0.1/24.

3. Test you can reach the node address via ping, SSH and HTTPS, and note this address for the following step.

CONFIGURE A PER-NODE MODULE ACTIVATION POLICY

The process of automatically or manually activating Secure Provisioning on a node prepares it to become a Secure Provisioning server, securely over Lighthouse VPN.

Activating a node for Secure Provisioning consumes an activation from the license. Deactivation returns the activation to the available pool. To deactivate and remove a NetOps Module from a given node, see ["Deactivate \(remove\) a NetOps Module" on page 301](#).

Note: Operations Manager activation deploys the Secure Provisioning container to the node, which may take several minutes.

OPTION A. AUTOMATICALLY ACTIVATE ALL NODES UPON ENROLLMENT

This is the default policy. When a license is present and activations are available, all nodes are activated for Secure Provisioning as they enroll. Nodes that have been previously enrolled must be manually activated.

1. Ensure CONFIGURE > NetOps Modules > Manage Modules > Secure Provisioning > Always Activate is checked and applied.
2. To activate a node, enroll it into Lighthouse.



OPTION B. AUTOMATICALLY ACTIVATE SELECT NODES UPON ENROLLMENT

You may selectively activate Secure Provisioning on a subset of nodes using Enrollment Bundles. Only nodes enrolling using one of these bundles will be automatically activated.

1. Uncheck **CONFIGURE > NetOps Modules > Manage Modules > Secure Provisioning > Always Activate** and click **Apply**.
2. Select **CONFIGURE > Node Enrollment > Enrollment Bundles** and add a new bundle (you may also edit an existing bundle) Enter a bundle **Name** and **Token**, and choose whether or not to **Auto-Approve** enrollment.
3. Scroll down to **NetOps Modules** and add **Secure Provisioning** then **Apply**.
4. When enrolling the node to Lighthouse, specify the **Enrollment Bundle Name** and **Token**.

Note:Lighthouse-initiated manual enrollment (i.e. clicking the **Add Node** button in the Lighthouse web UI) does not support bundles, you must use a node-initiated enrollment method.


OPTION C. MANUALLY ACTIVATE NODES AFTER ENROLLMENT

1. Select **CONFIGURE > Configuration Templating > Apply Templates**.
2. Under **NetOps Module Activation**, select **Secure Provisioning** and click **Next**. Select the nodes to to activate and click **Next**.
3. To ensure the preflight check has succeeded click the  *Update* icon above the table, then click **Next**.
4. Click the  *Update* icon, to ensure activation is successful.

ENROLL THE NODE INTO LIGHTHOUSE

1. Launch an HTTPS browser session to Lighthouse.
2. Login using root and the secure password set earlier.

Tip: You may also login as a Lighthouse Administrator user, if you have configured one.

3. At the top of the UI, click **Add Node**.
4. Select An Opengear appliance, the second option in the **Product** dropdown list.
5. Enter the Operations Manager's Network Address, Username (root) and Password (default) **Check Auto-approve node** then **Apply**.
6. From menu, select **CONFIGURE -> Node Enrollment -> Enrolled Nodes** then click the  *Update* icon to check enrollment has completed.
7. If you are using the Automatically activate select nodes upon enrollment policy, you must manually activate the node after enrollment.

The node now has a secure Lighthouse VPN (OpenVPN) tunnel back to Lighthouse, over which all communications are now secured.

CONNECT TARGET DEVICE

Secure Provisioning currently supports provisioning devices from these vendors:

- Cisco
- Juniper
- Arista
- HPE/Aruba
- Huawei
- Cumulus
- Pica8
- Opengear

Note: Additional devices may be supported using custom DHCP configuration. To request built-in support for additional devices, contact customer support.

PROCEDURE

1. Connect a supported managed device's management NIC directly to the node.
2. If the node has a built-in Ethernet switch, connect the device to any switch port.
3. Otherwise, connect the device directly to the node's NET2 Ethernet, or via an intermediary management switch.
4. Power on the managed device.
5. Ensure the managed device is in ZTP mode, this typically requires the device to have its configuration erased/reset to factory defaults.

UI-BASED WORKFLOW

Each NetOps Module provides a simple web UI for configuration and status monitoring. This UI is designed primarily for manual operation, evaluation and testing. For comprehensive automation, refer to the CLI-based workflow section that follows. It may be useful to familiarize yourself with the system using the UI before adopting a CLI-based workflow.

Note: Changes pushed to nodes via the Lighthouse UI or API will override those made by direct repository access, therefore UI-based or CLI-based workflows should be considered mutually exclusive modes of operation.

UI WORKFLOW

Launch an HTTPS browser session to Lighthouse.

Login using root and the secure password set earlier.

Tip: You may also login as a Lighthouse Administrator user, if you have one configured.

CREATE DEVICE RESOURCE BUNDLE

1. In the menu, navigate to **CONFIGURE > Secure Provisioning > Device Resources**.

2. Click the **Add (+)** button. The **Modify Device Resource** page opens.

MODIFY DEVICE RESOURCE

DEVICE RESOURCE DETAILS

Name

Device Type

Configuration File ?

 No file chosen

Image File ?

 No file chosen

MAC Addresses ?

Serial Numbers ?

ADVANCED

Advanced features are only available on Operations Manager nodes.

3. Choose a **Name** to identify this bundle, for example, demo_bundle1.
4. Select the **Device Type** corresponding to a target managed device.

Note:Each device type may display different resource fields documented below, this is dependent on the device-specific ZTP featureset

5. The **Configuration File** is the initial configuration file for the device to load via ZTP. Select a previously uploaded file or click the **Browse** button to upload a new file.
6. The **Image File** is the initial software image for the device loaded via ZTP. Select a previously uploaded **Image File** or click the **Browse** button to upload a new file.
7. Optionally, target this bundle at devices matching the specified MAC Addresses, click the **Add** and **Remove** buttons when specifying multiples.

Note:Each MAC address is specified in full, using a wildcard (for example, 00:10:FA:C2:BF:*), or negated to exclude from the match (for example, !01:23:45:67:89:AB)

8. Optionally, target this bundle at devices matching specified **Serial Numbers**, click the **Add** and **Remove** icons when specifying multiples.
9. Click **Save**.

DEFINE RESOURCE DISTRIBUTION

See the Node Inventory section earlier in this document for an overview of available distribution methods.

DEFINE A STATIC NODE INVENTORY

1. Navigate to **CONFIGURE > Secure Provisioning > Resource Distribution**.
2. Under **Static Node Inventory List** click the **Add +** button. The **New Node Inventory** window opens, displaying inventory details.
3. Choose, and enter a Name to identify this bundle, for example, `branchinventory_`
4. From the Resource Distribution list, select the bundles to distribute.

NEW NODE INVENTORY

INVENTORY DETAILS

Name

Resource Distribution

<input type="checkbox"/>	NAME	DEVICE TYPE	RESOURCES
<input type="checkbox"/>	example_router	cisco_xr	Configuration File: demo_xrv.cfg
<input type="checkbox"/>	example_switch	arista	Configuration File: demo_arista.cfg

🔍 FILTERING

Smart Group Filtering

Free Text Search

5. Select the **Nodes** to which these bundles are to be distributed.

Note:The **Free Text Search** and **Smart Group** filter options are to help locate nodes for inclusion in the static inventory, these filters are *not* applied

dynamically to the inventory going forward.

6. Click **Apply**.

DEFINE A DYNAMIC NODE INVENTORY

1. Create a Lighthouse Smart Group. See ["Creating Smart Groups" on page 163](#)
2. In the Lighthouse UI, navigate to **CONFIGURE > Secure Provisioning > Resource Distribution**.
3. Under **Dynamic Node Inventory List** click the **Add +** button. The **Modify Node Inventory** window opens, displaying inventory details.
4. Choose, and enter a Name to identify this bundle, for example, LabInventory_
5. Select the **Smart Group** to link to this inventory,

Note:this **Smart Group** search is dynamically evaluated to a list of nodes each time resources are pushed.

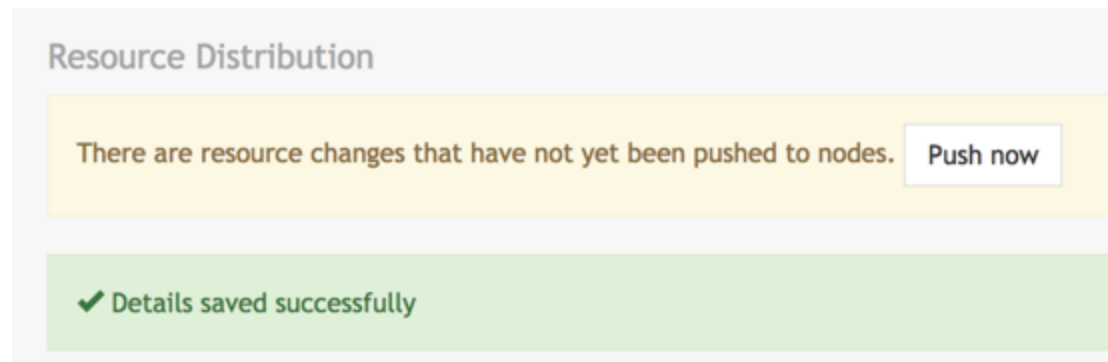
6. Select the bundles to distribute, listed in the **Resource Distribution** table.
7. Click **Apply**.

Note:Changes to resource bundle or distribution configuration are not applied to nodes immediately, they must be explicitly pushed to nodes.

PUSH RESOURCES

Any changes to the resource bundle or distribution configuration made in the previous steps are not applied to nodes immediately, they must be explicitly pushed to nodes.

When changes are detected, a **Push now** button is displayed above the Secure Provisioning UI pages.



Resources may always be resynchronized by clicking **CONFIGURE > Secure Provisioning > Resource Distribution > Push Resources**.

The push operation distributes resource bundles as configured, then as needed restarts DHCP services on remote nodes. Push status is displayed above the Secure Provisioning UI pages.

You may also monitor the syslog output on Lighthouse for low-level output from the Ansible playbook.

CLI BASED WORKFLOW

Advanced automation users may choose to manage device resources and resource distribution with direct access to the central file repository on Lighthouse.

All necessary resource and configuration files are uploaded to Lighthouse using the Secure Copy protocol such as scp, WinScp or similar - or advanced users may prefer to use git directly.

If you have adopted DevOps-style configuration management using your own source repository (such as git, Mercurial or Subversion) and/or configuration deployment using continuous integration (such as Jenkins or GitLab), this interface also provides a convenient way to hook the Opegear system into these tools and workflows. For example, a configuration commit in the upstream system could automatically proliferate to the Lighthouse file repository, and then in turn to the downstream nodes.

Note that changes pushed to nodes via the Lighthouse UI or API will override those made by direct repository access, therefore UI- based or CLI-based workflows should be considered mutually exclusive modes of operation.

CREATE CONFIGURATION YAML

The first step is to assign resource files to specific device types (collectively known as device resources), and to assign device resources to be deployed to specific nodes.

Tip: The web UI provides a convenient way to start provisioning managed devices without needing to be fully familiar with YAML or git. The generated YAML files that controls resource bundling and distributions is located on Lighthouse, inside the central-dop container. You can view it by running the following command:

```
sudo docker exec -it central-dop cat /srv/central-  
ui/root/config.yml | less
```

Use a YAML file to bundle device resources, and control the distribution of device resources from Lighthouse to the nodes.

PROCEDURE

1. Create a new directory or folder of your choosing, for example: *nom-prov*
2. Inside the *nom-prov* directory, create a new directory or folder called: *downloads*.
3. In the *nom-prov* directory, create a file with the .yml or .yaml extension, using the following format:

nom-prov.yml

```
device_resources:
  demo_arista:
    device_type: arista
    config_file: 'demo_arista.cfg'
    image_file: 'arista_eos.swi'

node_inventory:
  MyNodes:
    static:
      - nodes-1

deployment:
  MyNodes:
    - demo_arista
```

Note:Note that indentation is meaningful in YAML, and you must use space characters not tabs to indent.

The **device_resources** list groups and assigns resource files to particular device types (i.e. resource bundles).

4. Choose an identifier for each resource bundle item, for example: *demo_arista*.
5. For each item, you must provide the **device_type**, as well as one or more resources, ie. *config_file* or *image_file*.
 - **device_type** matches this device resource item to all devices from the specified vendor – it may be one of the following: Cisco, Cisco_xe, Cisco_xr, Cisco_nx, Juniper, Arista, Aruba, Huawei, Cumulus, Pica, Opendgear.
 - **config_file** is the initial configuration file for the device to load via ZTP, as present in the *downloads* directory.
 - **image_file** is the initial software image for the device to load via ZTP, as present in the *downloads* directory.

Note: HPE/Aruba devices do not support the image upgrade via ZTP.

The Cisco Autoinstall process does not support image upgrade via ZTP, to automate image upgrade you must supply a TCL script file rather than a configuration file.

- **mac_address** optionally target this bundle at the listed MAC address(es), which may be specified in full, using a wildcard (for example, 00:10:FA:C2:BF:*), or negated to exclude from the match (for example, !01:23:45:67:89:AB)
- **serial_number** optionally target this bundle at the listed serial number(s)

Device resource items are then assigned to nodes using the **deployment** and optionally the **node_inventory** lists. See *Node Inventory* for an overview of available distribution methods.

The **node_inventory list** defines groups of nodes.

Choose an identifier for each inventory, for example: *branchinventory_* or *labinventory_*

DEFINE A STATIC INVENTORY:

1. Create a list named **static**.
2. List nodes by node ID, for example, *nodes-1*.
3. You can view node IDs by running the following command on Lighthouse: `node-info --all`

DEFINE A DYNAMIC INVENTORY:

1. Create a Lighthouse Smart Group, as documented in the *Creating Smart Groups* section of the *Lighthouse User Guide*.
2. Create a key named **smartgroup** with a value of the Smart Group name, this Smart Group search is dynamically evaluated to a list of nodes each time resources are pushed

The **deployment** list assigns device resources to the node inventories defined above, or all nodes.

- Deployment identifiers correspond to **node_inventory** identifiers, for example, *branchinventory_* .
- Assign device resources by listing device resource items, for example, *demo_arista*.
- You may have multiple device resources per deployment.

A more comprehensive YAML file may look like:

more-devices.yml

```
device_resources:
  access_switch:
    device_type: juniper
    config_file: 'jn-switch35.config'
    image_file: 'jinstall-ex-4200-13.2R1.1-domestic-signed.tgz'
    mac_address:
      - '00:00:0c:15:c0:*'
      - '!00:00:0c:15:c0:99'
  branch_router:
    serial_number:
      - 'SAD15300D4W'
      - 'FOC1749N1BD'
      - 'AVJ18163A52'
    config_file: 'branch_xr.cfg'
    device_type: cisco_xr
  demo_arista:
    device_type: arista
    config_file: 'demo_arista.cfg'
    image_file: 'arista_eos.swi'

node_inventory:
  branch_inventory:
    static:
      - nodes-1
      - nodes-2
```

```
- nodes-10
lab_inventory:
  smartgroup: LabNodes

deployment:
  lab_inventory:
    - demo_arista
    - access_switch
  branch_inventory:
    - branch_router
    - access_switch
```

HOW UI FIELDS CORRESPOND TO THE YAML FILE (EXAMPLE)

The following example YAML file contains line-by-line comments (blue text) denoting the UI page or field above each corresponding YAML element:

```
# CONFIGURE NODES > Secure Provisioning > Device Resources
device_resources:
  # Device Resource Details > Name
  access_switch:
    # Device Resource Details > Device Type
    device_type: juniper
    # Device Resource Details > Configuration File
    config_file: 'jn-switch35.config'
    # Device Resource Details > Image File
    image_file: 'jinstall-ex-4200-13.2R1.1-domestic-signed.tgz'
    # Device Resource Details > MAC Addresses
    mac_address:
```

```
- '00:00:0c:15:c0:*'  
- '!00:00:0c:15:c0:99'  
  
# Device Resource Details > Provision After  
  
provision_after:  
- branch_router  
  
  
# Device Resource Details > Name  
  
branch_router:  
  
# Device Resource Details > Device Type  
  
device_type: cisco_xr  
  
# Device Resource Details > Serial Numbers  
  
serial_number:  
- 'SAD15300D4W'  
- 'FOC1749N1BD'  
- 'AVJ18163A52'  
  
# Device Resource Details > Configuration File  
  
config_file: 'branch_xr.cfg'  
  
  
# Device Resource Details > Name  
  
demo_arista:  
  
# Device Resource Details > Device Type  
  
device_type: arista  
  
# Device Resource Details > Configuration File  
  
config_file: 'demo_arista.cfg.j2'  
  
# Device Resource Details > Image File  
  
image_file: 'arista_eos.swi'  
  
# Device Resource Details > Post-Provisioning Script  
  
post_provision_script: arista_fixups_over_ssh.py
```

```
    post_provision_script_timeout: 900
# CONFIGURE NODES > Secure Provisioning > Resource Distribution
node_inventory:
  # Static Node Inventory List > Inventory Details > Name
BranchInventory:
  # Inventory Details > Select Nodes
  static:
  - nodes-1
  - nodes-2
  - nodes-10

  # Dynamic Node Inventory List > Inventory Details > Name
LabInventory:
  # Inventory Details > Smart Group
  smartgroup: LabNodes

# CONFIGURE NODES > Secure Provisioning > Resource Distribution
(mostly!)
deployment:

  # CONFIGURE NODES > Secure Provisioning > Resource Distribution
Inventory Details > Resource Push
  LabInventory:
  - demo_arista
  - branch_router
  - access_switch
  # CONFIGURE NODES > Secure Provisioning > Resource Distribution >
```

[Inventory Details](#) > [Resource Distribution](#)

BranchInventory:

- branch_router
- access_switch

UPLOAD CONFIGURATION AND RESOURCES

1. Assemble device resources on your PC or laptop in preparation for upload.
2. Locate the *nom-prov* directory created in the previous section
3. Copy device resources into *nom-prov/downloads*.

Your locally assembled files will now look similar to that below:

```
.
├── nom-prov
│   ├── nom-prov.yml
│   └── downloads
│       ├── arista_eos.swi
│       └── demo_arista.cfg
```

You must now choose how you will upload files to the central Secure Provisioning repository, using Secure Copy or git.

OPTION A. SECURE COPY METHOD

Secure copy the entire *nom-prov* directory to Lighthouse port 2222, to the */srv/central-auto/* directory and authenticating as root, for example, using the `scp` command:

```
cd nom-prov
scp -P 2222 -rp ./* root@192.168.0.1:/srv/central-auto/
```

.. where 192.168.0.1 is the IP address of Lighthouse.

Secure Provisioning now automatically propagates the device resources to the nodes specified by the YAML, it automatically configures and starts or restarts ZTP services on the nodes.

At this point, target device will begin the ZTP process and become provisioned.

OPTION B. GIT METHOD

Advanced users may choose to access the Secure Provisioning git repository on Lighthouse directly, rather than using scp. This has the advantage of supporting commit messages and integrate with upstream git or other continuous integration systems.

Example commands to initialize the repository for the first time:

```
ssh-copy-id root@192.168.0.1
cd nom-prov
git init
git remote add origin ssh://root@192.168.0.1:2222/srv/central
git add -A
git commit -a -m "Initial commit of ZTP resources"
git push origin master
```

.. where 192.168.0.1 is the IP address of Lighthouse.

Once the repository has been initialized, subsequent users can operate on it using the clone command:

```
ssh-copy-id root@192.168.0.1
git clone ssh://root@192.168.0.1:2222/srv/central nom-prov
cd nom-prov
echo >> nom-prov.yml
git commit -a -m "Whitespace change for testing, please ignore"
git push origin master
```

.. where 192.168.0.1 is the IP address of Lighthouse.

ADDITIONAL RESOURCE FILES AND DEVICE TYPE FILES

You may also provide additional resource files that are not explicitly part of Device Resource Bundles, for example, final configuration files that may be conditionally fetched and applied by the device's primary ZTP script.

You may also extend Secure Provisioning to support additional device types by providing ISC DHCP configuration snippets, for example:

new-vendor.conf

```
class "new-vendor-class" {
    match if (option vendor-class-identifier = "new-vendor";
    option bootfile-name "new-vendor.cfg";
}
```

Additional files must be placed in the subdirectory named after the Node Inventory they will be deployed to. Within this subdirectory, files must be placed in the following:

- Resource files such as device configuration or image files are placed in the **downloads** directory.

- Advanced: DHCP snippets may be placed in the **dhcpd** directory.

Directly added files are pushed together with YAML-generated files to the nodes. An example local directory structure is shown below with a YAML config file from the earlier example, as well as manual new-vendor files added to the **my_inventory** directory:

```
.
├── nom-prov
├── nom-prov.yml
├── downloads
│   ├── demo_arista.cfg
│   ├── cumulus_interfaces
│   ├── cumulus_setup.sh
│   └── arista_eos.swi
├── my_inventory
│   ├── downloads
│   │   └── new-vendor.cfg
│   └── dhcpd
│       └── new-vendor.conf
```

The files are uploaded to the central Secure Provisioning repository, using Secure Copy or git, in the same way as the earlier example.

CONFIGURE DEVICE RESOURCES VIA ZTP

There are two factors that determine which resources are delivered to which devices via ZTP:

DEVICE RESOURCE BUNDLE MATCHING

As well as containing resource files themselves, each Resource Bundle itself has a few extra parameters: device vendor, device MAC address(es) and device serial number(s) (not supported by all vendors). Of these, only the device vendor is mandatory.

When a managed device broadcasts a BOOTP/DHCP request to initiate ZTP, it advertises its vendor ID string, MAC address, and in some cases serial number. These values are compared to the values in each Resource Bundle contained on the local node.

If there's a match, the local node provisions the device with the resource files in the matching bundle.

RESOURCE DISTRIBUTION

Node Inventories are used to selectively control which Resource Bundles are pushed to which nodes.

A node will only respond to a BOOTP/DHCP request on its local network if a matched Resource Bundle has been pushed to it.

Note that resources are not distributed any nodes by default.

BASELINE VS FINAL DEVICE CONFIGURATION

Broadly speaking, there are two approaches to secure provisioning using ZTP.

You may use strict matching and distribution settings to provision specific devices with unique, final configurations.

Alternatively, you may use laxer matching and wider distribution settings to provision many devices with a baseline configuration, for example, "just enough configuration" to route to a central production configuration system for final configuration and service provisioning.

You may also combine the two approaches, for example, use a reverse MAC address match to opt a specific device or devices out of an otherwise general, baseline configuration.

RUN A SCRIPT ON A NEWLY PROVISIONED DEVICE

Note: Post-provisioning scripting is an advanced feature only supported by Operations Manager nodes.

It is possible to upload a script and associated with a device Resource Bundle, to be run by remote Operations Manager node once a Managed Device is considered provisioned. A device is considered to be in a provisioned state once has downloaded all of the files in the Resource Bundle it is being provisioned with.

The script may be uploaded and associated via the UI during Resource Bundle creation using the **Post-Provisioning Script** option, or via **git/scp** and the "[CLI based WorkFlow](#)" on page 351.

Scripts may be implemented in bash, Python 2 or Python 3, and must start with a shebang – i.e. the first line must be one of:

```
#!/bin/bash
```

```
#!/usr/bin/env python2
```

```
#!/usr/bin/env python3
```

- Scripts are run in a monitored background processes in the Secure Provisioning container (remote-dop) on the node.
- Scripts have a default 15 minute timeout, this can be manually configured in the YAML config (post_provision_script_timeout).
- Scripts may login to target device via the network using SSH key auth where `nom_remote_ssh_pub_key` has been injected into the device config, or using username/password with the **sshpass** command.

MONITOR THE ZTP PROGRESS OF A MANAGED DEVICE

The current provisioning state of managed devices can be monitored via syslog on the Operations Manager (local devices only) or Lighthouse (all devices).

Each Secure Provisioning syslog message contains a prefix identifying the MAC address of the device being provisioned, similar to:

```
[NetOps-DOP device="01:23:45:67:89:AB"]
```

For example, here are sample messages showing an Opendgear ACM7004 device being provisioned:

```
[NetOps-DOP device="00:13:C6:EF:00:08"] Received DHCP request from  
device with vendor ID Opendgear/ACM7004-5-LMR  
[NetOps-DOP device="00:13:C6:EF:00:08"] Assigned DHCP address of  
10.0.0.2 to device  
[NetOps-DOP device="00:13:C6:EF:00:08"] Provisioning device with  
resource bundle my\_acm7004  
[NetOps-DOP device="00:13:C6:EF:00:08"] Device retrieved resource  
file /files/acm7004-5-4.3.1.flash via HTTP/HTTPS
```

Syslog can be viewed from the CLI by running:

```
tail -F /var/log/messages | grep NetOps-DOP
```

WAN GATEWAY SERVICES

In addition to LAN provisioning, the node can utilize its built-in cellular connection to act as a WAN gateway and provide a proxy to essential services for devices on day one.

The node's DHCP server hands out the node's address as:

- NTP server
 - This is a local service, synced to the node's system clock
- DNS server
 - DNS lookups by devices are relayed via Lighthouse VPN, to the DNS server that Lighthouse is configured to use

- Syslog server
 - Note that incoming syslog messages are dropped unless LogZilla for NetOps Automation has been activated
- Default gateway
 - When the node is configured in cellular router mode (i.e. with forwarding and masquerading enabled), devices can route to external services, for example, to enroll with third-party management systems for additional configuration.

ADVANCED OPTIONS

USING VARIABLES IN CONFIGURATION FILE TEMPLATES

In addition to static files, you may create templated ZTP configuration or script files. This is useful if your file needs to reference site- specific values such as an assigned IP addresses.

Any file uploaded via the web UI, or into the downloads directly with a file suffix of .j2 (Jinja2) will be automatically templated. The .j2 suffix is stripped when serving templated files to devices.

Available variables:

- `{{ nom_remote_server }}`
 - Address of provisioning interface on the node
 - Example: 10.0.0.1

- `{{ nom_remote_interface }}`
 - Name of provisioning interface on the node
 - Example: net2
- `{{ nom_remote_netmask }}`
 - Netmask of provisioning interface on the node (and netmask assigned in DHCP offers)
 - Example: 255.255.255.0
- `{{ nomremotenetmaskcidr }}_`
 - CIDR format netmask (prefix length) of provisioning interface on the node
 - Example: 24
- `{{ nom_remote_ntp_server }}`
 - Address of NTP server assigned in DHCP offers (same as `nom_remote_server`)
 - Example: 10.0.0.1
- `{{ nom_remote_dns_server }}`
 - Address of DNS server assigned in DHCP offers (same as `nom_remote_server`)
 - Example: 10.0.0.1
- `{{ nom_device_ipv4_address }}`
 - This feature is only supported by Operations Manager nodes.
 - DHCP address assigned to target device
 - Example: 10.0.0.13

- `{{ nomremotesshpubkey }}`
 - Public part of an auto-generated SSH keypair on the remote node, which may be injected into device config to pre- authenticate the node for any post-provisioning activities.
 - Example: ssh-rsa
AAAAB3NzaC1yc2EAAAADAQABAAQADHO50MVT4A9NI7vjDIS+76LgD
BtEDm+J1gaQPNIIV62CGA6cm5wASDiddY/KZkHA
 - `root@platypus.employee.bne.opengear.com` (*example only*).
- `{{ nom_device_hostname }}`
 - This feature is only supported by Operations Manager nodes.
 - Hostname advertised by target device
 - Example: router
- `{{ nom_device_mac_address }}`

Note: This feature is only supported by Operations Manager nodes.

- MAC Address of target device
- Example: 00:12:34:56:78:9A

For example, a basic Cumulus templated provisioning script may look like:

cumulus_setup.sh.j2

```
#!/bin/bash  
  
curl tftp://{{nom_remote_server}}/cumulus_interfaces >  
/etc/network/interfaces
```

POST-PROVISIONING SCRIPTS

Note: This feature is only supported by Operations Manager nodes.

It is possible to upload a script and associated with a device Resource Bundle, to be run by remote Operations Manager node once a Managed Device is considered provisioned. A device is considered to be in a provisioned state once has downloaded all of the files in the Resource Bundle it is being provisioned with.

The script may be uploaded and associated via the UI during Resource Bundle creation using the **Post-Provisioning Script** option, or checked-in to the **downloads** directly via `git/scp` and specified in the YAML configuration for the device Resource Bundle:

```
demo_arista:
  device_type: arista
  config_file: 'demo_arista.cfg'
  image_file: 'arista_eos.swi'
  post_provision_script: arista_fixups_over_ssh.py
  post_provision_script_timeout: 900
```

Scripts may be implemented in bash, Python 2 or Python 3, and must start with a shebang – i.e. the first line must be one of:

```
#!/bin/bash
#!/usr/bin/env python2
#!/usr/bin/env python3
```

Notes:

- Scripts are run in a monitored background processes in the Secure Provisioning container (remote-dop) on the node
- Scripts have a default 15 minute timeout, this can be manually configured in the YAML config (postprovisionscripttimeout_)
- Scripts may login to target device via the network using SSH key auth where nomremotesshpubkey has been injected into the device config (see Templated resource above), or using username/password with the sshpass command

ORDERED PROVISIONING

Note: This feature is only supported by Operations Manager nodes.

The **Provision After** option allows you to create basic dependency chains, to enforce the order in which devices are provisioned. In certain scenarios it may be advantageous to control the order in which devices are provisioned, for example:

- Ensure security infrastructure is provisioned ahead of systems that may other become inadvertently exposed on the network.
- Bring the production WAN up early to allow devices to provision services in-band, saving cellular data.
- Disallow local user access to the LAN until the network is fully up and running.

When a dependent Resource Bundle has the **Provision After** option set, the node will not respond to ZTP requests for these resources until all required dependencies have been met.

The Provision After property lists of one or more other, required Resource Bundles. Each required Resource Bundle creates a dependency that at least one device has been provisioned using the required bundle.

If multiples of a particular required device must be provisioned before a dependent device, simply specify the dependency multiple times in the list.

You may configure this via the UI during Resource Bundle creation using the Provision After option, or directly via git/scp in the YAML configuration for the device Resource Bundle:

```
access_switch:
  device_type: juniper
  config_file: 'jn-switch35.config'
  image_file: 'jinstall-ex-4200-13.2R1.1-domestic-signed.tgz'
  provision_after:
    - branch_router
```

TROUBLESHOOTING SECURE PROVISIONING

Secure Provisioning consists of several Docker containers:

- The central-dop container runs on Lighthouse, hosting git repository
- The dop-ui container runs on Lighthouse, serving the Secure Provisioning web UI
- The remote-dop container runs on Operations Manager nodes, running DHCP and TFTP/HTTP ZTP services

Additionally, the deployment container runs on Lighthouse, orchestrates new module installation on Lighthouse and nodes.

See the troubleshooting commands on the following page.

TROUBLESHOOTING COMMANDS

The following are useful commands for troubleshooting issues with the NetOps modules:

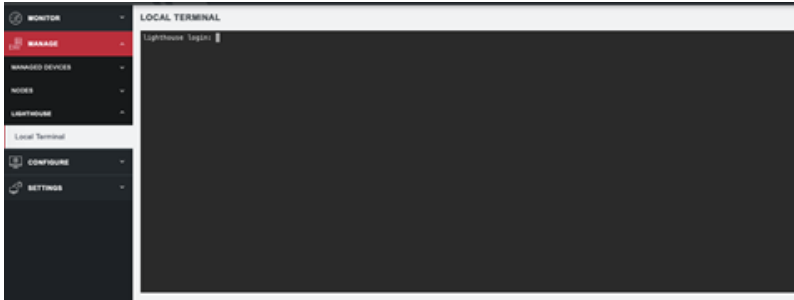
Command	
<code>docker ps</code>	
View running Docker containers.	
<code>docker exec -ti container-name bash</code>	
Spawn a bash shell inside a container.	
<code>docker logs container-name</code>	
View logs of a container.	
<code>docker exec -ti deployment ansible-playbook -vvv /ansible/dop_2.0.0.yml</code>	
Manually run module deployment in verbose mode, on Lighthouse.	
<code>/etc/scripts/post-receive</code>	
Manually push ZTP resources from Lighthouse to Operations Manager nodes (inside central-dop container).	
<code>/etc/scripts/netops_ui_handler</code>	

If the Lighthouse UI fails to display after an upgrade, it's possible a NetOps UI component is failing to load and may be able to recover by running this command.

COMMAND LINE TOOLS

Lighthouse includes a web-based terminal. To access this bash shell instance:

1. Select **MANAGE > LIGHTHOUSE > Local Terminal**. A login prompt displays



2. Enter an administrator's username and press Return.
3. A password: prompt displays. Enter the administrator's password and press Return.
4. A bash shell prompt displays.

This shell supports most standard bash commands and also supports copy-and-paste to and from the terminal.

Lighthouse-specific shell-based tools are listed below.

```
node-command --list-nodes
```

EXAMPLE NODE-COMMAND OUTPUT

```
== node-command ID 2017-05-19T14:08:33.360164_29534 ==  
14:08:33 [SUCCESS] BNE-R01-ACM7004-5 192.168.128.2:22  
OpenGear/ACM7004-5 Lighthouse 3b90d826 -- Tue May 9 13:42:16 EST 2017
```

```
14:08:33 [SUCCESS] BNE-R02-IM7216 192.168.128.3:22  
OpenGear/IM72xx Lighthouse 3b90d826 -- Tue Jul 5 13:42:16 EST 20167
```

NODE-INFO

`node-info` is a shell-based tool for pulling more detailed information from console servers.

EXAMPLE NODE-INFO OUTPUT

```
$ node-info -A
BNE-R01-ACM7004-5
  address: 192.168.128.2
  id: nodes-1
  ssh port: 22
  description: Brisbane Rack 1
  Enrollment status: Enrolled
  connection status: Connected
BNE-R02-IM7216
  address: 192.168.128.3
  id: nodes-2
  ssh port: 22
  description: Brisbane Rack 2
  Enrollment status: Enrolled
  connection status: Connected
```

NODE-UPGRADE

`node-upgrade` is a tool for running firmware upgrades on multiple managed console servers with a single command and returns the results in tabular form to stdout.

`node-upgrade` accepts the following arguments:

Short Argument	Long Argument	Description
-h	--help	Display usage information and exit
-q	--quiet	Suppress log messages
-V	--verbose	Display logs generated while upgrading
-l	--list-nodes	Display nodes and their upgradeable paths without executing upgrade
-D	--debug	Display detailed log messages, implies --verbose
-I	--ignore-version	Ignore firmware version warnings for upgrade
-i	--node-id=<id>	Select node by config ID
-n	--node-name=<name>	Select node by name
-a	--node-addresses=<address>	Select node by VPN address
-A	--all	Select all available nodes
-p	--product=<family>	Select node by product family

Short Argument	Long Argument	Description
-g	--smartgroup=<name>	Select nodes by smartgroup filter
-f	--firmware-dir=r=<directory>	The directory of the firmware files(s)
-F	--firmware-file=<path>	The firmware image to use for upgrade
-v	--version=<version>	The firmware version to upgrade to

AN EXAMPLE NODE-UPGRADE RUN

The following is an example node-upgrade command. It sets /mnt/data/nvram/latest-firmware as the directory node-upgrade looks to for the firmware image used as the source for all the firmware upgrade attempts. Every console server being managed from the active Lighthouse instance is targeted for an upgrade and the target console servers are set to upgrade to firmware 4.11.0.

```
# node-upgrade --all --firmware-dir /mnt/data/nvram/latest-firmware/
--version 4.11.0

NODE (UUID) MODEL FAMILY ADDRESS VERSION RESULT
-----
-----
cm7116-2 (nodes-4) CM7116-2 CM71XX 192.168.128.5 4.11.0 SUCCESS
```

```
im7208-2 (nodes-6) IM7208-2 IM72XX 192.168.128.7 4.10.0 SUCCESS
cm7196a-2 (nodes-5) CM7196A-2 CM7196 192.168.128.6 4.10.0 SUCCESS
acm7004-2 (nodes-2) ACM7004-2 ACM700X 192.168.128.3 4.11.0 SUCCESS
acm5508-2 (nodes-1) ACM5508-2 ACM550X 192.168.128.2 4.1.1u2 SUCCESS
acm7004-5 (nodes-3) ACM7004-5 ACM7004-5 192.168.128.4 4.11.0 SUCCESS
om2216-1 (nodes-8) OM2216-L OMXXXX 192.168.128.9 21.Q2.1
FileNotFoundError
om1208-8e (nodes-7) OM1208-8E OMXXXX 192.168.128.8 21.Q2.1
FileNotFoundError
```

- Version shows the device version prior to upgrade.
- Result shows whether the upgrade for each device succeeded, or returns an error with more detail.

RESULTS AND ERROR MESSAGES IN NODE-UPGRADE

When the node-upgrade command is run with valid arguments and parameters, the program will return exit status 0 and the following results and error messages may be returned for each node listed.

Result	Causes
SUCCESS	Node upgrade succeeded
FileNotFoundError	No upgrade file found matching provided device family or version

Result	Causes
UpgradeError	Device already has same or higher firm-ware version Network connection lost
IncompatibleFirmwareError	Firmware file provided does not match the product family

In addition, the following exit statuses may be returned.

Exit Status	Description
0	Command exited normally
1	Invalid parameter
2	Unknown argument

CRON

The `cron` service can be used to schedule file execution at specific times. Daemon can be managed via the `/etc/init.d/crond` interface, and cron tables managed via `crontab`.

Usage:

```
crontab [options] file  
crontab [options]  
crontab -n [hostname]
```

Options:

Options	Description
-u <user>	define user
-e	edit user's crontab
-l	list user's crontab
-r	delete user's crontab
-i	prompt before deleting
-n <host>	set host in cluster to run users' crontabs
-c	get host in cluster to run users' crontabs
-x <mask>	enable debugging

To perform start/stop/restart on `crond` service:

```
/etc/init.d/crond start
```

To verify the current `crond` status:

```
/etc/init.d/crond status
```

To check current cron jobs running with the following command to list all crontabs:

```
crontab -l
```

To edit or create a custom crontab file:

```
crontab -e
```

This opens a personal `crontab` configuration file. Each line can contain one command to run. The following format is used:

```
minute hour day-of-month month day-of-week command
```

For example, the following entry will run a the specified `backup.sh` script every day at 3am:

```
0 3 * * * /etc/config/backup.sh
```

When finished, save and close the `crontab` file.

SYSFLASH

`sysflash` is a shell-based tool for upgrading a Lighthouse instance's system. `Sysflash` will warn you if you do not have enough available space to upgrade to, though this is unlikely as space is reserved specifically for the upgrade process.

Basic syntax is as follows:

```
# sysflash [flags] [path/to/system-image.lg_upg | Percent-  
encoded URL to firmware-image.lg_upg]
```

Note:URLs must be Percent-encoded and image filenames cannot include spaces.

`sysflash` includes eight flags which modify the standard upgrade behavior as well as the `-h` or `--help` flag, which returns all the available flags and their effects:

Arguments	Description
<code>-b</code>	Override board name (currently lighthouse-vm)
<code>--board-name <name></code>	
<code>-B</code>	Override board revision (currently 1.0)
<code>--board-revision <version></code>	
<code>-V</code>	Override vendor (currently opengear)
<code>--vendor <vendor></code>	
<code>-l</code>	Do not check software version for upgradability
<code>--no-version-check</code>	
<code>-m</code>	Do not migrate current config. Start fresh.
<code>--no-migration</code>	
<code>-v</code>	Increase verbosity (may repeat)
<code>--verbose</code>	
<code>-o</code>	Do not modify bootloader (implies <code>--no-reboot</code>)
<code>--no-boot-once</code>	
<code>-r</code>	Do not reboot after upgrading
<code>--no-reboot</code>	
<code>-h</code>	Print this help
<code>--help</code>	

SUPPORT FOR MOUNTING THE HARD DISKS WITH OGCONFIG-CLI

Extra hard disks can be mounted in the Lighthouse VM by adding them to the configuration. Each new disk must have a partition created and formatted. Partitions can be created using `fdisk` or `cgdisk`, and should be formatted using the `ext4` filesystem, using the `mkfs.ext4` command:

```
root@lighthouse:~# mkfs.ext4 /dev/sdb1
```

The directory in which to mount the filesystem must be created. In general, new filesystems should be mounted in the provided `mountpoint` of `/mnt/au`. Any other filesystems should be mounted within the filesystem mounted here. The UUID can be obtained by running `blkid`. This will output the UUID's of all the extra hard disks on the system. When referencing the UUID, ensure the entire UUID is enclosed within quote marks like this:

```
"UUID=33464920-f54f-46b6-bd84-12f76eeb92da"
```

else the command will not run correctly.

Add the information to the configuration system using `ogconfig-cli` as follows, modifying the path for the specific situation.

```
ogcfg> var m !append system.mountpoints map
{8435270-fb39-11e7-8fcf-4fa11570959}: Map <>
ogcfg> set {m}.node "UUID=33464920-f54f-46b6-bd84-12f76eeb92da"
{b8c37c6-fb39-11e7-971c-23517b19319}: String </dev/sdb1>
ogcfg> set {m}.path "/mnt/aux"
{1fb50d8-fb39-11e7-994c-0f10b09cbd4}: String </mnt/aux>
ogcfg> push
OK
```


SUPPORT FOR MULTIPLE INSTANCE LIGHTHOUSE WITH OGCONFIG-CLI

Configuration system information can be displayed, searched, and set from both the primary and secondary Lighthouse instances. To reference the primary instance, use `lighthouse_configurations[0]`. The secondary instance is reachable with `lighthouse_configurations[1]`.

For example, to display nodes all network connections to the primary Lighthouse, use:

```
ogcfg> print lighthouse_configurations[0].system.net.conns
```

CLI SUPPORT FOR CONFIGURING NETWORK TRAFFIC MIRRORING

`traffic_mirroring` is a tool that allows network administrators to set up an integration with their enterprise Intrusion Detection System (IDS). For more details see ["Configuring Lighthouse for Network traffic Mirroring" on page 224](#).

```
root@lighthouse:~# traffic_mirroring --enable --destination-ip
10.97.100.1 --vlan-id 100
Configuring for Primary Lighthouse instance (Instance ID: 1).
Confirming that Traffic Mirroring is set up...
Traffic Mirroring successfully enabled.
root@lighthouse:~# traffic_mirroring --status
Primary Lighthouse 1 has traffic mirroring enabled.
Mirroring Node VPN (tun0) -> 10.97.100.1 (VLAN 100)
Mirroring Multi Instance VPN (tun1) -> 10.97.100.1 (VLAN 100)
```

```
root@lighthouse:~# traffic_mirroring --test
Preparing to test Node VPN (tun0) interface.
Pinging address '192.168.128.2' on interface 'tun0'.
Preparing to test Multi Instance VPN (tun1) interface.
Pinging address '172.16.1.2' on interface 'tun1'.
Test complete. The pings sent across the VPN's should have been
mirrored.

root@lighthouse:~# traffic_mirroring --disable
Traffic Mirroring disabled.
```

NETWORK TRAFFIC MIRRORING

Network Traffic Mirroring can only be configured by a network administrator with `sudo` access. Only a command line interface is available for this feature.

These commands work on the primary Lighthouse to enable network traffic mirroring, however secondary lighthouses can use `--test` and `--status` to check if the network traffic mirroring is in use.

Command Argument	Description
<code>traffic_mirroring --help</code>	Display usage information and exit
<code>traffic_mirroring --test</code>	Test the setup by sending a single ping on each VPN and attempt

Command Argument	Description
	to confirm that the current setup is valid, and the correct rules and interfaces exist, and the destination IP is reachable.
<code>traffic_mirroring --disable</code>	Disable network traffic mirroring
<code>traffic_mirroring --status</code>	Get the current status of the traffic mirroring config
<code>traffic_mirroring --enable --destination-ip <ip_address></code>	Enable network traffic mirroring and configure the destination IP address where mirrored packets will be sent to (for example, IDS).
<code>traffic_mirroring --enable --destination-ip <ip_address> --vlan-id <vlan_number></code>	Enable network traffic mirroring, configure the destination IP address, and configure the VLAN tag for all mirrored packets.

Command Argument	Description
<pre>traffic_mirroring --enable --destination- ip <ip_address> --vlan-id <vlan_number> -- ignore-multi-instance</pre>	<p>Enable network traffic mirroring, configure the destination IP address, configures the VLAN tag and not mirror traffic between multi-instances Lighthouses.</p>
<pre>traffic_mirroring --enable --destination- ip <ip_address> --vlan-id <vlan_number> -- instance-id <lighthouse_instance_id></pre>	<p>Enable network traffic mirroring, configure the destination IP address, configure the VLAN tag, and configure the instance ID of the lighthouse for which to configure traffic mirroring. If <code>--instance-id</code> is omitted, then all Lighthouses in a multi-instances will be configured for traffic mirroring.</p>

GLOSSARY

Terms used in this guide to define Lighthouse elements and concepts are listed below.

Term	Definition
AUTHDOWNLOCAL (RADIUS/LDAP/TACAS)	When AUTHDOWNLOCAL authentication option is selected, if remote authentication fails because the user does not exist on the remote AAA server, the user is denied access.
AUTHLOCAL (RADIUS/LDAP/TACAS)	When AUTHLOCAL authentication option is selected, if remote authentication fails because the user does not exist on the remote AAA server, Lighthouse tries to authenticate the user using a local account.
CELLULAR HEALTH	Status of the cellular connection of a node.
DARK MODE	Changes the user interface to display mostly dark colors, reducing the light emitted by device screens.
DOCKER	An open platform for developing, shipping, and running applications. Docker enables you to separate your applications from your infrastructure so you can deliver software quickly.

	Docker powers the NetOps platform within the Lighthouse product.
ENROLLMENT	Connecting a node to Lighthouse.
ENROLLMENT BUNDLE	Used to assign a number of tags to a set of nodes when they are enrolled. During Enrollment, the bundle is specified using its name, and a bundle-specific Enrollment token.
ENROLLED NODE	A Node that has been connected to Lighthouse and is ready for use.
ENROLLMENT TOKEN	A password that authorizes the node with Lighthouse. Used when performing Node-based, or ZTP Enrollment.
INSTANCE	A single running Lighthouse.
INTRUSION DETECTION SYSTEM	An Intrusion Detection System (IDS) is a network security technology built for detecting vulnerability exploits against a target application.
LIGHT MODE	Changes the user interface to display mostly light colors. This is the default UI setting.

LIGHTHOUSE	System for accessing, managing and monitoring Opengear console servers.
LIGHTHOUSE ENTERPRISE	Offers an elevated centralized management solution with additional functionality. It supports growing trends such as edge computing and SD-WAN with High Availability and Remote IP Access.
LIGHTHOUSE VPN	The OpenVPN based connections that the Lighthouse instance has with the nodes it is managing
LOCALAUTH (RADIUS/LDAP/AAA)	When LOCALAUTH authentication option is selected, if local authentication fails, Lighthouse tries to authenticate the user using a remote AAA server.
MANAGED DEVICE	A device that is managed via a node through a serial, USB, or network connection.
MULTIPLE INSTANCE	Access nodes through multiple Lighthouse instances at the same time.
NODE	A device that can be enrolled with Lighthouse, allowing it to be accessed, managed, and monitored. Currently, Opengear console servers are supported on a standard license, with support for other vendors Console Servers available as an add-on.

PASSWORD POLICY	Administrative users can define rules for Lighthouse user passwords including length, types of characters, reuse, and expiration period.
PENDING NODE	A node that has been connected to Lighthouse and has been configured with a VPN Tunnel, but which has not yet been approved for access, monitoring, or management. The approval operation can be automated by configuring Lighthouse to auto-approve nodes.
PRIMARY INSTANCE	The main instance of Lighthouse used for updating configuration and node enrollment.
REMOTE LOGGING/REMOTE SYSLOG	The ability to send logs to a remote server, for the offsite storage and review of logs.
REPLICATION	Automatic copying of the primary Lighthouse database to any connected dependent instances. Replication ensures that these instances mirror the same information and maintains connections to the same nodes.
ROLE	A set of access rights for a particular group. Three roles are defined within Lighthouse: Lighthouse Administrator, Node Administrator, and Node User.
SECONDARY/DEPENDENT INSTANCES	Redundant instances of Lighthouse that are used to access Lighthouse information and connected nodes.

SMART GROUP	Dynamic filter used to search for particular nodes, or for defining the access rights of a group of users. Smart Groups use node properties, as well as tags defined by users.
TAG	User-defined attribute and value that is assigned to one or more nodes or ports. Tags are used when creating Smart Groups for filtering views or access to nodes and ports.