Cumulus NetQ 1.4.0

Image and Provisioning Management User Guide

Table of Contents

This guide is intended for network administrators who are responsible for provisioning switches with Cumulus Linux operating system and network configuration, whether initially or as an upgrade, in their data center environment. The Image and Provisioning Management (IPM) application provides local storage and distribution services for the Cumulus Linux network operating system (NOS) and installation and provisioning scripts used to deploy Cumulus Linux and NetQ software. A command line interface (CLI) simplifies the provisioning of these assets. IPM is installed by default with NetQ 1.4 and later. It is disabled by default during NetQ installation and requires minor configuration and activation to enable the software.

NetQ IPM is supported on:

- Cumulus Linux version 3.6.2 and later.
- Cumulus Linux version 3.6.1 if static mapping is used between a MAC address and a Network Operating System or provisioning script.

Early Access Feature

The NetQ IPM application is introduced as an early access feature with version 1.4.0.

This guide is organized into several topics as follows:

IPM Preface

A variety of resources are available for you to become familiar with Cumulus Linux and Cumulus NetQ applications. These resources are identified here along with information about how the document contents are presented.

Contents

This topic describes...

What's New in Cumulus NetQ 1.4.0

Cumulus NetQ 1.4.0 includes the following new features:

- Added
  - support for monitoring up to 200 Cumulus Linux nodes
  - validation of symmetric VXLAN routes through CLI
  - validation of forward error correction (FEC) operation through NetQL
- Up dated
  - color cues for **`netq show services`** command to more easily view status of services at a glance
  - NetQ CLI syntax for creating NetQ Notifier filters t o improve usability and operation
  - trace functionality to improve usability and operation
- Early access feature
  - Image and Provisioning Management (IPM) application

For further information regarding bug fixes and known issues present in this release, refer to the release notes.

Available Documentation

All of the IPM documentation assumes you have already installed Cumulus Linux and NetQ.

You may start anywhere in the documentation or read it from start to finish depending on your role and familiarity with the NetQ software and Linux networking. If you are new to NetQ, you may want to read the Cumulus NetQ Primer before reading the other available documents to gain a high-level understanding of the product capabilities and operation.

The following NetQ-related documents are available:

- Cumulus NetQ Primer
- Cumulus NetQ Image and Provisioning Management User Guide (this guide)
- Cumulus NetQ Deployment Guide
- Cumulus NetQ Telemetry User Guide
- Cumulus NetQ Data Sheet
- Cumulus NetQ Release Notes

Document Formatting

The Cumulus IPM User Guide uses the following typographical and note conventions.

Typographical Conventions

Throughout the guide, text formatting is used to convey contextual information about the content.

Text Format	Meaning
Green text	Link to additional content within the topic or to another topic
`Text in Monospace font`	Filename, directory and path names, and command usage
[`Text within square brackets`]	Optional command parameters; may be presented in mixed case or all caps text
<`Text within angle brackets`>	Required command parameter values–variables that are to be replaced with a relevant value; may be presented in mixed case or all caps text

Note Conventions

Several note types are used throughout the document. The formatting of the note indicates its intent and urgency.

Tip or Best Practice

Offers information to improve your experience with the tool, such as time-saving or shortcut options, or i ndicates the common or recommended method for performing a particular task or process

Information

Provides additional information or a reminder about a task or process that may impact your next step or selection

Caution

Advises that failure to take or avoid specific action can result in possible data loss

Warning

Advises that failure to take or avoid specific action can result in possible physical harm to yourself, hardware equipment, or facility

IPM Command Line Overview

The IPM CLI (TIPCTL) behaves in a similar manner to the other Cumulus CLIs . It provides help for commands and options, but it does not support TAB completion of commands . The commands support four functional categories–configuration, DHCP (dynamic host control protocol), network OS (operating system), and ZTP (zero-touch provisioning):

- **config:** sets the network interface the service is bound to (either eth0 or eth1) and the IP address where it publishes.
- **dhcp**: adds and deletes DHCP reservations of IP and hostname options, and shows reservations and leases.
- **nos:** manages the mappings between meta-information sent by the ONIE tool and NOS (network operating system) images**.**
- **ztp:** manages mappings between ZTP scripts and the meta-information the ZTP tool sends.

The TIPCTL syntax is organized around the command actions–add, delete, show, configure, import, sync, and reset–for each of the functions, as appropriate.

The NetQ IPM command line interface only runs on switches and server hosts implemented with Intel x86 or ARM-based architectures. If you are unsure what architecture your switch or server employs, check the Cumulus Hardware Compatibility List and verify the value in the **Platforms** tab > **CPU** column.

Contents

This topic describes...

CLI Access

Once you have enabled the IPM service (refer to the Activate and Initialize IPM (see page 11) topic) and logged into the NetQ Telemetry Server (TS), simply enter commands at the prompt.

To access the CLI from TS:

1. Log in to TS. This example uses a username of *Cumulus* and a Telemetry Server with a name of *ts*.

```
<computer>:~Cumulus$ ssh ts
```

2. Enter your password, if required, to reach the command prompt. For example:

```
Enter passphrase for key '/Users/<username>/.ssh/id_rsa':
Welcome to Ubuntu 16.04.3 LTS (GNU/Linux 4.4.0-112-generic
x86_64)
 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage
Last login: Thu Aug 16 06:28:12 2018 from 10.50.11.103
Cumulus@ts:~$
```

3. Run commands. For example:

```
Cumulus@ts:~$ tipctl config setup
Cumulus@ts:~$ tipctl add ztp
```

Command Line Structure

The Cumulus NetQ IPM command line has a flat structure as opposed to a modal structure. This means that all commands can be run from the primary prompt instead of only in a specific mode. For example, some command lines require the administrator to switch between a configuration mode and an operation mode. Configuration commands can only be run in the configuration mode and operational commands can only be run in operation mode. This structure requires the administrator to switch between modes to run commands which can be tedious and time consuming. Cumulus NetQ IPM command line enables the administrator to run all of its commands at the same level.

Command Syntax

IPM CLI commands all begin with `tipctl`. The TIPCTL syntax is organized around the command actions–add, delete, show, configure, import, sync, and reset. The syntax is as follows:

```
tipctl [--version|--help|-h] add [dhcp <options>|nos <options>|ztp
<options>]
tipctl [--version|--help|-h] config [setup <options>|verify <options>]
tipctl [--version|--help|-h] del [dhcp <options>|nos <options>|ztp
<options>]
tipctl [--version|--help|-h] show [dhcp <options>|nos <options>|repo
<options>|ztp <options>]
```

Symbols	Meaning
Parentheses ( )	Enter one of the objects or keywords

Symbols	Meaning
Square brackets [ ]	Optional parameter; enter keyword or keyword-value pair as needed
Angle brackets < >	Variable value for a keyword or option; required, enter according to your deployment nomenclature
Pipe |	Separates keyword options, also separates value options; enter one keyword and zero or one value

Command Prompt

IPM code examples use the following prompt:

- `cumulus@ts:~$` Indicates the user *cumulus* is logged in to the NetQ Telemetry Server (TS) to run the example command

The TS must be running the Cumulus Linux operating system (OS) and NetQ . Refer to the Install NetQ topic for details.

Command Help

As you enter commands, you can get help with command syntax by entering *--help* or *-h* at various points within a command entry. For example, to find out what options are available for DHCP configuration, enter *-h* after entering a portion of the `tipctl add dhcp` command. In this example, you can see that there are three possible commands related to DHCP configuration.

```
cumulus@ts:~$ tipctl add dhcp -h

Usage: tipctl add dhcp [OPTIONS] COMMAND [ARGS]...
  Add reservations and subnet pools

Options:
  -h, --help  Show this message and exit.

Commands:
  load         Load reservations from a CSV file via stdin
  pool         Add DHCP subnet pool
  reservation  Add DHCP reservation

cumulus@ts:~$
```

Command History

The CLI stores commands issued within a session, which enables you to review and rerun commands that have already been run. At the command prompt, press the **Up Arrow** and **Down Arrow** keys to move back and forth through the list of commands previously entered. When you have found a given command, you can run the command by pressing **Enter**, just as you would if you had entered it manually. Optionally you can modify the command before you run it.

Activate and Initialize IPM

There is no need to install the IPM software as it comes pre-installed on the NetQ Telemetry Server when NetQ is installed. However, there are a few simple steps needed to activate and configure the application for your environment. These are described in this topic.

Contents

This topic describes how to...

Activation and Initialization Task Flow

The following steps are required to fully activate and perform the initial configuration needed to run the IPM application.

The IPM application comes configured with the minimum DHCP configuration and a default ONIE and ZTP script mapping. If you want to expand on the DHCP configuration (specify an IP address pool, reservations, and leases) or add and map additional ONIE and ZTP scripts, you can do so. Please refer to the corresponding topics for instructions for these tasks.

Open VM Network Ports

The primary IPM services are located in Docker containers. They are configured to run in network *host mode* , meaning the internal ports they expose are bound to the VM (virtual machine) network ports. This provides a direct path, or pass through, for traffic from the applications and services running within the VM to the external ecosystem where the VM is running. To ensure proper operation of the IPM services, you must open the following ports in the VM where the IPM services are run:

- Ports 67 and 68: DHCP (Dynamic Host Control Protocol)
- Port 9300: ZTP (Zero-Touch Provisioning) and ONIE (Open Network Installation Environment)

> **Note**: It may also be necessary to configure external firewalls and the substrate the image runs on, such as the QEMU, VirtualBox, or VMware hypervisors.

How to configure these ports is outside the scope of this document.

Start the Image and Provisioning Management Application

The application is activated in a similar manner as most UNIX services, using the `systemctrl` command to start the application service.

To start the IPM application and all of its services:

1. Log in to the NetQ Telemetry Server.
2. Start the application using the `start` option of the `systemctrl` command using root-level credentials or using the `sudo` command.
3. Configure the application to start on subsequent boots using the `enable` option of the command.
4. Verify the application is running using the `status` option of the command.

```
<machine-name>:~<username>$ ssh cumulus@<telemetry-server-name-
or-ip-address>
cumulus@ts:~$ sudo systemctl start tips-appliance

cumulus@ts:~$ sudo systemctl enable tips-appliance
Created symlink from /etc/systemd/system/multi-user.target.wants
/tips-appliance.service to /lib/systemd/system/tips-appliance.
service.

cumulus@oob-mgmt-server:~$ sudo systemctl status tips-appliance
 tips-appliance.service - tips Backend
   Loaded: loaded (/lib/systemd/system/tips-appliance.service;
enabled)
   Active: active (running) since Wed 2018-09-12 20:06:45 UTC;
1min 59s ago
 Main PID: 16909 (docker-compose)
   CGroup: /system.slice/tips-appliance.service
           16909 /opt/venvs/cl-docker-compose/bin/python /usr
/sbin/docker-compose -p tips -f /etc/tips/docker/tips-compose.
yml up --no-color
```

Once the IPM application is running, the IPM Command Line Interface, *TIPCTL*, is available. TIPCTL is the key user interface used to activate, configure, and monitor the IPM application and services.

Perform Initial Configuration

The next step in setting up IPM is to use TIPCTL to configure key application and service parameters. Configuration is performed using the `tipctl config` command, which can be run in one of two modes: traditional command line or prompt. Prompt mode provides the user with the steps and choices needed to perform the configuration. The command line mode requires the user to know what commands to execute and the appropriate parameter values. Either mode effectively completes the initial configuration of the IPM server.

Running the configuration setup sequence:

- Configures the KEA service with the network interface to bind to and the IP address to use to serve up the default-url and the cumulus-provision-url
- Causes the KEA service to create either one or two subnet pools based on the designated IP address of the server (if it is in the middle of the address range, two pools are created, each excluding the server IP address)

Use Prompt Mode

To perform the initial configuration in prompt mode:

1. Run configuration setup and follow the prompts.
2. Accept the default eth0 address as the port for the DHCP to listen on (as shown in the example here) or select another interface using the Up and Down Arrows on your keyboard. The selected address is highlighted in blue. Press Return. The application completes the configuration and returns you to the command line prompt.
3. Confirm the status of the IPM application.

```
cumulus@ts:~$ tipctl config setup
[?] Select local network configuration: eth0:10.255.0.92
 > eth0:10.255.0.92
   eth1:192.168.0.254
   Quit

Using eth0 10.255.0.92 to finish the configuration

cumulus@ts:~$ tipctl config verify
The TIPS application is running as expected.
```

If the application is not running as expected, the output indicates the problem. For example:

```
cumulus@ts:~$ tipctl config verify
Status      Service
----------  ---------
restarting  DHCP missing

DB Status   Issue
--------    -------------------------
error       Cannot connect to backend.
```

Use Command Line Mode

To perform the initial configuration in traditional command line mode:

1. Specify the interface OR the IP address on which the server should listen.
2. Confirm the status of the IPM application.

```
cumulus@ts:~$ tipctl config setup --interface eth1
Using eth1 192.168.0.254 to finish the configuration

cumulus@ts:~$ tipctl config setup --ip 10.255.0.92
Using eth0 10.255.0.92 to finish the configuration

cumulus@ts:~$ tipscl config verify
The TIPS application is running as expected.
```

Configure and Manage DHCP Options

The default DHCP configuration uses the eth0 interface on which to listen and uses an address pool of 10.255.0.0/24. A default directory is provided for the ONIE installer script and the default ZTP script. Domain name, NTP, and web servers have assigned IP addresses. No reservations are configured. While not required, you may want to s pecify a DHCP address pool more well-suited for your environment or set up reservations for interfaces that require unchanging IP addresses.

Contents

This topic describes how to...

Command Overview

IPM enables you to add, delete, and view all of the DHCP configurations. The command syntax is:

```
tipctl add dhcp load [--dry-run|--mac <TEXT>|--hostname <TEXT>|--ip
<TEXT>|--with-column|--without-column] [-h|--help]
tipctl add dhcp pool [-h|--help] START_IP END_IP
tipctl add dhcp reservation [-h|--help] MAC IP [HOSTNAME]

tipctl del dhcp pool [-h|--help]
tipctl del dhcp reservation [-h|--help] MAC

tipctl show dhcp config [-h|--help]
tipctl show dhcp leases [MAC] [-h|--help]
tipctl show dhcp reservations [MAC] [-h|--help]
```

The *-h* option provides help and the *-j* option shows the output in JSON format.

View the Current DHCP Configuration

You can view the current configuration of the DHCP server using the `tipctl show dhcp` command. This example shows the parameters configured by default on initial start up. Your settings should reflect the IP addressing scheme of your network.

```
cumulus@ts:~$ tipctl show dhcp config
Config                  Setting
----------------------  ------------------------------------------------
interface               eth0
subnet                  10.255.0.0/24
default-ip-ttl          0xf0
cumulus-provision-url   http://10.255.0.92:9300/default/ztp-default.sh
default-url             http://10.255.0.92:9300/default/onie-installer
domain-name             cltips
domain-name-servers     10.255.0.92
ntp-servers             10.255.0.92
www-server              10.255.0.92
```

Configure DHCP Address Pool

You can configure a pool that uses a single contiguous address space. You can also change or remove a configured address pool.

Configure an Address Pool

Only one DHCP address pool can be defined, and it must be contained within a contiguous address space. The only exception to this is if you accidentally configure the address pool with a range that includes the Telemetry Server address, IPM breaks the pool into two smaller pools excluding the TS address.

To configure an address pool:

1. Use the `tipctl add dhcp pool` command and specify the starting and ending IP addresses for the space.
2. Confirm the configuration.
3. Verify that the change has not adversely impacted IPM operation.

This example shows the creation of an address pool with a starting IP address of *10.255.0.100* and an ending IP address of *10.255.0.200*. Then it shows the updated configuration with the newly created pool, *pool 0*, and confirms the application is still running properly.

```
cumulus@ts:~$ tipctl add dhcp pool 10.255.0.100 10.255.0.200

cumulus@ts:~$ tipctl show dhcp config
Config                  Setting
----------------------  ------------------------------------------------
interface               eth0
subnet                  10.255.0.0/24
```

```
default-ip-ttl          0xf0
cumulus-provision-url   http://10.255.0.92:9300/default/ztp-default.sh
default-url             http://10.255.0.92:9300/default/onie-installer
domain-name             cltips
domain-name-servers     10.255.0.92
ntp-servers             10.255.0.92
www-server              10.255.0.92
pool 0                  10.255.0.100 - 10.255.0.200

cumulus@ts:~$ tipctl config verify
The TIPS application is running as expected.
```

Modify an Address Pool

You might want to change the range of addresses available to the DHCP server due to network changes or current address reservations. For example, you may want to expand the pool as your network grows, or you might want to change the range of addresses to avoid addresses that are reserved.

To modify the existing address pool:

1. Use the `tipctl add dhcp pool` command and specify the new starting and ending IP addresses for the space.
2. Confirm the configuration.
3. Verify that the change has not adversely impacted IPM operation.

This example shows the creation of an address pool with a starting IP address of *10.255.0.100* and an ending IP address of *10.255.0.225*. Then it shows the updated configuration with the newly modified pool, *pool 0*, and confirms the application is still running properly.

```
cumulus@ts:~$ tipctl add dhcp pool 10.255.0.100 10.255.0.225

cumulus@ts:~$ tipctl show dhcp config
Config                  Setting
----------------------  ----------------------------------------------
interface               eth0
subnet                  10.255.0.0/24
default-ip-ttl          0xf0
cumulus-provision-url   http://10.255.0.92:9300/default/ztp-default.sh
default-url             http://10.255.0.92:9300/default/onie-installer
domain-name             cltips
domain-name-servers     10.255.0.92
ntp-servers             10.255.0.92
www-server              10.255.0.92
pool 0                  10.255.0.100 - 10.255.0.225

cumulus@ts:~$ tipctl config verify
The TIPS application is running as expected.
```

Remove an Address Pool

You might want to remove the designated address pool altogether if you are using a separate DHCP server or server pool in your network.

To remove an address pool:

1. Use the `tipctl del dhcp` command with the *pool* keyword.
2. Confirm the configuration change.
3. Verify that the change has not adversely impacted IPM operation.

This example shows the removal of *address pool 0*, confirms that it has been removed, and then verifies the application is still running properly.

```
cumulus@ts:~$ tipctl del dhcp pool

cumulus@ts:~$ tipctl show dhcp config
Config                 Setting
---------------------  ----------------------------------------------
interface              eth0
subnet                 10.255.0.0/24
default-ip-ttl         0xf0
cumulus-provision-url  http://10.255.0.92:9300/default/ztp-default.sh
default-url            http://10.255.0.92:9300/default/onie-installer
domain-name            cltips
domain-name-servers    10.255.0.92
ntp-servers            10.255.0.92
www-server             10.255.0.92

cumulus@ts:~$ tipctl config verify
The TIPS application is running as expected.
```

Configure DHCP Reservations

DHCP reservations are used when you have a switch that requires the same IP address every time you want to reach it. Creating a reservation avoids having to look up the address for the switch each time there is a need to talk to it and simplifies the assignment because it is handled where the routing decision is made rather than at the individual switches. Essentially, a DHCP reservation provides a permanent lease of the address to a particular switch. The reservation itself maps an IP address (in/out of the address pool?) to the MAC address of the switch.

IPM enables you to add, delete, and view DHCP reservations. Adding reservations can be performed one at a time or import many from a file.

Add Reservations Manually

You can add DHCP reservations one at a time using the `tipctl add dhcp reservation` command.

To add a reservation:

1. Use the `tipctl add dhcp reservation` command and specify the MAC address of the switch you want mapped and the IP address to use when talking to it. You can optionally specify a hostname.
2. Confirm the configuration.

This example show the addition of reservation for spine01 with a MAC address of *a0:00:00:00:00:21* and an IP address of *192.168.0.21*. We have included the hostname for additional clarity, but that is optional. The example then reviews the configuration change.

```
cumulus@ts:~$ tipctl add dhcp reservation a0:00:00:00:00:21
192.168.0.21 spine01
Reservation updated.
cumulus@ts:~$ tipctl show dhcp reservations
mac                ip            hostname
-----------------  ------------  ----------
A0:00:00:00:00:21  192.168.0.21  spine01
```

Import Reservations from a File

If you have a number of switches that you want to specify DHCP reservations for, then importing the mapping information using a comma separated values (.csv) file format might be preferred. This is accomplished by piping the .csv file through the standard input (stdin) method using the `tipctl add dhcp load` command. There are several options for the import:

Option	Description/Usage
dry-run	Imports file, storing the mapping in the DB, but also prints the results to the standard output (stdout) where you can verify that the column mappings imported correctly
mac TEXT	(Required) Location of MAC address in file. Specified by column name or offset.
hostname TEXT	Location of hostname in file. Specified by column name or offset.
ip TEXT	Location of IPv4 address in file. Specified by column name or offset.
with-column	Causes command to calculate MAC, hostname, and IP values using the text specifying the column name. This is applied when the first row of the file contains header text instead of values. Either this option or the *without-column* option must be specified.
without-column	Causes command to calculate MAC, hostname, and IP values using a numeric offset. Either this option or the *with-column* option must be specified.

To import reservations:

1. Use the `tipctl add dhcp load` command and specify the name of the column or an offset to the column in the file that contains the MAC address of the switch.

2. Optionally, specify a hostname to
3. Optionally, specify an IP address to
4. Specify method to calculate the MAC, hostname, and IP address value locations.
5. View the configuration change.

A simple .csv file format might contain a row for each switch with the MAC address listed first, hostname listed second, and IP address listed. For example:

```
MACaddr,Hostname,IPaddr
A0:00:00:00:00:21,spine01,192.168.0.21
A0:00:00:00:00:22,spine02,192.168.0.22
...
```

This example shows how to import the above sample file. We have named the file *reservations.csv* and have used column names to identify the locations of the data.

```
cumulus@ts:~$ tipctl add dhcp load < <path/reservations.csv> --mac
MACaddr --hostname Hostname --ip IPaddr --with-column
cumulus@ts:~$ tipctl show dhcp reservations
mac                ip             hostname
-----------------  -------------  ----------
A0:00:00:00:00:21  192.168.0.21   spine01
A0:00:00:00:00:22  192.168.0.22   spine02
...
```

This example shows how to import the *reservations.csv* file using a numeric offset to identify the locations of the data.

```
cumulus@ts:~$ tipctl add dhcp load < <path/reservations.csv> --mac 0
--hostname 1 --ip 2 --without-column
cumulus@ts:~$ tipctl show dhcp reservations
mac                ip             hostname
-----------------  -------------  ----------
A0:00:00:00:00:21  192.168.0.21   spine01
A0:00:00:00:00:22  192.168.0.22   spine02
...
```

If the `dhcp load` command was not successful, when you run the `show` command, a *No DHCP reservations* message appears.

Remove a Reservation

You can remove a DHCP reservation at any time using the `tipctl del dhcp` command with the *reservation* keyword. This example shows how to remove the reservation for the switch with a MAC address of *A0:00:00:00:00:22*.

```
```

```
cumulus@ts:~$ tipctl del dhcp reservation a0:00:00:00:00:22
cumulus@ts:~$ tipctl show dhcp reservations
mac                ip            hostname
-----------------  ------------  ----------
A0:00:00:00:00:21  192.168.0.21  spine01
```

View Leases

It can be useful to view the leases currently being used by the DHCP server when you are troubleshooting. You might need to determine why certain clients are not able to connect–all of your leases are in use–or confirm whether a switch has the expected address.

To view leases, use the `tipctl show leases` command.

```
cumulus@switch:~$ tipctl show dhcp leases
mac               ip          ttl   expire                hostname
----------------- ----------- ----- -------------------- ----------
70:72:CF:F5:5B:FE 89.0.0.151 3600  2018-09-26 22:18:27 sw1
EC:0D:9A:AB:39:B4 89.0.0.152 3600  2018-09-26 22:20:58 sw2
00:E0:EC:36:20:F0 89.0.0.153 3600  2018-09-26 22:22:56 sw3
00:30:AB:F2:D7:A5 89.0.0.154 3600  2018-09-26 22:24:49 sw4
```

Manage Network Operating System Images

You can manage your network operating system (NOS) images with the NetQ Image and Provisioning Management (IPM) application. On initial installation, IPM points to the latest image of the Cumulus Linux operating system and a default ONIE script. You can add additional NOS images, add images, map switches to particular images, as well as view the available images and their mappings.

Contents

This topic describes how to...

Command Overview

IPM enables you to add, delete, and view all of the DHCP configurations. The command syntax is:

```
tipctl add nos [-h|--help] MAC NOS
tipctl del nos [-h|--help] mac MAC
tipctl del nos [-h|--help] nos NOS
tipctl reset nos [-h|--help]
tipctl show nos all [--with-date|-h|--help]
tipctl show nos mac [--with-date|-h|--help] MAC
tipctl show nos nos [--with-date|-h|--help] NOS
```

The *-h* option is a short cut for the *--help* option. The *--with-date* option lists the timestamp when the last mapping occurred.

Import NOS Images

While IPM is preconfigured to use the latest Cumulus Linux NOS, you can add prior NOS images to manage switches installed with earlier releases. The NOS images are stored in the */var/tips/www/onie/images/* directory.

To import an image to the local repository:

1. Log in to the NetQ Telemetry Server using your security credentials.
2. Run the Easy Script to copy the image to the */var/tips/www/onie/images/* directory.

This example shows the import of a NOS image.

```
<username>@<hostname>:~/Downloads$ ssh <username>@<telemetry-server-
name-or-ip-address>
<username>@<ts>:~$ tips-easy --images <path>/<image-filename>
<username>@<ts>:~$ tipctl show nos
```

View Stored Images

You can view all of the images stored in IPM using the `tipctl show nos` command. You can filter the results by MAC address and NOS image. Additionally, you can display the date at which mapping was performed.

This example shows all images in the directory.

```
cumulus@ts:~$ tipctl show nos all
Category   Match              Base
---------- ------------------ ------------------------------
onie_mac   00:11:22:33:44:55 cumulus-rmp-3.6.1-bcm-amd64.bin
onie_mac   70:72:cf:f5:5b:fe cumulus-linux-bcm-amd64.bin
```

This example shows only the images mapped to switches associated with a MAC address of *70:72:cf:f5:5b:fe*.

```
cumulus@ts:~$ tipctl show nos mac 70:72:cf:f5:5b:fe
Category   Match              Base
---------- ------------------ ------------------------------
onie_mac   70:72:cf:f5:5b:fe cumulus-linux-bcm-amd64.bin
```

This example shows only the images mapped to switches associated with a NOS of *cumulus-rmp-3.6.1-bcm-amd64.bin*.

```
cumulus@ts:~$ tipctl show nos mac 70:72:cf:f5:5b:fe
Category   Match              Base
---------- ------------------ ------------------------------
onie_mac   00:11:22:33:44:55 cumulus-rmp-3.6.1-bcm-amd64.bin
```

Apply Images

Once you have all of the NOS images loaded into IPM, you can then map the images to the various switches in your network using the `tipctl add nos` command.

This example shows how to map a switch with MAC address of *70:72:cf:f5:5b:fe* to the NOS image *cumulus-rmp-3.6.1-bcm-amd64.bin* , and then verify the mapping.

```
cumulus@ts:~$ tipctl add nos 70:72:cf:f5:5b:fe cumulus-rmp-3.6.1-bcm-
amd64.bin
cumulus@ts:~$ tipctl show nos mac 70:72:cf:f5:5b:fe
Category   Match              Base
---------- ------------------ ------------------------------
onie_mac   00:11:22:33:44:55 cumulus-rmp-3.6.1-bcm-amd64.bin
```

If you want to add a NOS to multiple switches, create an automation script that runs the `add nos` command.

Manage Images

IPM enables you to manage your local image repository, including mapping, deleting, and viewing images. Mapping images was covered above. Viewing and deleting images are described here.

View Images in Repository

You can view the NOS image repository located in the */var/tips/www/onie/images/* directory on the Telemetry Server.

This example shows how to view the contents of the NOS repository.

```
cumulus@ts:~$ tipctl show repo nos
NOS
------------------------------------------------------------------------
cumulus-linux-3.6.1-bcm-armel.bin
cumulus-rmp-3.6.1-bcm-amd64.bin
cumulus-linux-3.6.1-bcm-amd64.bin
cumulus-linux-3.6.1-mlx-amd64.bin
cumulus-linux-3.6.1-vx-amd64.bin
cumulus-linux-3.6.1-vx-amd64.box
cumulus-linux-3.6.1-vx-amd64-libvirt.box
cumulus-linux-3.6.1-vx-amd64-1527285785.a89d37cz7d41081-libvirt.box
cumulus-linux-3.6.1-vx-amd64.ova
cumulus-linux-3.6.1-vx-amd64-vmware.ova
cumulus-linux-3.6.1-vx-amd64-1527285785.a89d37cz7d41081-qa.qcow2
cumulus-linux-3.6.1-vx-amd64.qcow2
cumulus-linux-bcm-amd64.bin
```

Remove Image Mappings

You can remove all mappings to a NOS image or the mapping to a particular switch.This example shows how to remove the mapping of a NOS image from all of your switches currently using this image, and then verify that no switches are mapped to that NOS.

```
cumulus@ts:~$ tipctl del nos nos <nos-filename>
cumulus@ts:~$ tipctl show nos nos <nos-filename>
```

This example shows how to remove the mapping of a NOS image from a switch with a MAC address of A0:00:00:00:00:12.

```
cumulus@ts:~$ tipctl del nos mac a0:00:00:00:00:12
cumulus@ts:~$ tipctl show nos mac a0:00:00:00:00:12
```

Delete Images from Repository

If you are no longer using a particular NOS, you can remove it from your local repository to simplify your management processes and prevent mismatching of switches with incorrect NOS versions.This example shows how to remove an image from your local repository.

```
cumulus@<ts>:~$ cd ~/var/tips/www/onie/images/
cumulus@<ts>:~/var/tips/www/onie/images/$ ls
cumulus@<ts>:~/var/tips/www/onie/images/$ rm <image-filename>
```

Manage Zero-Touch Provisioning Scripts

You can manage your zero-touch provisioning (ZTP) scripts with the NetQ Image and Provisioning Management (IPM) application. IPM uses a default ZTP script to provision and configure the basic network information needed to add them to your data center network automatically during the first boot of a switch. After that, you can have more than one script and assign each to selected switches.

To take advantage of the ZTP script management feature, you must be running Cumulus Linux 3.6.2 or later.

Contents

This topic describes how to...

Command Overview

IPM enables you to map and remove mapping of scripts to switches, and view the available ZTP scripts. The command syntax is:

```
tipctl add ztp [-h|--help] MAC SCRIPT
tipctl del ztp mac [-h|--help] MAC
tipctl del ztp script [-h|--help] SCRIPT
tipctl show ztp all [--with-date|-h|--help]
tipctl show ztp mac [--with-date|-h|--help] MAC
tipctl show ztp script [--with-date|-h|--help] SCRIPT
tipctl show repo ztp
```

The *-h* option is a short cut for the *--help* option. The *--with-date* option lists the timestamp when the last mapping occurred.

Import Custom Scripts

While IPM is preconfigured to use the default script, *ztp-default.sh*, you can import additional scripts to manage automatic provisioning and configuration of switches to better match your network deployment. For example, you might want a new script for an upgrade or patching process than you used during the initial configuration. The ZTP scripts are stored in the */var/tips/www/ztp/scripts/* directory.

To import an image to the local repository:

1. Open a terminal window.
2. Log in to the NetQ Telemetry Server using your security credentials.
3. Copy the image to the */var/tips/www/ztp/scripts/* directory.

This example shows the import of a ZTP script to IPM, and then verifies it has been imported correctly.

```
<username>@<hostname>:~/<directory-name>$ ssh <username>@<telemetry-
server-name-or-ip-address>
<username>@<ts>:~$ cp /<path>/<ztp-script-name> /var/tips/www/ztp
/scripts/<ztp-script-name>
<username>@<ts>:~$ tipctl show ztp all
```

View Stored Scripts

You can view all of the scripts loaded into IPM using the `tipctl show ztp` command. You can filter the results by MAC address and script name. Additionally, you can display the (creation/install?) date of the scripts.

This example shows all scripts in the directory.

```
cumulus@ts:~$ tipctl show ztp all
Category   Match              Base
---------- ------------------ ---------
ztp_mac    70:72:cf:f5:5b:fe ns_ztp.sh
```

This example shows only the ZTP scripts mapped to switches associated with a MAC address of *70:72:cf:f5:5b:fe*.

```
cumulus@ts:~$ tipctl show ztp mac 70:72:cf:f5:5b:fe
Category   Match              Base
---------- ------------------ ---------
ztp_mac    70:72:cf:f5:5b:fe ns_ztp.sh
```

This example shows the ZTP script with the name of *ns_ztp.sh*.

```
```

```
cumulus@ts:~$ tipctl show ztp ns_ztp.sh
Category   Match              Base
---------- ------------------ ---------
ztp_mac    70:72:cf:f5:5b:fe ns_ztp.sh
```

This example show the scripts included in the ZTP repository.

```
cumulus@ts:~$ tipctl show repo ztp
ZTP Script
------------
demo_ztp.sh
ns_ztp.sh
```

Map Scripts to Switches

Once you have all of the ZTP scripts needed loaded into IPM, you can then map the scripts to the various switches in your network using the `tipctl add ztp` command. When you upgrade or apply patches, you can remove an existing switch mapping and map the new script.

Add a Script Mapping

This example shows how to map a switch with MAC address of *A0:00:00:00:00:32* to the ZTP script named *ztp-servers* and map a switch with MAC address of *A0:00:00:00:00:14* to the ZTP script named *ztp-leafs.* It then verifies the mappings are correct. This example shows all ZTP scripts for illustration purposes, but if you have a large number of scripts, you could verify the addition using the MAC address or by the script name instead.

```
cumulus@ts:~$ tipctl add ztp a0:00:00:00:00:32 ztp-servers.sh
cumulus@ts:~$ tipctl add ztp a0:00:00:00:00:14 ztp-leafs.sh
cumulus@ts:~$ tipctl show ztp all
Category   Match              Base
---------- ------------------ ---------
ztp_mac    a0:00:00:00:00:32 ztp-servers.sh
ztp_mac    a0:00:00:00:00:14 ztp-leafs.sh
```

Remove Script Mappings

You can remove all mappings to a ZTP script or the mapping to a particular switch.This example shows how to remove the mapping of the *ztp-servers.sh* ZTP script from all of your switches currently using this script, and then verify that no switches are mapped to that script.

```
cumulus@ts:~$ tipctl del ztp script ztp-servers.sh
cumulus@ts:~$ tipctl show ztp script ztp-servers.sh
cumulus@ts:~$
```

This example shows how to remove the current mapping of a ZTP script to the switch with MAC address of *A0:00:00:00:00:14*.

```
cumulus@ts:~$ tipctl del script mac a0:00:00:00:00:14
cumulus@ts:~$ tipctl show script mac a0:00:00:00:00:14
```

Remove Scripts from Repository

If you are no longer using a particular ZTP script, you can remove it from your local repository to simplify your management processes and prevent mismapping of switches with incorrect scripts.This example shows how to remove a script from your local repository, and then verify it has been deleted.

```
cumulus@<ts>:~$ cd ~/var/tips/www/ztp/scripts/
cumulus@<ts>:~/var/tips/www/ztp/scripts/$ ls
cumulus@<ts>:~/var/tips/www/ztp/scripts/$ rm <script-filename>
cumulus@<ts>:~/var/tips/www/ztp/scripts/$ ls
```

Example Script

The following is a sample of the kinds of tasks you might perform in an provisioning script.

```
#!/usr/bin/env bash

function install_license(){
    # Install license
    echo "$(date) INFO: Installing License..."
    echo $1 | /usr/cumulus/bin/cl-license -i
    return_code=$?
    if [ "$return_code" == "0" ]; then
        echo "$(date) INFO: License Installed."
    else
        echo "$(date) ERROR: License not installed. Return code was:
$return_code"
        /usr/cumulus/bin/cl-license
        exit 1
    fi
}

function ping_until_reachable(){
    last_code=1
    max_tries=30
    tries=0
    while [ "0" != "$last_code" ] && [ "$tries" -lt "$max_tries" ]; do
        tries=$((tries+1))
```

```
        echo "$(date) INFO: ( Attempt $tries of $max_tries ) Pinging
$1 Target Until Reachable."
        ping $1 -c2 &> /dev/null
        last_code=$?
            sleep 1
    done
    if [ "$tries" -eq "$max_tries" ] && [ "$last_code" -ne "0" ]; then
        echo "$(date) ERROR: Reached maximum number of attempts to
ping the target $1 ."
        exit 1
    fi
}

function set_hostname(){
    # Remove DHCP Setting of Hostname
    sed s/'SETHOSTNAME="yes"'/'SETHOSTNAME="no"'/g -i /etc/dhcp
/dhclient-exit-hooks.d/dhcp-sethostname
    hostnamectl set-hostname $1
}

## A little something for the script to do

#Output state of interfaces
netshow interface

# CUMULUS-AUTOPROVISIONING
exit 0
```