Extreme Fabric Automation 2.0.0 Administration Guide v1.0

July 2019

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Contents

Version	**Summary of changes**	**Publication date**
1.0	Initial release	31 January 2019
2.0	Updates to installation, upgrade, Tenant Services	14 February 2019

3.0	Updates to OVA installation, Container stats, Tenant bulk CLIs	7 June 2019

Preface

Contacting Extreme Technical Support

As an Extreme customer, you can contact Extreme Technical Support using one of the following methods: 24x7 online or by telephone. OEM customers should contact their OEM/solution provider.

If you require assistance, contact Extreme Networks using one of the following methods:

GTAC (Global Technical Assistance Center) for immediate support

Phone: 1-800-998-2408 (toll-free in U.S. and Canada) or +1 408-579-2826. For the support phone number in your country, visit: www.extremenetworks.com/support/contact.

Email: support@extremenetworks.com. To expedite your message, enter the product name or model number in the subject line.

GTAC Knowledge - Get on-demand and tested resolutions from the GTAC Knowledgebase, or create a help case if you need more guidance.

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Before contacting Extreme Networks for technical support, have the following information ready:

Your Extreme Networks service contract number and/or serial numbers for all involved Extreme Networks products

A description of the failure

A description of any action(s) already taken to resolve the problem

A description of your network environment (such as layout, cable type, other relevant environmental information)

Network load at the time of trouble (if known)

The device history (for example, if you have returned the device before, or if this is a recurring problem)

Any related RMA (Return Material Authorization) numbers

Extreme resources

Visit the Extreme website to locate related documentation for your product and additional Extreme resources.

White papers, data sheets, and the most recent versions of Extreme software and hardware manuals are available at www.extremenetworks.com. Product documentation for all supported releases is available to registered users at www.extremenetworks.com/support/documentation.

Document feedback

Quality is our first concern at Extreme, and we have made every effort to ensure the accuracy and completeness of this document. However, if you find an error or an omission, or you think that a topic needs further development, we want to hear from you.

You can provide feedback in two ways:

- Use our short online feedback form at http://www.extremenetworks.com/documentation-feedback-pdf/
- Email us at internalinfodev@extremenetworks.com

Provide the publication title, part number, and as much detail as possible, including the topic heading and page number if applicable, as well as your suggestions for improvement.

Introduction

Extreme Fabric Automation (EFA) is also known as Data Center Automation Application (DCA) is a microservices-based scalable application written in GoLang that orchestrates the following installations:

- 3-stage IP Clos Fabric
- 5-stage IP Clos Fabric
- Tenant Aware Networks

NOTE: This document was originally a "Controlled Release" document titled *Data Center Automation Application (DCA), 2.0.0 Administration Guide v3.0.* Its content has been subsequently updated.

This release addresses only the automation of Fabric infrastructure and Tenant Services lifecycle management of 3- and 5-stage IP Clos DC Fabrics. It does not address the automation of Small Data Centers or 7-stage IP Clos Fabrics.

The key tenets of this orchestration are as follows:

- Conformance to the EVD (Extreme Validated Design) for IP Fabric): https://www.extremenetworks.com/resources/extreme-validated-design/extreme-ip-Fabric-architecture/
- Speed of provisioning
- Seamless installation/deployment mechanism
- High in performance, low in resource utilization, with minimal touch points
- Programmable containerized services, through an industry-standard Open API (https://www.openapis.org/)-based programmable interface
- Easy-to-use CLI commands to manage devices in an IP Fabric and Tenant Networks.

EFA comprises three core containerized services that interact with each other and other infrastructure services to provide the core functions of IP Fabric automation:

Asset Service	Provides the secure credential store and deep discovery of physical/logical Assets of the managed devices, and publishes the Asset refresh/change events to other services
Fabric Service	Helps orchestrate and visualize the BGP/EVPN-based 3- and 5-stage Clos networks
Tenant Service	Helps manage the Tenants, Tenant Networks, and end points, fully leveraging the knowledge of Assets and the underlying Fabric

The following figure illustrates the application's Docker-based functionality in provisioning and discovery.

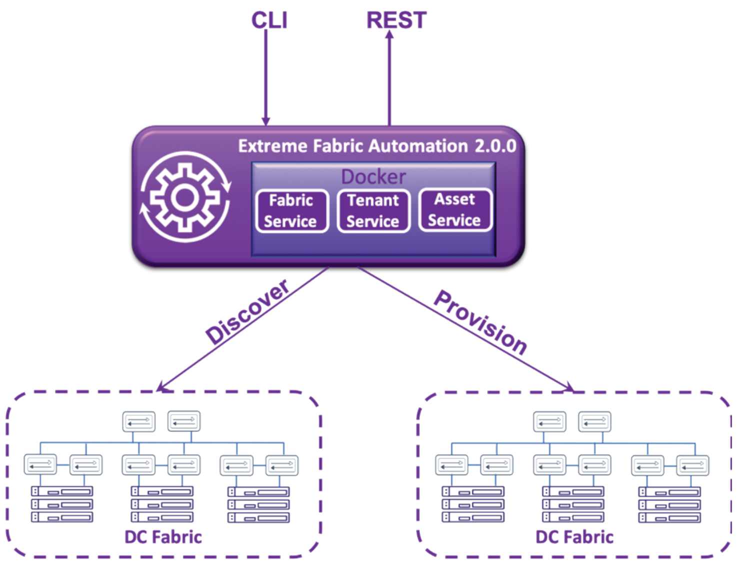


Figure 1. Docker-based provisioning and discovery

Supported Platform Matrix

This application is supported on the following platforms.

Platform	Role	SLXOS version
SLX-9140	Leaf	18s.1.01 /a /b
SLX-9240	Leaf/spine/super-spine	18s.1.01 /a /b
SLX-9850	Spine/super-spine	18r.1.00aa /b /c
EN-SLX-9030-48S	Leaf	18x.1.00 /a /b
EN-SLX-9030-48T	Leaf	18x.1.00 /a /b
SLX-9540	Leaf/border leaf	18r.1.00aa /b /c

Installation

Note the following requirements.

Prerequisites	• **Minimum System Requirements** - CPU: 4 cores - Storage: 50 GB - RAM: 8 GB - OS: Ubuntu 16.04+ • **Software (installed by deployment script)** - Docker CE: v18.06.1~ce~3-0~ubuntu - Docker-compose: v1.22 - Docker-compose file: version 3 - postgresql-client: v9.6

New installation

Do the following to install the application for the first time, referring to following flow.

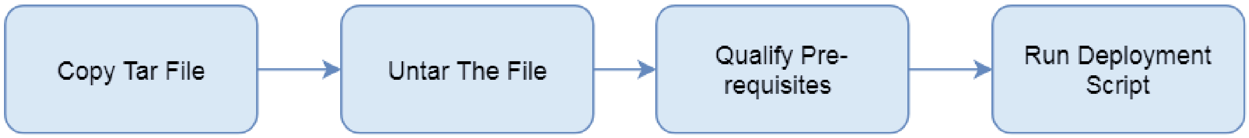


Figure 2. New installation flow

1. Download image (*.tar.gz) and untar it.
   ```
   # tar -xfz single-node-deployment-<TAR_VERSION>.tar.gz
   ```

2. Change directory to single-node-deployment.
   ```
   # cd single-node-deployment
   ```

3. Check for pre-requisites.
   - CPU: 4 cores
   - Storage: 50 GB
   - RAM: 8 GB
   - OS: Ubuntu 16.04+

4. Run the App Installation script.
   ```
   # source deployment.sh
   ```

OVA installation

Open Virtual Appliance (OVA) is an OVF file packaged with base image Ubuntu 16.04, storage = 50 G, RAM = 8 GB, and preinstalled with EFA. OVA is also compatible with VMware ESXi servers, so it can be deployed with VMware products.

To deploy the OVA using VirtualBox, follow the steps below:

1. Download the ***EFA_v2.0.0_<build_number>.ova*** file.
2. Start Oracle VirtualBox.
3. Choose **File -> Import Appliance.**
4. Select the downloaded *.ova file and click **Open**.
5. After importing the OVA file, start the VM.

NOTE: Use the OVA image for new installations. For existing deployments, refer to the Upgrade/reinstall section.

User credentials:

There are three credentials; the default user is “ubuntu”.

1) user/password: ubuntu/ubuntu
2) user/password: xmc/xmc123
3) root/password : root/dca123

Upgrade/reinstall

Do the following to upgrade or reinstall the application, referring to the following flow chart.

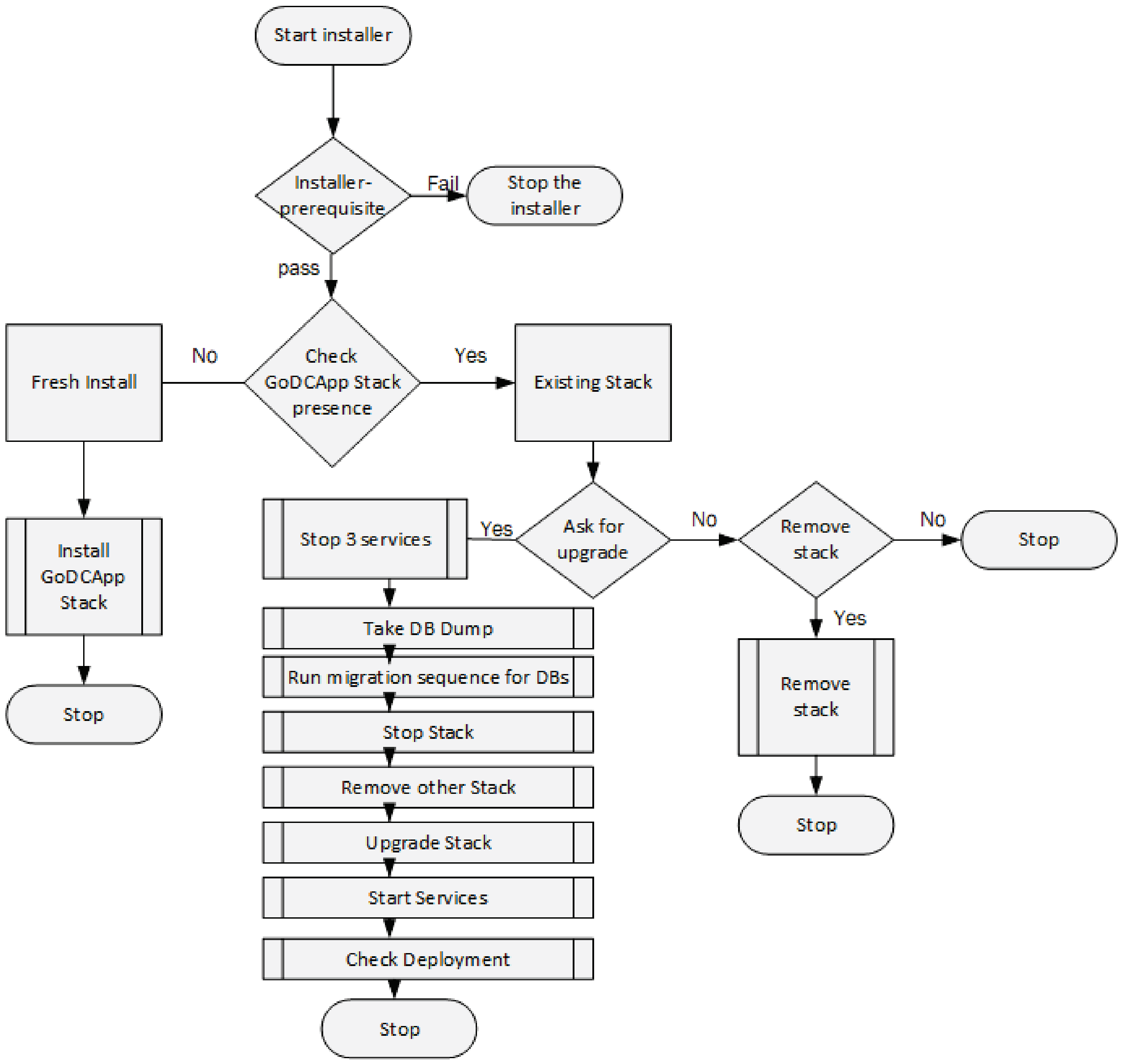


Figure 3. Upgrade/reinstall flow chart

1. Change directory to single-node-deployment.
   # cd single-node-deployment

2. Run the deployment script.
   # source deployment.sh
   This script will bring up the following components:
   a. Postgres database
   b. Rabbitmq
   c. Goinventory service
   d. GoFabric service
   e. GoTenant service

f. GoSwitch service
g. Konga
h. Kong-API-gateway
i. Metricbeats ELK Dashboard Stats/healthcheck monitor (available in ELK dashboard)
j. Filebeat-deployment
k. Kibana
l. Logstash
m. Elasticsearch

If the previous deployment stack is already running, the script will present the user with three options:

1. Remove the current stack: The user can simply remove the entire stack with this option.

2. Upgrade or Redeploy: If users are running the deployment.sh script from the new tar-ball , they can choose to upgrade the setup without wiping out the current database volume. Similarly, they will have the same option if the script is re-run from the same folder, in which case the stack will only get re-deployed.

3. Quit: No change in the current stack.

REST API Guide

Once EFA is installed the API guide is available as a HTML reference. http://<host_ip>:8002. The API guide is a good reference to help integrate with other automation tools. The REST API is specified via OpenAPI/Swagger.

IP Fabric/Clos Orchestration

Overview

A Fabric is a logical container for holding a group of devices. Here it denotes a collection of switches that are connected in a Clos topology and on which one can configure underlay and/or overlay.

Fabric service provides following features:

1. 3-stage Clos automation
2. 5-stage Clos automation
3. Multi-Fabric automation
4. Fabric topology view
5. Fabric validation, error reporting, and recovery
6. Single-homed leaf or multi-homed (MCT) leaf

Fabric CLIs/REST APIs provide the following:

- Mechanism to create a Fabric composed of multiple DC points of delivery (PoDs).
- Mechanism to configure Fabric settings. Fabric settings are collections of settings that control the various parameters of the Fabric being managed, for example, L2/L3 MTU, BGP maximum paths.
- Mechanism to fetch per-device errors occurring during Fabric configuration, for which the user can take corrective or remedial actions.

Errors occurring on the device during Fabric creation would be tagged against the devices and can be retrieved from the CLI/REST APIs for use in taking corrective or remedial actions.

Day-0 prerequisites on SLX devices

- Management IP addresses must be configured on all switches.
- SLX devices should have the appropriate firmware version as indicated in the “Supported Platform Matrix” section.
- On the SLX 9850, Fabric links must be enabled manually , through “no shut”.
- On the SLX 9540, the appropriate TCAM profile must be set and the switch rebooted, as follows.

```
SLX# conf
Entering configuration mode terminal
SLX(config)# hardware
SLX(config-hardware)# profile tcam vxlan-ext
%Warning: To activate the new profile config, please run
'copy running-config startup-config' followed by 'reload
system'.
SLX(config-hardware)#
```

- Breakout ports, if any, on SLX devices must be configured manually. Refer to the appropriate SLX-OS Management Guide for configuration steps for different platforms.
- Follow the EVD guidelines for Fabric and ICL port connections on leaf nodes for the following:
    - SLX 9140, SLX 9540: 0/49 -- 0/54
    - SLX 9030: 0/49 -- 0/52

Automating Clos Fabric provisioning

This consists of four basic steps.

1) Create the Fabric.
    a. Modify default Fabric settings if required.
2) Register devices with inventory (autodiscovery of various "Assets" of the registered device), with discovered Assets as follows:
    - Device details such as model, firmware, ASNs
    - Physical Interfaces, VEs
    - Logical Interfaces such as VLANs, BDs, port-channels
    - VRFs, BGP, MCT, EVPN, overlay
    - Stored device credentials, eliminating the need to specify device credentials in other provisioning commands

    a. Clos physical topology (physical connections as per EVD) between devices is validated.
    b. Based on device roles and topology, an intended configuration is generated.
3) Add devices to the Fabric.
    a. Clos physical topology (physical connections as per EVD) between devices is validated.
    b. Based on device roles and topology, an intended configuration is generated.
4) Configure the Fabric
    a. Provision the underlay and overlay configuration on the devices
        i. Basically, push all the L2 and L3 configurations necessary to form an IP Fabric down to the SLX devices.
        ii. Validate the configurations pushed to the devices.

Automating 3-stage Clos

This topology has two layers of devices, leaf and spine. All the links between the leaf and spine must be connected. Spine nodes should not be interconnected with each other. Refer to the following figure.

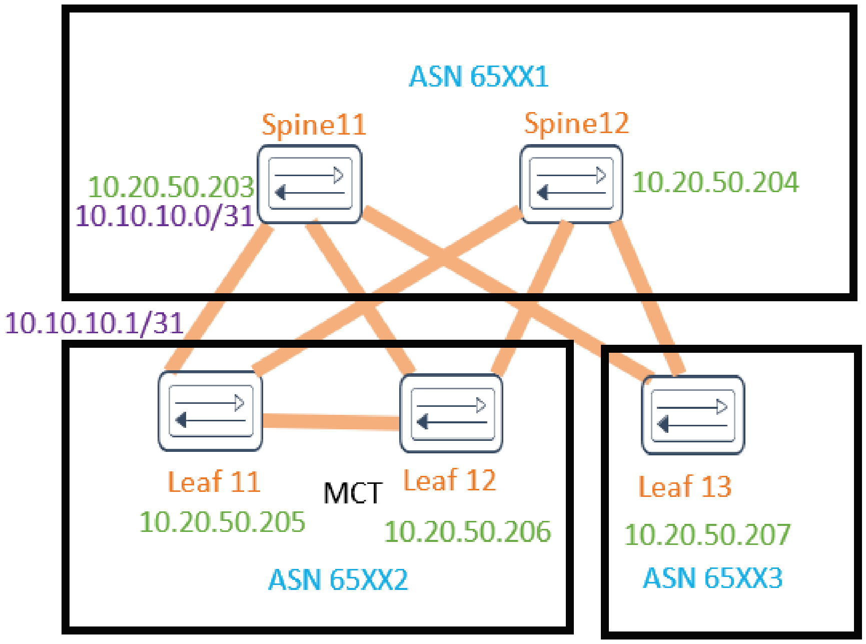


Figure 4. Automating 3-stage Clos

1. Create a 3-stage Fabric.

```
$ dca fabric create --name stage3 --stage 3
```

2. Add devices with appropriate roles to the Fabric. The user must provide device credentials as part of this command if the devices are not already registered with the inventory.

```
$ dca fabric device add-bulk --name stage3 --leaf
10.20.50.205,10.20.50.206,10.20.50.207 --spine
10.20.50.203,10.20.50.204 --username admin --password
password
```

NOTE: There is also an option to add/register single device at a time. Refer to Add a device to the Fabric.

3. Configure the Fabric.

```
$ dca fabric configure --name stage3
```

Automating 5-stage Clos

This topology allows three types of devices to be added: leaf , spine, and super-spine. All the links between the leaf and spine must be connected. Similarly, all the links between the spine and super-spine must be connected. A border leaf can be directly connected to a super-spine, but there should not be any connection between a border leaf and a spine.

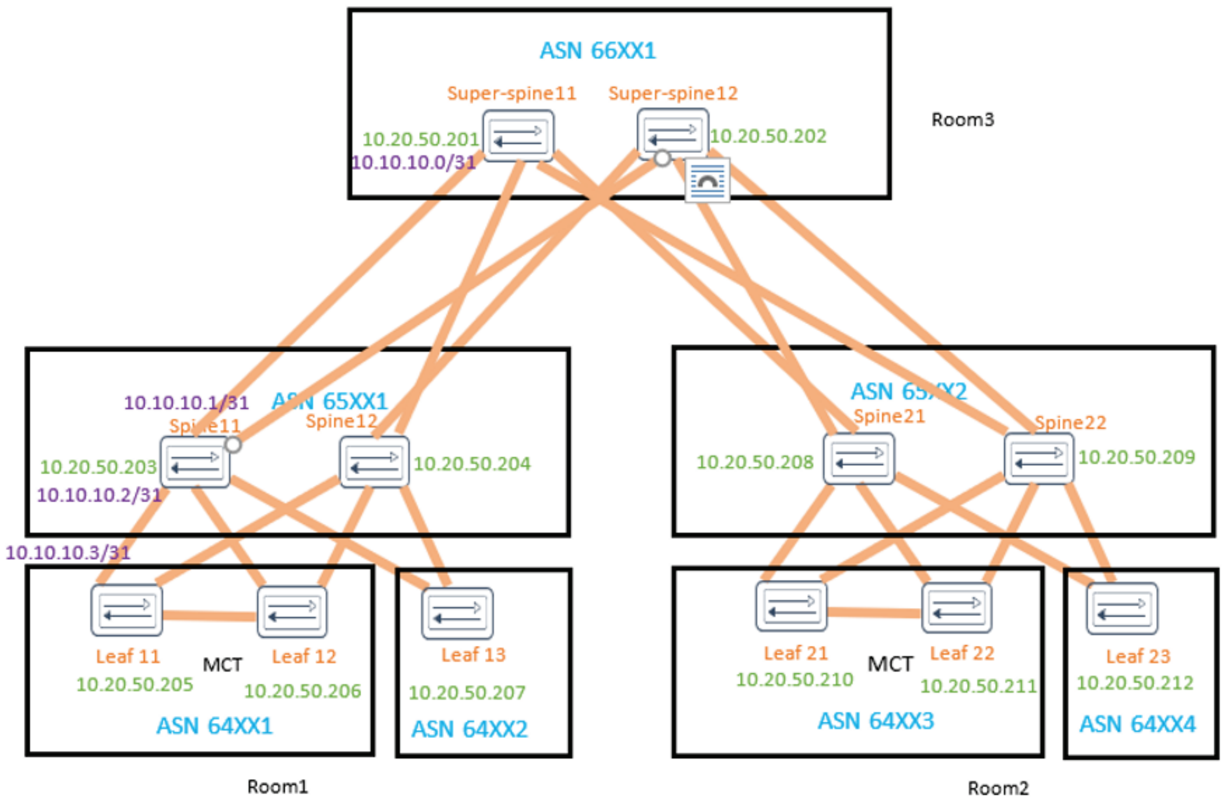


Figure 5. Automating 5-stage Clos

1. Create a 5-stage Fabric.

```
$ dca fabric create --name stage5 --stage 5
```

2. Add devices/PoDs to the 5-stage Fabric. The user must provide device credentials as part of this command if the devices are not already registered with the inventory.

   a. Add devices in PoD “Room1” and associate it to PoD “Room3”.

```
    $ dca fabric device add-bulk --name stage5 --leaf
10.20.50.205,10.20.50.206-207 --spine 10.20.50.203-204 --super-
spine 10.20.50.201-202 --three-stage-pod Room1 --five-stage-pod
Room3 --username admin --password password
```

b. Add an additional PoD “Room2”.

```
     $ dca fabric device add-bulk --name stage5 --leaf
10.20.50.210-212 --spine 10.20.50.208-209 --three-stage-pod Room2
--username admin --password password
```

3. Configure the Fabric.

```
     $ dca fabric configure --name stage5
```

Fabric Validation, Error Reporting, and Recovery

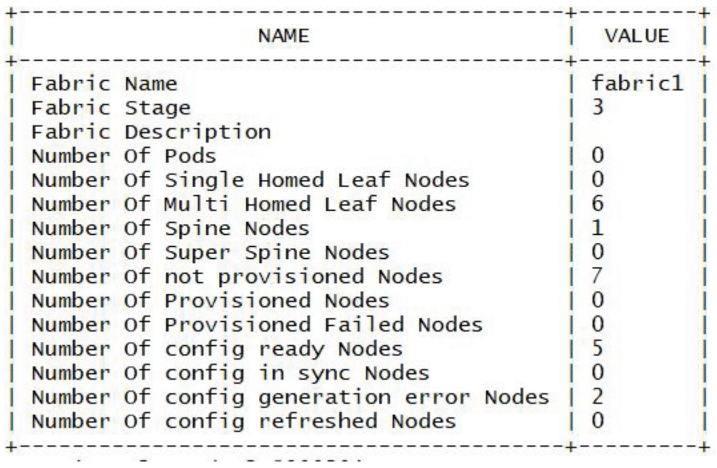
This section lists a variety of functions and their related commands.

Get Fabric summary

CLI	**dca fabric show summary [--name *<Fabric-name>*]**
Behavior	Displays the summary of all the Fabrics when the “—name” option is not provided. Displays the summary of a given Fabric when the “—name” option is provided.
Field Description	**--name** *string*: Name of the Fabric.

Example:

```
$ dca fabric show summary –name fabric1
```



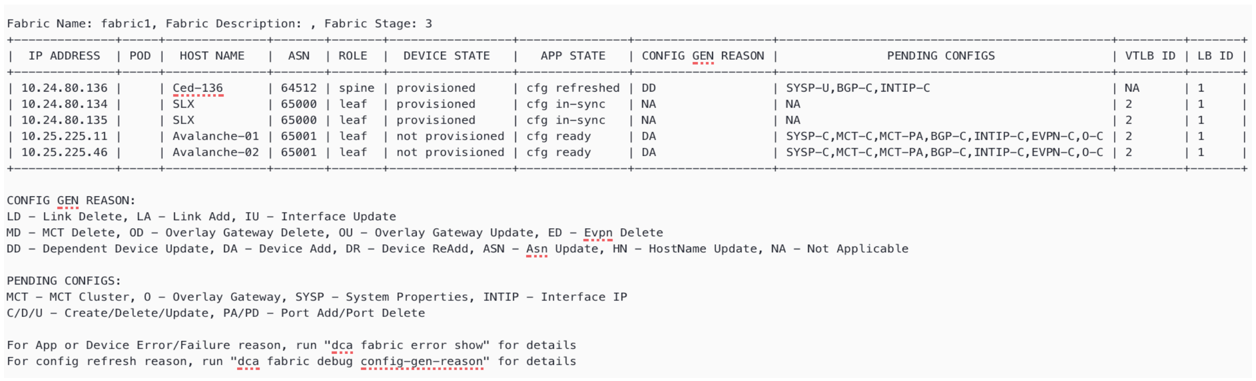
```
+----------------------------------------+---------+
|                  NAME                  |  VALUE  |
+----------------------------------------+---------+
| Fabric Name                            | fabric1 |
| Fabric Stage                           | 3       |
| Fabric Description                     |         |
| Number Of Pods                         | 0       |
| Number Of Single Homed Leaf Nodes      | 0       |
| Number Of Multi Homed Leaf Nodes       | 6       |
| Number Of Spine Nodes                  | 1       |
| Number Of Super Spine Nodes            | 0       |
| Number Of not provisioned Nodes        | 7       |
| Number Of Provisioned Nodes            | 0       |
| Number Of Provisioned Failed Nodes     | 0       |
| Number Of config ready Nodes           | 5       |
| Number Of config in sync Nodes         | 0       |
| Number Of config generation error Nodes | 2      |
| Number Of config refreshed Nodes       | 0       |
+----------------------------------------+---------+
```

Get Fabric details

CLI	**dca fabric show [--name *<Fabric-name>*]**
Behavior	Displays the details of all the Fabrics when the “--name” option is not provided. Displays the details of a given Fabric when the “--name” option is provided.
Field Description	**--name** *string*: Name of the Fabric. **--export** *string*: Export Fabric details to CSV file.

Example:

```
$ dca fabric show --name stage3
```



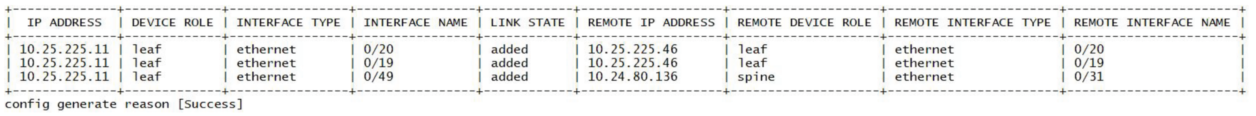
```
Fabric Name: fabric1, Fabric Description: , Fabric Stage: 3
+--------------+-----+---------------+-------+-------+------------------+---------------+-------------------+----------------------------------------------+---------+-------+
|  IP ADDRESS  | POD |   HOST NAME   |  ASN  | ROLE  |   DEVICE STATE   |   APP STATE   | CONFIG GEN REASON |                 PENDING CONFIGS              | VTLB ID | LB ID |
+--------------+-----+---------------+-------+-------+------------------+---------------+-------------------+----------------------------------------------+---------+-------+
| 10.24.80.136 |     | Ced-136       | 64512 | spine | provisioned      | cfg refreshed | DD                | SYSP-U,BGP-C,INTIP-C                         | NA      | 1     |
| 10.24.80.134 |     | SLX           | 65000 | leaf  | provisioned      | cfg in-sync   | NA                | NA                                           | 2       | 1     |
| 10.24.80.135 |     | SLX           | 65000 | leaf  | provisioned      | cfg in-sync   | NA                | NA                                           | 2       | 1     |
| 10.25.225.11 |     | Avalanche-01  | 65001 | leaf  | not provisioned  | cfg ready     | DA                | SYSP-C,MCT-C,MCT-PA,BGP-C,INTIP-C,EVPN-C,O-C | 2       | 1     |
| 10.25.225.46 |     | Avalanche-02  | 65001 | leaf  | not provisioned  | cfg ready     | DA                | SYSP-C,MCT-C,MCT-PA,BGP-C,INTIP-C,EVPN-C,O-C | 2       | 1     |
+--------------+-----+---------------+-------+-------+------------------+---------------+-------------------+----------------------------------------------+---------+-------+

CONFIG GEN REASON:
LD - Link Delete, LA - Link Add, IU - Interface Update
MD - MCT Delete, OD - Overlay Gateway Delete, OU - Overlay Gateway Update, ED - Evpn Delete
DD - Dependent Device Update, DA - Device Add, DR - Device ReAdd, ASN - Asn Update, HN - HostName Update, NA - Not Applicable

PENDING CONFIGS:
MCT - MCT Cluster, O - Overlay Gateway, SYSP - System Properties, INTIP - Interface IP
C/D/U - Create/Delete/Update, PA/PD - Port Add/Port Delete

For App or Device Error/Failure reason, run "dca fabric error show" for details
For config refresh reason, run "dca fabric debug config-gen-reason" for details
```

Get Fabric device config gen reason

This debug CLI can be used to get the configuration generation reason for a particular Fabric device.

CLI	**dca fabric debug config-gen-reason --device *<device-ip>* --name *<Fabric-name>***
Field Description	**--device**: Device IP address **-- name**: Name of the Fabric to which the device belongs.

Example:



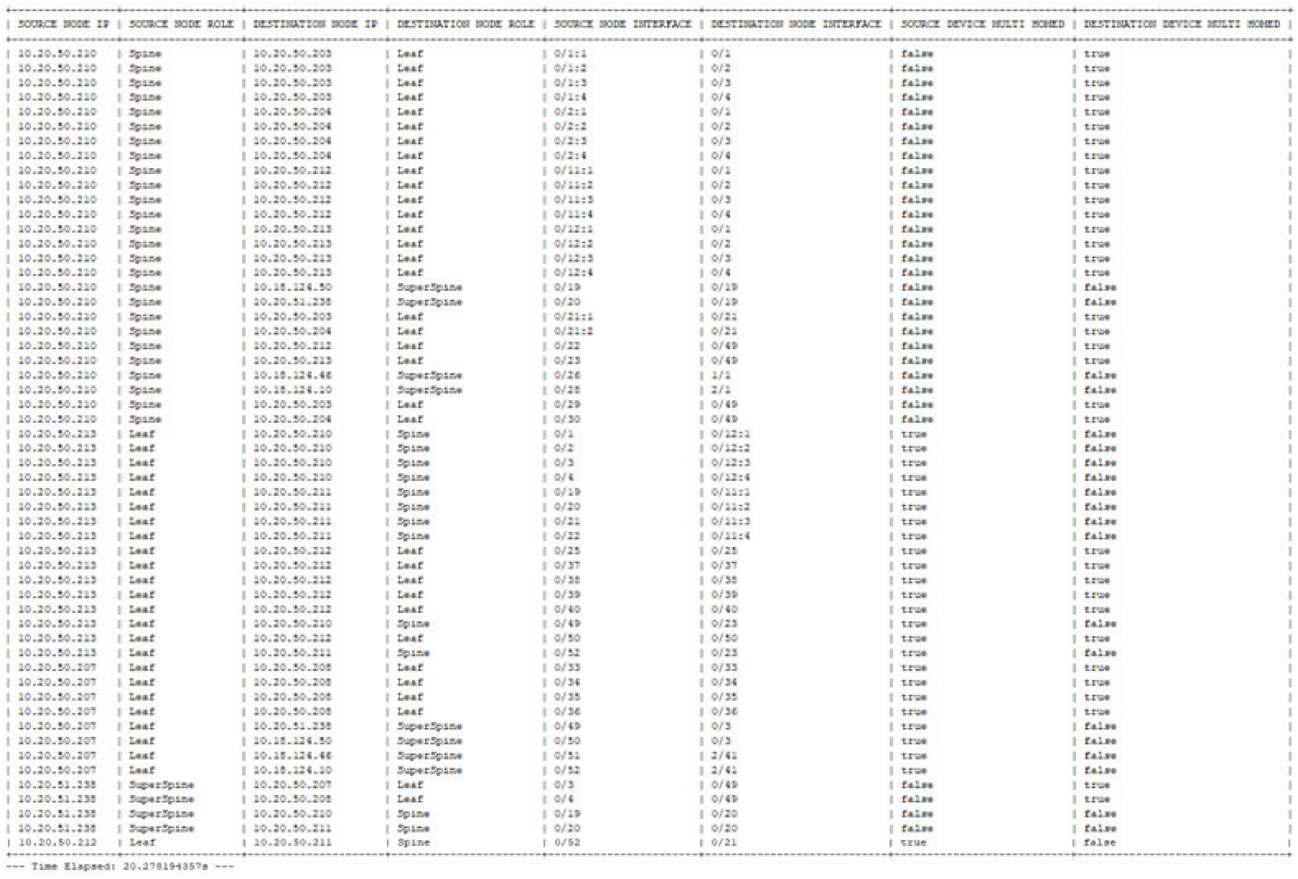
```
+---------------+-------------+----------------+----------------+------------+-------------------+--------------------+-----------------------+-----------------------+
|  IP ADDRESS   | DEVICE ROLE | INTERFACE TYPE | INTERFACE NAME | LINK STATE | REMOTE IP ADDRESS | REMOTE DEVICE ROLE | REMOTE INTERFACE TYPE | REMOTE INTERFACE NAME |
+---------------+-------------+----------------+----------------+------------+-------------------+--------------------+-----------------------+-----------------------+
| 10.25.225.11 | leaf         | ethernet       | 0/20           | added      | 10.25.225.46      | leaf               | ethernet              | 0/20                  |
| 10.25.225.11 | leaf         | ethernet       | 0/19           | added      | 10.25.225.46      | leaf               | ethernet              | 0/19                  |
| 10.25.225.11 | leaf         | ethernet       | 0/49           | added      | 10.24.80.136      | spine              | ethernet              | 0/31                  |
+---------------+-------------+----------------+----------------+------------+-------------------+--------------------+-----------------------+-----------------------+
config generate reason [Success]
```

Get physical topology

CLI	**dca fabric topology show physical --name *<Fabric name>***
Behavior	Displays all the physical connectivity of the devices in a Fabric.
Field Description	**--name** *string*: Name of the Fabric.

Example:

```
$ dca fabric topology show physical --name stage5
```



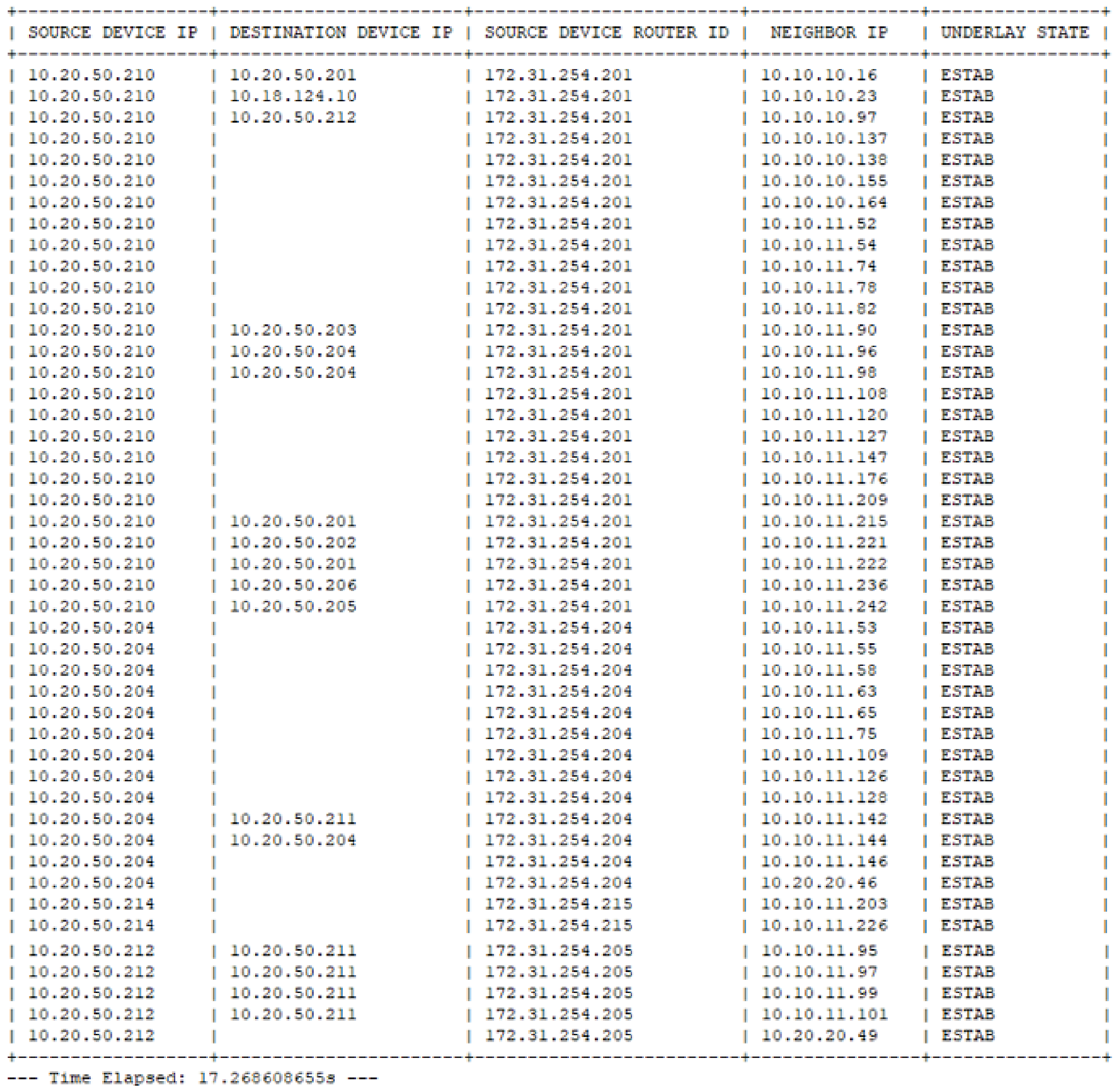
```
+----------------+------------------+---------------------+-----------------------+-----------------------+----------------------------+---------------------------+--------------------------------+
| SOURCE NODE IP | SOURCE NODE ROLE | DESTINATION NODE IP | DESTINATION NODE ROLE | SOURCE NODE INTERFACE | DESTINATION NODE INTERFACE | SOURCE DEVICE MULTI HOMED | DESTINATION DEVICE MULTI HOMED |
+----------------+------------------+---------------------+-----------------------+-----------------------+----------------------------+---------------------------+--------------------------------+
| 10.20.50.210   | Spine            | 10.20.50.203        | Leaf                  | 0/1:1                 | 0/1                        | false                     | true                           |
| 10.20.50.210   | Spine            | 10.20.50.203        | Leaf                  | 0/1:2                 | 0/2                        | false                     | true                           |
| 10.20.50.210   | Spine            | 10.20.50.203        | Leaf                  | 0/1:3                 | 0/3                        | false                     | true                           |
| 10.20.50.210   | Spine            | 10.20.50.203        | Leaf                  | 0/1:4                 | 0/4                        | false                     | true                           |
| 10.20.50.210   | Spine            | 10.20.50.204        | Leaf                  | 0/2:1                 | 0/1                        | false                     | true                           |
| 10.20.50.210   | Spine            | 10.20.50.204        | Leaf                  | 0/2:2                 | 0/2                        | false                     | true                           |
| 10.20.50.210   | Spine            | 10.20.50.204        | Leaf                  | 0/2:3                 | 0/3                        | false                     | true                           |
| 10.20.50.210   | Spine            | 10.20.50.204        | Leaf                  | 0/2:4                 | 0/4                        | false                     | true                           |
| 10.20.50.210   | Spine            | 10.20.50.212        | Leaf                  | 0/11:1                | 0/1                        | false                     | true                           |
| 10.20.50.210   | Spine            | 10.20.50.212        | Leaf                  | 0/11:2                | 0/2                        | false                     | true                           |
| 10.20.50.210   | Spine            | 10.20.50.212        | Leaf                  | 0/11:3                | 0/3                        | false                     | true                           |
| 10.20.50.210   | Spine            | 10.20.50.212        | Leaf                  | 0/11:4                | 0/4                        | false                     | true                           |
| 10.20.50.210   | Spine            | 10.20.50.213        | Leaf                  | 0/12:1                | 0/1                        | false                     | true                           |
| 10.20.50.210   | Spine            | 10.20.50.213        | Leaf                  | 0/12:2                | 0/2                        | false                     | true                           |
| 10.20.50.210   | Spine            | 10.20.50.213        | Leaf                  | 0/12:3                | 0/3                        | false                     | true                           |
| 10.20.50.210   | Spine            | 10.20.50.213        | Leaf                  | 0/12:4                | 0/4                        | false                     | true                           |
| 10.20.50.210   | Spine            | 10.18.124.50        | SuperSpine            | 0/19                  | 0/19                       | false                     | false                          |
| 10.20.50.210   | Spine            | 10.20.51.238        | SuperSpine            | 0/20                  | 0/19                       | false                     | false                          |
| 10.20.50.210   | Spine            | 10.20.50.203        | Leaf                  | 0/21:1                | 0/21                       | false                     | true                           |
| 10.20.50.210   | Spine            | 10.20.50.204        | Leaf                  | 0/21:2                | 0/21                       | false                     | true                           |
| 10.20.50.210   | Spine            | 10.20.50.212        | Leaf                  | 0/22                  | 0/49                       | false                     | true                           |
| 10.20.50.210   | Spine            | 10.20.50.213        | Leaf                  | 0/23                  | 0/49                       | false                     | true                           |
| 10.20.50.210   | Spine            | 10.18.124.46        | SuperSpine            | 0/26                  | 1/1                        | false                     | false                          |
| 10.20.50.210   | Spine            | 10.18.124.10        | SuperSpine            | 0/28                  | 2/1                        | false                     | false                          |
| 10.20.50.210   | Spine            | 10.20.50.203        | Leaf                  | 0/29                  | 0/49                       | false                     | true                           |
| 10.20.50.210   | Spine            | 10.20.50.204        | Leaf                  | 0/30                  | 0/49                       | false                     | true                           |
| 10.20.50.213   | Leaf             | 10.20.50.210        | Spine                 | 0/1                   | 0/12:1                     | true                      | false                          |
| 10.20.50.213   | Leaf             | 10.20.50.210        | Spine                 | 0/2                   | 0/12:2                     | true                      | false                          |
| 10.20.50.213   | Leaf             | 10.20.50.210        | Spine                 | 0/3                   | 0/12:3                     | true                      | false                          |
| 10.20.50.213   | Leaf             | 10.20.50.210        | Spine                 | 0/4                   | 0/12:4                     | true                      | false                          |
| 10.20.50.213   | Leaf             | 10.20.50.211        | Spine                 | 0/19                  | 0/11:1                     | true                      | false                          |
| 10.20.50.213   | Leaf             | 10.20.50.211        | Spine                 | 0/20                  | 0/11:2                     | true                      | false                          |
| 10.20.50.213   | Leaf             | 10.20.50.211        | Spine                 | 0/21                  | 0/11:3                     | true                      | false                          |
| 10.20.50.213   | Leaf             | 10.20.50.211        | Spine                 | 0/22                  | 0/11:4                     | true                      | false                          |
| 10.20.50.213   | Leaf             | 10.20.50.212        | Leaf                  | 0/25                  | 0/25                       | true                      | true                           |
| 10.20.50.213   | Leaf             | 10.20.50.212        | Leaf                  | 0/37                  | 0/37                       | true                      | true                           |
| 10.20.50.213   | Leaf             | 10.20.50.212        | Leaf                  | 0/38                  | 0/38                       | true                      | true                           |
| 10.20.50.213   | Leaf             | 10.20.50.212        | Leaf                  | 0/39                  | 0/39                       | true                      | true                           |
| 10.20.50.213   | Leaf             | 10.20.50.212        | Leaf                  | 0/40                  | 0/40                       | true                      | true                           |
| 10.20.50.213   | Leaf             | 10.20.50.210        | Spine                 | 0/49                  | 0/23                       | true                      | false                          |
| 10.20.50.213   | Leaf             | 10.20.50.212        | Leaf                  | 0/50                  | 0/50                       | true                      | true                           |
| 10.20.50.213   | Leaf             | 10.20.50.211        | Spine                 | 0/52                  | 0/23                       | true                      | false                          |
| 10.20.50.207   | Leaf             | 10.20.50.208        | Leaf                  | 0/33                  | 0/33                       | true                      | true                           |
| 10.20.50.207   | Leaf             | 10.20.50.208        | Leaf                  | 0/34                  | 0/34                       | true                      | true                           |
| 10.20.50.207   | Leaf             | 10.20.50.208        | Leaf                  | 0/35                  | 0/35                       | true                      | true                           |
| 10.20.50.207   | Leaf             | 10.20.50.208        | Leaf                  | 0/36                  | 0/36                       | true                      | true                           |
| 10.20.50.207   | Leaf             | 10.20.51.238        | SuperSpine            | 0/49                  | 0/3                        | true                      | false                          |
| 10.20.50.207   | Leaf             | 10.18.124.50        | SuperSpine            | 0/50                  | 0/3                        | true                      | false                          |
| 10.20.50.207   | Leaf             | 10.18.124.46        | SuperSpine            | 0/51                  | 2/41                       | true                      | false                          |
| 10.20.50.207   | Leaf             | 10.18.124.10        | SuperSpine            | 0/52                  | 2/41                       | true                      | false                          |
| 10.20.51.238   | SuperSpine       | 10.20.50.207        | Leaf                  | 0/3                   | 0/49                       | false                     | true                           |
| 10.20.51.238   | SuperSpine       | 10.20.50.208        | Leaf                  | 0/4                   | 0/49                       | false                     | true                           |
| 10.20.51.238   | SuperSpine       | 10.20.50.210        | Spine                 | 0/19                  | 0/20                       | false                     | false                          |
| 10.20.51.238   | SuperSpine       | 10.20.50.211        | Spine                 | 0/20                  | 0/20                       | false                     | false                          |
| 10.20.50.212   | Leaf             | 10.20.50.211        | Spine                 | 0/52                  | 0/21                       | true                      | false                          |
+----------------+------------------+---------------------+-----------------------+-----------------------+----------------------------+---------------------------+--------------------------------+
--- Time Elapsed: 20.278194357s ---
```

Get underlay topology

CLI	**dca fabric topology show overlay --name <*Fabric name*>**
Behavior	Displays underlay connectivity, as well asBGP neighborship and the state of BGP sessions of the devices in a Fabric.
Field Description	**--name** *string*: Name of the Fabric.

Example:

```
$dca fabric topology show underlay --name stage5
```



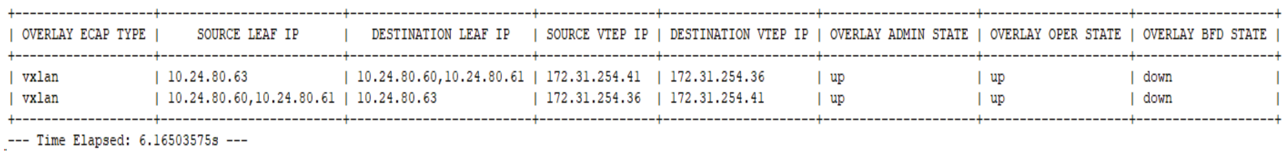
```
+------------------+-----------------------+-------------------------+----------------+----------------+
| SOURCE DEVICE IP | DESTINATION DEVICE IP | SOURCE DEVICE ROUTER ID |  NEIGHBOR IP   | UNDERLAY STATE |
+------------------+-----------------------+-------------------------+----------------+----------------+
| 10.20.50.210     | 10.20.50.201          | 172.31.254.201          | 10.10.10.16    | ESTAB          |
| 10.20.50.210     | 10.18.124.10          | 172.31.254.201          | 10.10.10.23    | ESTAB          |
| 10.20.50.210     | 10.20.50.212          | 172.31.254.201          | 10.10.10.97    | ESTAB          |
| 10.20.50.210     |                       | 172.31.254.201          | 10.10.10.137   | ESTAB          |
| 10.20.50.210     |                       | 172.31.254.201          | 10.10.10.138   | ESTAB          |
| 10.20.50.210     |                       | 172.31.254.201          | 10.10.10.155   | ESTAB          |
| 10.20.50.210     |                       | 172.31.254.201          | 10.10.10.164   | ESTAB          |
| 10.20.50.210     |                       | 172.31.254.201          | 10.10.11.52    | ESTAB          |
| 10.20.50.210     |                       | 172.31.254.201          | 10.10.11.54    | ESTAB          |
| 10.20.50.210     |                       | 172.31.254.201          | 10.10.11.74    | ESTAB          |
| 10.20.50.210     |                       | 172.31.254.201          | 10.10.11.78    | ESTAB          |
| 10.20.50.210     |                       | 172.31.254.201          | 10.10.11.82    | ESTAB          |
| 10.20.50.210     | 10.20.50.203          | 172.31.254.201          | 10.10.11.90    | ESTAB          |
| 10.20.50.210     | 10.20.50.204          | 172.31.254.201          | 10.10.11.96    | ESTAB          |
| 10.20.50.210     | 10.20.50.204          | 172.31.254.201          | 10.10.11.98    | ESTAB          |
| 10.20.50.210     |                       | 172.31.254.201          | 10.10.11.108   | ESTAB          |
| 10.20.50.210     |                       | 172.31.254.201          | 10.10.11.120   | ESTAB          |
| 10.20.50.210     |                       | 172.31.254.201          | 10.10.11.127   | ESTAB          |
| 10.20.50.210     |                       | 172.31.254.201          | 10.10.11.147   | ESTAB          |
| 10.20.50.210     |                       | 172.31.254.201          | 10.10.11.176   | ESTAB          |
| 10.20.50.210     |                       | 172.31.254.201          | 10.10.11.209   | ESTAB          |
| 10.20.50.210     | 10.20.50.201          | 172.31.254.201          | 10.10.11.215   | ESTAB          |
| 10.20.50.210     | 10.20.50.202          | 172.31.254.201          | 10.10.11.221   | ESTAB          |
| 10.20.50.210     | 10.20.50.201          | 172.31.254.201          | 10.10.11.222   | ESTAB          |
| 10.20.50.210     | 10.20.50.206          | 172.31.254.201          | 10.10.11.236   | ESTAB          |
| 10.20.50.210     | 10.20.50.205          | 172.31.254.201          | 10.10.11.242   | ESTAB          |
| 10.20.50.204     |                       | 172.31.254.204          | 10.10.11.53    | ESTAB          |
| 10.20.50.204     |                       | 172.31.254.204          | 10.10.11.55    | ESTAB          |
| 10.20.50.204     |                       | 172.31.254.204          | 10.10.11.58    | ESTAB          |
| 10.20.50.204     |                       | 172.31.254.204          | 10.10.11.63    | ESTAB          |
| 10.20.50.204     |                       | 172.31.254.204          | 10.10.11.65    | ESTAB          |
| 10.20.50.204     |                       | 172.31.254.204          | 10.10.11.75    | ESTAB          |
| 10.20.50.204     |                       | 172.31.254.204          | 10.10.11.109   | ESTAB          |
| 10.20.50.204     |                       | 172.31.254.204          | 10.10.11.126   | ESTAB          |
| 10.20.50.204     |                       | 172.31.254.204          | 10.10.11.128   | ESTAB          |
| 10.20.50.204     | 10.20.50.211          | 172.31.254.204          | 10.10.11.142   | ESTAB          |
| 10.20.50.204     | 10.20.50.204          | 172.31.254.204          | 10.10.11.144   | ESTAB          |
| 10.20.50.204     |                       | 172.31.254.204          | 10.10.11.146   | ESTAB          |
| 10.20.50.204     |                       | 172.31.254.204          | 10.20.20.46    | ESTAB          |
| 10.20.50.214     |                       | 172.31.254.215          | 10.10.11.203   | ESTAB          |
| 10.20.50.214     |                       | 172.31.254.215          | 10.10.11.226   | ESTAB          |
| 10.20.50.212     | 10.20.50.211          | 172.31.254.205          | 10.10.11.95    | ESTAB          |
| 10.20.50.212     | 10.20.50.211          | 172.31.254.205          | 10.10.11.97    | ESTAB          |
| 10.20.50.212     | 10.20.50.211          | 172.31.254.205          | 10.10.11.99    | ESTAB          |
| 10.20.50.212     | 10.20.50.211          | 172.31.254.205          | 10.10.11.101   | ESTAB          |
| 10.20.50.212     |                       | 172.31.254.205          | 10.20.20.49    | ESTAB          |
+------------------+-----------------------+-------------------------+----------------+----------------+
--- Time Elapsed: 17.268608655s ---
```

Get overlay topology

CLI	**dca fabric topology show overlay --name <*Fabric name*>**
Behavior	Displays overlay connectivity of the devices in a Fabric.
Field Description	**--name** *string*: Name of the Fabric.

Example:

```
$dca fabric topology show overlay --name stage5
```



```
+-------------------+-------------------------+-------------------------+----------------+---------------------+----------------------+----------------------+-------------------+
| OVERLAY ECAP TYPE |     SOURCE LEAF IP      |   DESTINATION LEAF IP   | SOURCE VTEP IP | DESTINATION VTEP IP | OVERLAY ADMIN STATE | OVERLAY OPER STATE | OVERLAY BFD STATE |
+-------------------+-------------------------+-------------------------+----------------+---------------------+----------------------+----------------------+-------------------+
| vxlan             | 10.24.80.63             | 10.24.80.60,10.24.80.61 | 172.31.254.41  | 172.31.254.36       | up                   | up                   | down              |
| vxlan             | 10.24.80.60,10.24.80.61 | 10.24.80.63             | 172.31.254.36  | 172.31.254.41       | up                   | up                   | down              |
+-------------------+-------------------------+-------------------------+----------------+---------------------+----------------------+----------------------+-------------------+
--- Time Elapsed: 6.16503575s ---
```

Get device config

CLI	**dca fabric show-config --name <Fabric name> [--device-role <string>]**
Behavior	Displays the device configuration in JSON format.
Field Description	**--name** *string*: Name of the Fabric **--device-role** *string*: Filters the config based on device-role (super-spine/spine/leaf/all) (default "all")

Example:

```
$ dca fabric show-config --name stage5
```

Output Snippet:

```
{{
  "Fabric_name": "stage5",
  "switches": [
    {
      "switch": "10.20.50.212",
      "role": "Leaf",
      "bgp": {
        "local_as": "65002",
        "network": "172.31.254.22/32",
        "max_paths": "8",
        "bfd_rx": "0",
        "bfd_tx": "0",
        "bfd_multiplier": "0",
        "peer_groups": [
          {
            "name": "podA-spine-group",
            "description": "To Spine",
            "bfd": "",
            "remote_as": "64512"
          }
        ],
        "neighbors": [
          {
            "remote_ip": "10.10.11.61",
            "remote_as": "0",
            "peer_group": "podA-spine-group",
            "bgp_multihop": ""
          },
          {
            "remote_ip": "10.10.11.63",
            "remote_as": "0",
            "peer_group": "podA-spine-group",
            "bgp_multihop": ""
          },
          {
            "remote_ip": "10.10.11.65",
            "remote_as": "0",
            "peer_group": "podA-spine-group",
            "bgp_multihop": ""
          },
          ←Output truncated→

        {
          "interface_name": "0/37",
          "interface_type": "ethernet",
          "interface_ip_address": "",
          "interface_description": ""
        },
        {
          "interface_name": "0/51",
          "interface_type": "ethernet",
          "interface_ip_address": "",
          "interface_description": ""
        },
          ←Output truncated→
    },
    {
      "switch": "10.20.50.213",
      "role": "Leaf",
      "bgp": {
        "local_as": "65002",
        "network": "172.31.254.93/32",
        "max_paths": "8",
        "bfd_rx": "0",
        "bfd_tx": "0",
        "bfd_multiplier": "0",
        "peer_groups": [
          {
            "name": "podA-spine-group",
            "description": "To Spine",
            "bfd": "",
            "remote_as": "64512"
          }
        ],
        "neighbors": [

        {
          "interface_name": "1",
          "interface_type": "loopback",
          "interface_ip_address": "172.31.254.27",
          "interface_description": ""
        },
        {
          "interface_name": "2",
          "interface_type": "loopback",
          "interface_ip_address": "172.31.254.23",
          "interface_description": ""
        }
      ]
    }
  ]
}}
```

```
-- Time Elapsed: 4.8378569s --
```

Clear device config

CLI	**dca fabric debug clear-config --device *<device-ip>***
Behavior	Clears the underlay/overlay configuration from the device, to recover the device from erroneous conditions.
Field Description	**--device** *<device-ip>:* Device IP address. **--username** *string*: Username of device. **--password** *string*: Password of device.

Example:

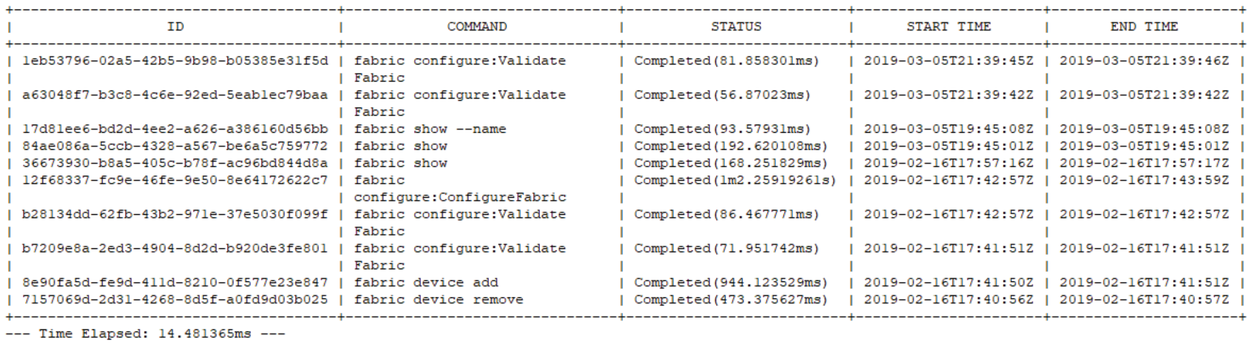
```
$ dca fabric debug clear-config --device
10.24.80.134,10.24.80.135,10.24.80.136,10.25.225.163,10.25.225.167,10.
25.225.172,10.25.225.11,10.25.225.46,10.24.85.74,10.24.85.76
```

Get Fabric execution

CLI	**dca fabric execution show [--id *<execution id>* | --limit *<num-of-executions>* | --status { failed | succeeded | all }]**
Behavior	Displays the REST API executions of Fabric Service.
Field Description	**--id** *string* : Filters the executions based on execution id. "limit" and "status" flags are ignored when "id" flag is given. **--limit** *int32* : Limits the number of executions to be listed. Value "0"lists all the executions. (default = 10) **--status** *string* : Filters the executions based on the status(failed/succeeded/all) (default "all")

Example:

```
$ dca fabric execution show
```



```
+--------------------------------------+-----------------------------------------+--------------------------+----------------------+----------------------+
|                  ID                  |                 COMMAND                 |          STATUS          |      START TIME      |       END TIME       |
+--------------------------------------+-----------------------------------------+--------------------------+----------------------+----------------------+
| 1eb53796-02a5-42b5-9b98-b05385e31f5d | fabric configure:Validate               | Completed(81.858301ms)   | 2019-03-05T21:39:45Z | 2019-03-05T21:39:46Z |
|                                      | Fabric                                  |                          |                      |                      |
| a63048f7-b3c8-4c6e-92ed-5eab1ec79baa | fabric configure:Validate               | Completed(56.87023ms)    | 2019-03-05T21:39:42Z | 2019-03-05T21:39:42Z |
|                                      | Fabric                                  |                          |                      |                      |
| 17d81ee6-bd2d-4ee2-a626-a386160d56bb | fabric show --name                      | Completed(93.57931ms)    | 2019-03-05T19:45:08Z | 2019-03-05T19:45:08Z |
| 84ae086a-5ccb-4328-a567-be6a5c759772 | fabric show                             | Completed(192.620108ms)  | 2019-03-05T19:45:01Z | 2019-03-05T19:45:01Z |
| 36673930-b8a5-405c-b78f-ac96bd844d8a | fabric show                             | Completed(168.251829ms)  | 2019-02-16T17:57:16Z | 2019-02-16T17:57:17Z |
| 12f68337-fc9e-46fe-9e50-8e64172622c7 | fabric                                  | Completed(1m2.25919261s) | 2019-02-16T17:42:57Z | 2019-02-16T17:43:59Z |
|                                      | configure:ConfigureFabric               |                          |                      |                      |
| b28134dd-62fb-43b2-971e-37e5030f099f | fabric configure:Validate               | Completed(86.467771ms)   | 2019-02-16T17:42:57Z | 2019-02-16T17:42:57Z |
|                                      | Fabric                                  |                          |                      |                      |
| b7209e8a-2ed3-4904-8d2d-b920de3fe801 | fabric configure:Validate               | Completed(71.951742ms)   | 2019-02-16T17:41:51Z | 2019-02-16T17:41:51Z |
|                                      | Fabric                                  |                          |                      |                      |
| 8e90fa5d-fe9d-411d-8210-0f577e23e847 | fabric device add                       | Completed(944.123529ms)  | 2019-02-16T17:41:50Z | 2019-02-16T17:41:51Z |
| 7157069d-2d31-4268-8d5f-a0fd9d03b025 | fabric device remove                    | Completed(473.375627ms)  | 2019-02-16T17:40:56Z | 2019-02-16T17:40:57Z |
+--------------------------------------+-----------------------------------------+--------------------------+----------------------+----------------------+
--- Time Elapsed: 14.481365ms ---
```

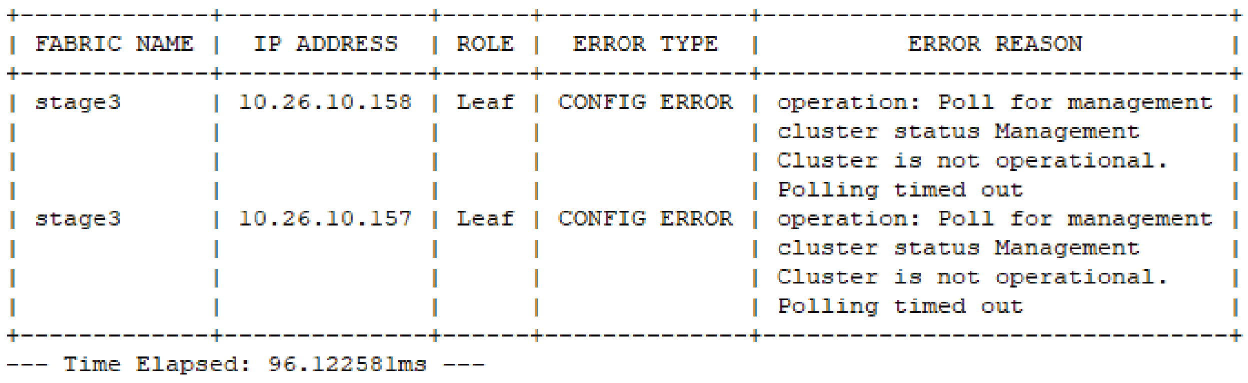
Get Fabric error

Any validation errors (topology and configuration errors) are reported to the user for corrective action, when a device is added to the Fabric and also during Fabric configuration. Any errors occurred during add, validate and configure phases persist in the DB and the following CLI lists the device errors.

CLI	**dca fabric error show --name *<Fabric-name>* [--export *<file-name>*]**
Behavior	Displays Fabric validation errors.
Field Description	**--name** *string* : Name of the Fabric. **--export** *string* : Exports Fabric details to a CSV file.

Example:

```
$ dca fabric error show -name stage3
```



```
+-------------+-------------+-----+-------------+-------------------------------+
| FABRIC NAME |  IP ADDRESS | ROLE |  ERROR TYPE  |          ERROR REASON          |
+-------------+-------------+-----+-------------+-------------------------------+
| stage3      | 10.26.10.158 | Leaf | CONFIG ERROR | operation: Poll for management |
|             |              |      |              | cluster status Management      |
|             |              |      |              | Cluster is not operational.    |
|             |              |      |              | Polling timed out              |
| stage3      | 10.26.10.157 | Leaf | CONFIG ERROR | operation: Poll for management |
|             |              |      |              | cluster status Management      |
|             |              |      |              | Cluster is not operational.    |
|             |              |      |              | Polling timed out              |
+-------------+-------------+-----+-------------+-------------------------------+
--- Time Elapsed: 96.122581ms ---
```

Get supportSave

CLI	**dca supportsave**
Behavior	Collects supportSave data, which comprises of the Inventory, Tenant and Fabric service logs and the database dump of all the aforementioned services. It also includes the installer logs.

Example:

```
$ dca supportsave
Version : 2.0.0
Time Stamp: 19-01-29:17:20:28
Support Save File: /var/log/dcapp/dcapp_1548966881.logs.zip
-- Time Elapsed: 1.140725647s --
```

Tenant Network Provisioning

Overview

Tenant Services provides a unified means to create and manage the Tenants and their associated networks on the LEAF nodes of underlay and/or overlay IP Fabric. The Tenant network provisioning is allowed only on the LEAF nodes of the Fabric.

Tenant Network Provisioning provides following features on 3/5-Stage Clos Fabric:

1. L2 and L3 extension between racks
2. VLAN scoping at the ToR level
3. VLAN scoping at the port level within a ToR
4. Multi-homed leaf using Multi-Chassis Trunk (MCT)

Tenant CLIs/REST APIs provide the following:

- A mechanism to create a Tenant network on various endpoints spread across multiple leaf nodes in the Fabric.

Errors occurring on the device during Tenant network creation are tagged against the devices and can be retrieved from the CLI/REST APIs for use in taking corrective or remedial actions.

Day-0 prerequisites For Tenant Network Provisioning

- Management IP addresses must be configured on all switches.
- SLX devices must have the appropriate firmware version, as indicated in the “Supported Platform Matrix” section.
- 3/5-stage Clos Fabrics must be provisioned prior to Tenant network provisioning.

Tenant network creation

Tenant network creation involves the following steps to configure, manage, and associate networks in the Fabric:

1) Creating an Asset
   Creating an Asset includes reserving the devices and their physical ports from the existing leaf devices within a Fabric.
    a. An Asset contains physical ports from the devices belonging to the same Fabric.

   Default-Asset is auto created by Tenant Service, which owns all the physical ports in the data-center. Ports from Default-Asset can be carved out and assigned to other user assets. The ports are released back to Default-Asset once the user assets are deleted.

2) Creating a Tenant
    a. A Tenant is a logical entity with reserved resources being L2VNI, L3VNI, and Assets created in Step 1.
    b. If the Fabric type is overlay, based on the VNI setting in the Fabric, the VNI values can be set while the Tenant is created.
    c. An Asset cannot be part of multiple Tenants.
    d. Only one Asset from a Fabric can be owned by a Tenant.

   Default-Tenant is auto created by Tenant Service, which owns all the resources (VNIs) of the data-center and owns Default-Asset. Resources from Default-Tenant can be carved out and assigned to user tenants. The resources are released back to Default-Tenant once the user tenants are deleted.

3) Creating a port-channel
    a. A port-channel can be created by providing the port-channel name and the interfaces.
    b. Provisioning of a port-channel includes creating the port-channel with Tenant service and pushing the configurations to the devices.
    c. Port Channel creation is allowed on the following:
        - Interfaces spanning across MCT leaf nodes (dual-homed)
        - Interfaces originating from same leaf device (single-homed)

4) Creating an endpoint group (EPG)
    a. An EPG is a logical entity that is a collection of physical or port-channel interfaces that belong to one Asset, with same set of port properties being ctag, switchport mode, and endpoint tracking.
    b. EPG creation involves configuring switching mode (access/trunk), ctag and endpoint tracking on the interfaces belonging to this endpoint group.
    c. No configurations are pushed to the device as part of EPG creation.
    d. If the EPG is being created with port-channel interfaces, the port-channel must be created before it is assigned to EPG.

5) Creating a VRF

VRF creation is required for an L3 Tenant network. VRFs that are created are not provisioned on the devices until the associated Tenant network is created.

6) Creating a Tenant network
   a. A Tenant network is an entity that uses various forwarding constructs such as VLAN/bridge domain and VRFs to connect multiple EPGs across the leaf nodes in a Fabric.
   b. All the L2/L3 configurations necessary to bring up the Tenant network are pushed to the devices.

Tenant network provisioning

The following illustrates automating L2 and L3 extension between the leaf devices and between racks (network creation).

NOTE: Bridge domain, IRB-BD, IRB-VE(L3VNI), VRF RD, RT, port-channel IDs, and MCT client IDs are auto-generated by the system

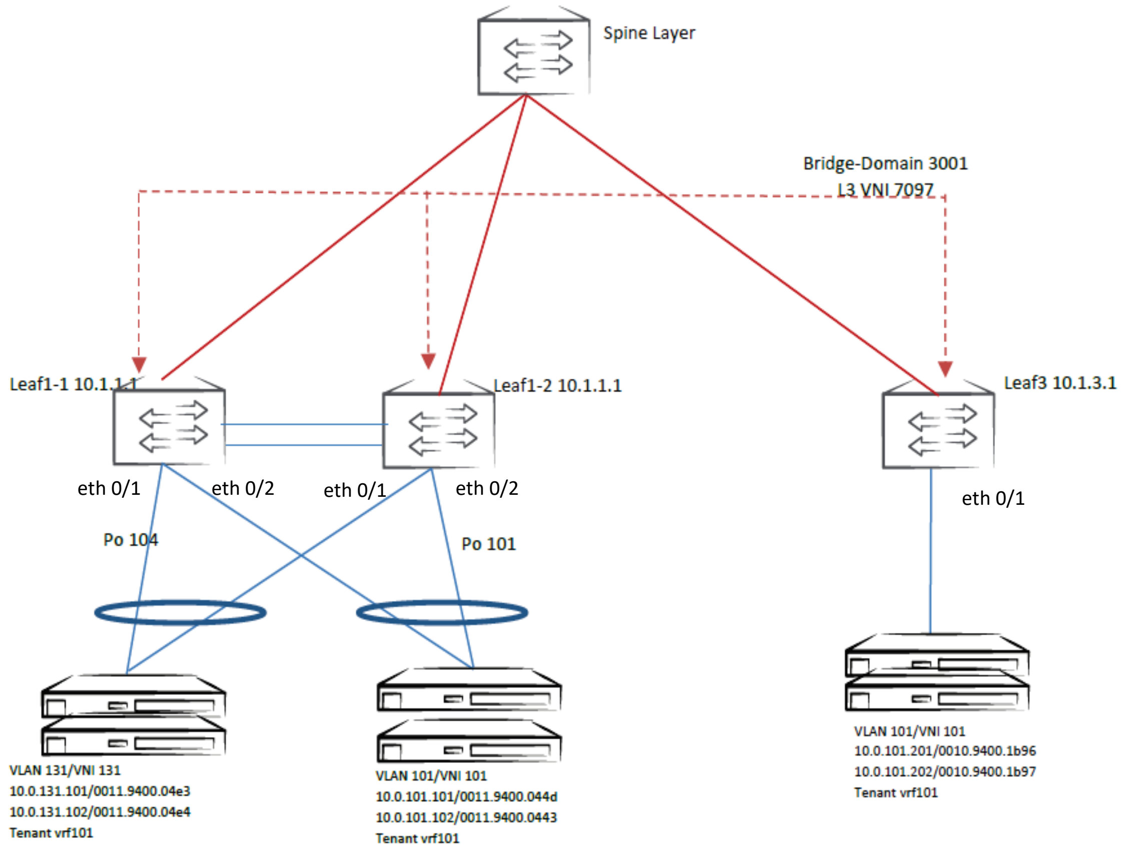


Figure 6. Automating L2/L3 extension between the racks

The following illustrates automating L2 and L3 extension between the leaf devices between racks (network creation).

Network creation

Do the following to create a network.

1. Create a VRF (only for L3 network).

   ```
   $ dca tenant vrf create --name vrf101
   ```

   NOTE: VRF properties such as route target value and type are auto-allocated if not provided.

2. Create a network that includes the creation of port-channels, EPG, and network.

   Network -- Ctag - 101

   ```
   $ dca tenant workflow network create --name network101
   --po-name po101 --po-speed 10Gbps --po-ports
   10.1.1.1[0/2],10.1.1.2[0/2] --ports 10.1.1.3[0/1] --ctag 101
   --enable-bd --vrf vrf101 --anycast-ip 10.0.101.254/22
   ```

   The above command does the following:
   - Creates port-channel “po101” with member ports as “Eth 0/2” from 10.1.1.1 and 10.1.1.2
   - Creates EPG with interfaces “po101” and “Eth 0/1” from 10.1.1.3 and associates it to ctag 101.
   - Associates “vrf101” to this network.
   - Configures anycast IP between MCT pairs.

   Network -- Ctag - 131

   ```
   $ dca tenant workflow network create --name network131
   --po-name po131 --po-speed 10Gbps --po-ports
   10.1.1.1[0/1],10.1.1.2[0/1] --ctag 131 --enable-bd --vrf
   vrf101 --anycast-ip 10.0.131.254/22
   ```

   The above command does the following:
   - Creates port-channel “po131” with member ports as “Eth 0/1” from 10.1.1.1 and 10.1.1.2
   - Creates EPG with interfaces “po131” and associates it to ctag 131.
   - Associates “vrf101” to this network.
   - Configures anycast IP between MCT pairs.

   NOTE: There is an advanced CLI option whereby user can create a port-channel, EPG, and network by using individual CLIs. Refer to the section “Advanced CLI”.

Network deletion

Do the following to delete a network.

1. Delete single or list of Tenant Network by providing the Tenant network names

   ```
   $ dca tenant workflow network delete --name network101,network131
   ```

2. Delete VRF

   ```
   $ dca tenant vrf create --name vrf101
   ```

Advanced CLIs

This section presents advanced CLIs for network creation and deletion.

Tenant network provisioning using Default-Tenant and Default-Asset

Network creation

1. Create port-channels.

```
$ dca tenant po create --name po104 --port 10.1.1.1[0/1],10.1.1.2[0/1]
--speed 10Gbps --negotiation active
```

```
$ dca tenant po create --name po101 --port 10.1.1.1[0/2],10.1.1.2[0/2]
--speed 10Gbps --negotiation active
```

2. Create an EPG.

```
$ dca tenant epg create --name epg1 --po po104 --ctag 131

$ dca tenant epg create --name epg2 --po po101 --port
10.1.3.1[0/1] --ctag 101
```

NOTE: EPG creation assigns the same CTAG to all the ports/port-channels. If multiple CTAGs for the same ports/port-channels must be associated, then multiple EPGs and their corresponding CTAGs must be created accordingly, as in the following example.

```
$ dca tenant epg create --name epg1 --po po104 --ctag 131

$ dca tenant epg create --name epg2 --po po104 --ctag 132
```

3. Create a VRF.

```
$ dca tenant vrf create --name vrf101
```

NOTE: VRF router target value and type are auto-allocated if not provided.

4. Create a Tenant network by providing the EPG names and network properties

```
$ dca tenant network create --name network131
 --epg epg1 --enable-bd --vrf vrf101
 --anycast-ip 10.0.131.254/22

$ dca tenant network create --name network101
 --epg epg2 --enable-bd --vrf vrf101
 --anycast-ip 10.0.101.254/22
```

NOTE: The **--enable-bd** command determines whether the configurations to be pushed onto the devices are VLAN or bridge-domain based.

Network deletion

1. Delete a Tenant network. L2/L3 configurations are deleted from the device.

   ```
   $ dca tenant network delete --name network131
   ```

   NOTE: If a VRF is mapped to multiple networks, it is deleted only if there are no networks associated to it.

2. Delete an EPG.

   ```
   $ dca tenant epg delete --name epg2
   ```

3. Delete a VRF.

   ```
   $ dca tenant vrf delete --name vrfRed
   ```

4. Delete port-channels.

   ```
   $ dca tenant po delete --name po104
   ```

Tenant network provisioning using User-Tenant and User-Asset

Network creation

1. Create an Asset.

   ```
   $ dca tenant asset create --name Asset-Group-1 --port
   10.1.1.1[0/1-2],10.1.1.2[0/1-2],10.1.1.3[0/1]
   ```

2. Create a Tenant.

   ```
   $ dca tenant tenant create --name Tenant-Sales –-asset
   Asset-Group-1 –-l2-vni-count 50 –-l3-vni-count 50
   ```

3. Create port-channels.

   ```
   $ dca tenant po create --name po104 --port
   10.1.1.1[0/1],10.1.1.2[0/1] --speed 10Gbps --negotiation active
   –-tenant Tenant-Sales
   ```

   ```
   $ dca tenant po create --name po101 --port
   10.1.1.1[0/2],10.1.1.2[0/2] --speed 10Gbps --negotiation active
   –-tenant Tenant-Sales
   ```

4. Create an EPG.

```
$ dca tenant epg create --name epg1 --po po104 --ctag 131
--tenant Tenant-Sales
```

```
$ dca tenant epg create --name epg2 --po po101 --
port 10.1.3.1[0/1] --ctag 101 –-tenant Tenant-Sales
```

5. Create a Tenant network by providing the EPG names and network properties

```
 $ dca tenant network create --name network131
  --epg epg1 --enable-bd --vrf vrf101
  --anycast-ip 10.0.131.254/22 –-tenant Tenant-Sales
```

```
$ dca tenant network create --name network101
 --epg epg2 --enable-bd --vrf vrf101
 --anycast-ip 10.0.101.254/22 –-tenant Tenant-Sales
```

Network deletion

1. Delete a Tenant network. L2/L3 configurations are deleted from the device.

```
$ dca tenant network delete --name network131 --tenant
Tenant-Sales
```

   NOTE: If a VRF is mapped to multiple networks, it is deleted only if there are no networks associated to it.

2. Delete an EPG.

```
$ dca tenant epg delete --name epg2 –-tenant Tenant-Sales
```

3. Delete a VRF.

```
$ dca tenant vrf delete --name vrfRed –-tenant Tenant-Sales
```

4. Delete port-channels.

```
$ dca tenant po delete --name po104 –-tenant Tenant-Sales
```

5. Delete Tenant.

```
$ dca tenant delete --name Tenant-Sales
```

6. Delete Asset.

```
$ dca tenant asset delete --name Asset-Group-1
```

Tenant Error Reporting and Recovery

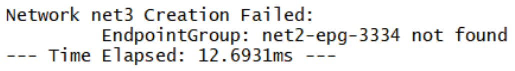
Tenant network error reporting (Advanced CLIs)

The appropriate error messages are displayed during configuration changes. Note the following examples.

1. Any validation or topology errors are reported in real time for corrective action. No entry in the DB is persisted for invalid/validation errors. All the errors are displayed through the CLI output.

   Example:

```
$ dca tenant network create --name net2 --epg net2-epg-3334
```

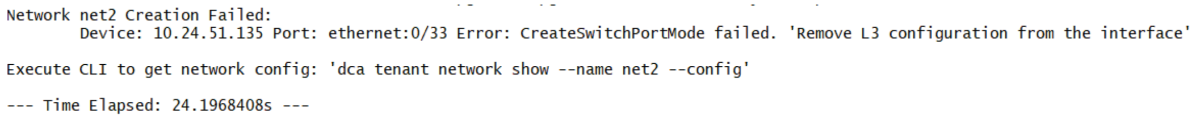


```
Network net3 Creation Failed:
        EndpointGroup: net2-epg-3334 not found
--- Time Elapsed: 12.6931ms ---
```

2. All device-level errors are displayed through CLI if the Tenant network fails during configuration or deconfiguration phase. Any errors that occur during add and delete phases are persisted in the DB and will displayed through the CLI. The errors can also be viewed by means of *'dca tenant network show --name <network name> --config'* .

   Example:

```
$ dca tenant network create --name net2 --epg net2-epg-333
```

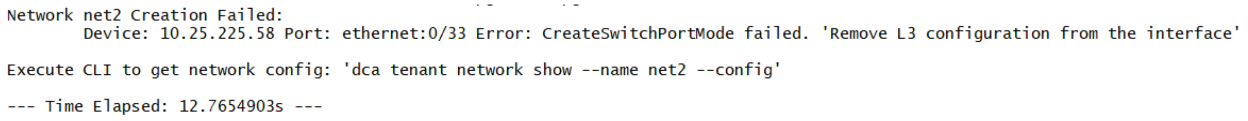


```
Network net2 Creation Failed:
       Device: 10.24.51.135 Port: ethernet:0/33 Error: CreateSwitchPortMode failed. 'Remove L3 configuration from the interface'

Execute CLI to get network config: 'dca tenant network show --name net2 --config'

--- Time Elapsed: 24.1968408s ---
```

3. Recovery of a Tenant network failed during creation

   Tenant network creation

```
$ dca tenant network create --name net2 --epg net2-epg-333
```



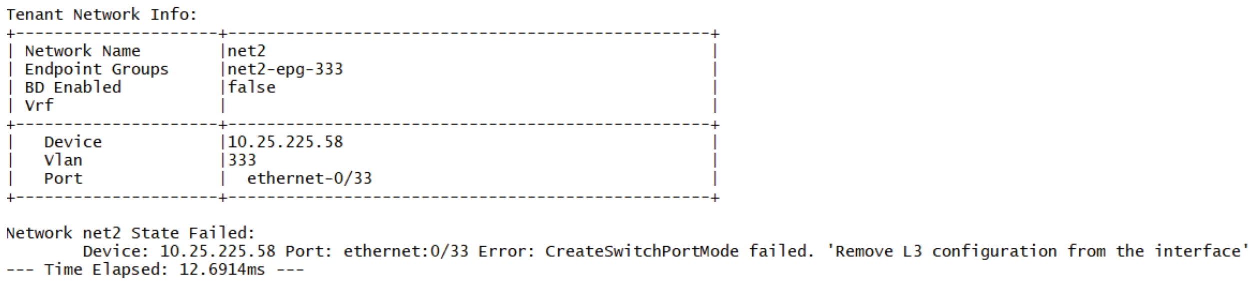
```
Network net2 Creation Failed:
       Device: 10.25.225.58 Port: ethernet:0/33 Error: CreateSwitchPortMode failed. 'Remove L3 configuration from the interface'

Execute CLI to get network config: 'dca tenant network show --name net2 --config'

--- Time Elapsed: 12.7654903s ---
```

Show Tenant network

This CLI shows the configurations that are pushed and also displays device specific errors.

Output:

```
$ dca tenant network show --name net2 --config
```



```
Tenant Network Info:
+--------------------+------------------------------------------------+
| Network Name       |net2                                            |
| Endpoint Groups    |net2-epg-333                                    |
| BD Enabled         |false                                           |
| Vrf                |                                                |
+--------------------+------------------------------------------------+
|   Device           |10.25.225.58                                    |
|   Vlan             |333                                             |
|   Port             |  ethernet-0/33                                 |
+--------------------+------------------------------------------------+

Network net2 State Failed:
        Device: 10.25.225.58 Port: ethernet:0/33 Error: CreateSwitchPortMode failed. 'Remove L3 configuration from the interface'
--- Time Elapsed: 12.6914ms ---
```

Reason of failure

- The tenant network creation failed since the port 0/33 on device 10.25.225.58 was a router interface. The configuration present on the device conflicts with tenant network configuration.

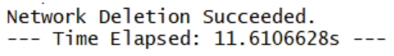
Recovery steps

- Delete the network
- Take the corrective action (by removing the conflicting configurations from the device)
- Recreate the tenant network

Delete Tenant

This CLI removes the configurations that are pushed to the devices and deletes the tenant network.

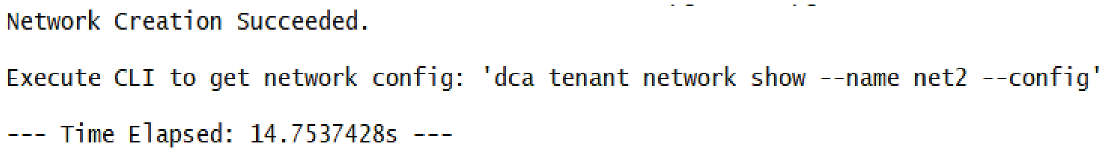
```
$ dca tenant network delete --name net2
```



```
Network Deletion Succeeded.
--- Time Elapsed: 11.6106628s ---
```

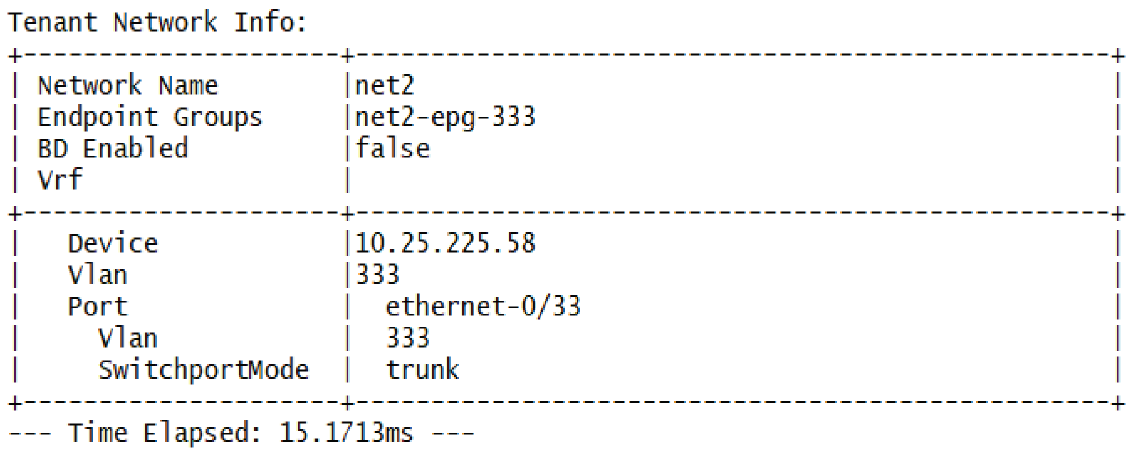
Tenant network re-creation

```
$ dca tenant network create --name net2 --epg net2-epg-333
```



```
Network Creation Succeeded.

Execute CLI to get network config: 'dca tenant network show --name net2 --config'

--- Time Elapsed: 14.7537428s ---
```

```
$ dca tenant network show --name net2 --config
```



```
Tenant Network Info:
+--------------------+--------------------------------------------------+
| Network Name       |net2                                              |
| Endpoint Groups    |net2-epg-333                                      |
| BD Enabled         |false                                             |
| Vrf                |                                                  |
+--------------------+--------------------------------------------------+
|   Device           |10.25.225.58                                      |
|   Vlan             |333                                               |
|   Port             |  ethernet-0/33                                   |
|     Vlan           |  333                                             |
|     SwitchportMode |  trunk                                           |
+--------------------+--------------------------------------------------+
--- Time Elapsed: 15.1713ms ---
```

4. Recovery of a Tenant network failed during deletion

If a tenant network deletion fails (for example, due to any conflicting configurations pushed to the device manually), once the corrective action is taken , do the following.

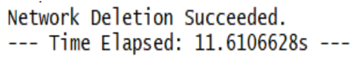
- Delete request can be rerun by means of *'dca tenant network delete --name <network-name>'*

5. Force delete of a Tenant network

A Tenant network deletion can fail due to miscellaneous reasons such as bad configurations on the devices or device becoming unreachable. Such networks can be deleted by using the -- **force** option, which will clean up the Tenant network from the Tenant service and try to delete the configurations from the devices (any errors during this will be ignored).

Example:

```
$ dca tenant network delete --name net2 --force
```



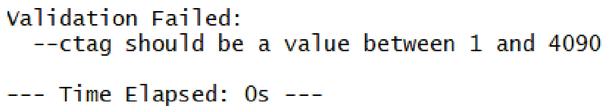
```
Network Deletion Succeeded.
--- Time Elapsed: 11.6106628s ---
```

Tenant network workflow-error reporting

Workflow-error reporting is similar to that provided through Advanced CLIs, where the validation and topology errors are displayed through the CLI without creating an entry in the DB. All the device-level configuration or deconfiguration errors are displayed through the **network show** CLIs.

Example:

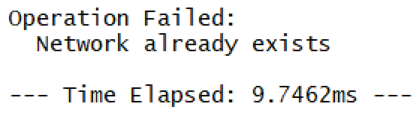
```
$ dca tenant workflow network create --name net1 --ports
10.25.225.58[0/33] --ctag 33333
```



```
Validation Failed:
  --ctag should be a value between 1 and 4090

--- Time Elapsed: 0s ---
```

Example:

```
$ dca tenant workflow network create --name net1 --ports
10.25.225.58[0/33] --ctag 333
```



```
Operation Failed:
  Network already exists

--- Time Elapsed: 9.7462ms ---
```

Please refer to step 3, 4&5 of section Tenant network error reporting (advanced CLIs) for recovering a failed tenant network

Logging/ELK Integration

In the DCA ecosystem, ELK (Elasticsearch, Logstash, Kibana) is implemented in the same network as that of the Application stack.

URLs to access the ELK stack:

-Elasticsearch: http://<host_ip>:9200

-Kibana: http://<host_ip>:5601

Sample log

@timestamp*:December 13th 2018, 22:18:12.929* ***source****:/var/log/dcapp/fabric/fabric.log offset:513,560 message:{"****level****":"info","msg":"Fabric service Health status OK ","time":"2018-12-12T18:03:04Z"} prospector.type:log json.level:info* ***json.msg****:Fabric service Health status OK json.time:2018-12-12T18:03:04Z beat.name:5d2a1a83ed27 beat.hostname:5d2a1a83ed27 beat.version:6.2.2* ***_id****:YdN4qGcBzheJSFbXB7U5 _type:doc _index:filebeat-6.2.2-2018.12.13 _score:1*

Ws	**TAG**	**INFO**
Who	source	Provides the information about which service the log belongs to.
Why	level	Provides the level of log, for example, whether a log is “Error” or “Info” or “Warning”.
Where	_id	Each log is numbered with a unique ID.
What	json.msg	Contains details about the operation or error message in this field.
When	timestamp	Details about when the operation was performed. Gives exact time of log creation.

Infra level

```
# docker logs <container-id>
```

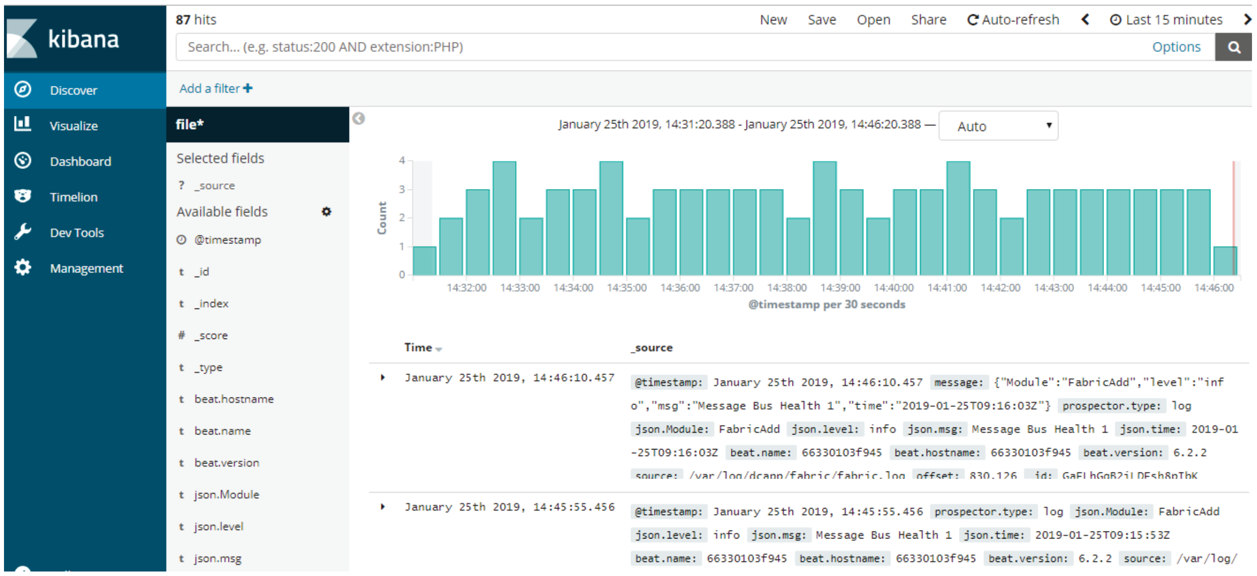
NOTE: To obtain a *<container-id>*, execute **docker ps.**

Application level

The ELK stack is deployed as part of the deployment, which helps analyzing the application-specific logs. Logs for the services are available in the host at /var/log/dcapp.

```
├── fabric
│   ├── fabric-2019-03-05T05-00-16.988.log
│   ├── fabric_database_dump_1551750078.log
│   ├── fabric_database_dump_1551750677.log
│   └── fabric.log
├── goswitch
│   ├── fabric
│   │   ├── goSwitch-2019-03-04T23-57-46.111.log
│   │   ├── goSwitch-2019-03-05T00-16-20.523.log
│   │   ├── goSwitch-2019-03-05T01-35-13.273.log
│   │   └── goSwitch.log
│   ├── goswitch
│   │   └── goSwitch.log
│   ├── inventory
│   │   ├── goSwitch-2019-03-05T01-27-24.761.log
│   │   └── goSwitch.log
│   └── ts
│       ├── goSwitch-2019-03-04T22-36-00.042.log
│       └── goSwitch.log
├── installer
│   ├── installer_201902281810.log
│   └── installer_201903042038.log
├── inventory
│   ├── inventory_database_dump_1551750078.log
│   ├── inventory_database_dump_1551750677.log
│   └── inventory-server.log
└── ts
    ├── tenant_database_dump_1551750078.log
    ├── tenant_database_dump_1551750677.log
    ├── ts-2019-03-04T23-18-26.411.log
    └── ts.log
```

Logs are visualized on a Kibana dashboard. Below are some sample application-specific logs.



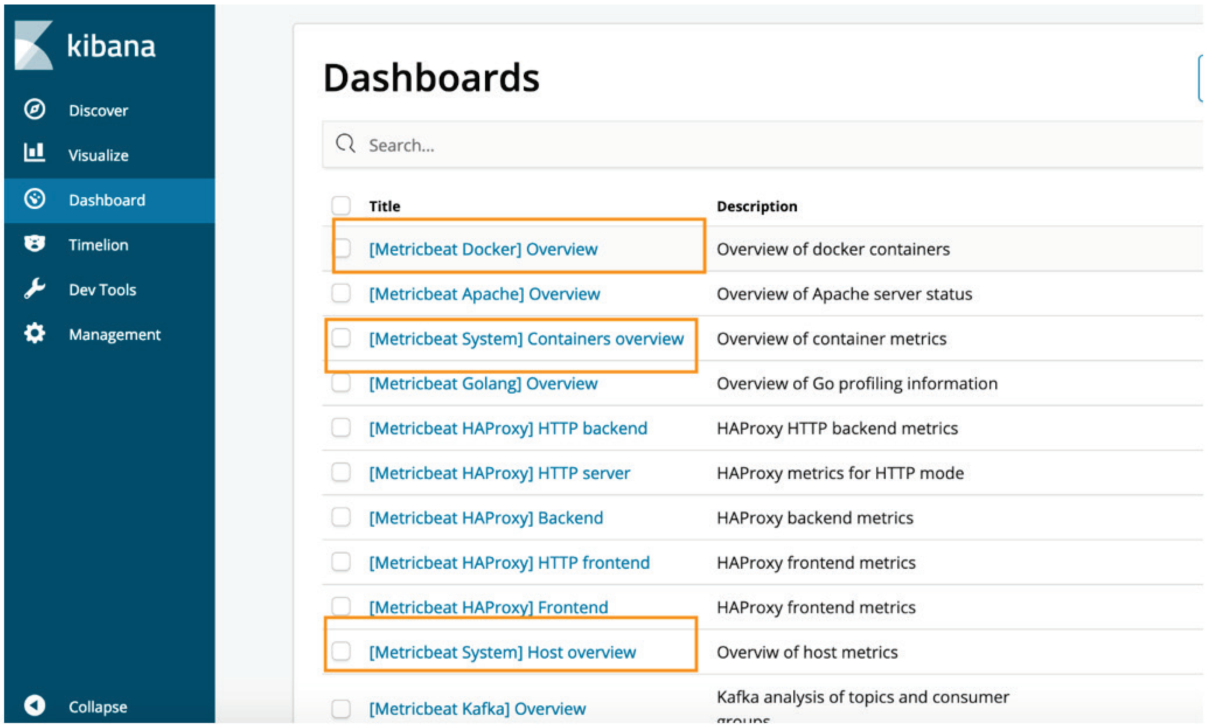
```
Time          _source
January 25th 2019, 14:46:10.457   @timestamp: January 25th 2019, 14:46:10.457 message: {"Module":"FabricAdd","level":"info","msg":"Message Bus Health 1","time":"2019-01-25T09:16:03Z"} prospector.type: log json.Module: FabricAdd json.level: info json.msg: Message Bus Health 1 json.time: 2019-01-25T09:16:03Z beat.name: 66330103f945 beat.hostname: 66330103f945 beat.version: 6.2.2 source: /var/log/dcapp/fabric/fabric.log offset: 830,126 _id: GaFLhGgB2iLDFsh8pTbK
January 25th 2019, 14:45:55.456   @timestamp: January 25th 2019, 14:45:55.456 prospector.type: log json.Module: FabricAdd json.level: info json.msg: Message Bus Health 1 json.time: 2019-01-25T09:15:53Z beat.name: 66330103f945 beat.hostname: 66330103f945 beat.version: 6.2.2 source: /var/log/
```

Figure 6. Kibana dashboard

Container stats and host stats

Metricbeat integration helps track the containers and host stats. This can help identify the memory leak and CPU usage per container or host. The Kibana stack launched as part of the DCAPP provides a number of Metricbeat dashboards.

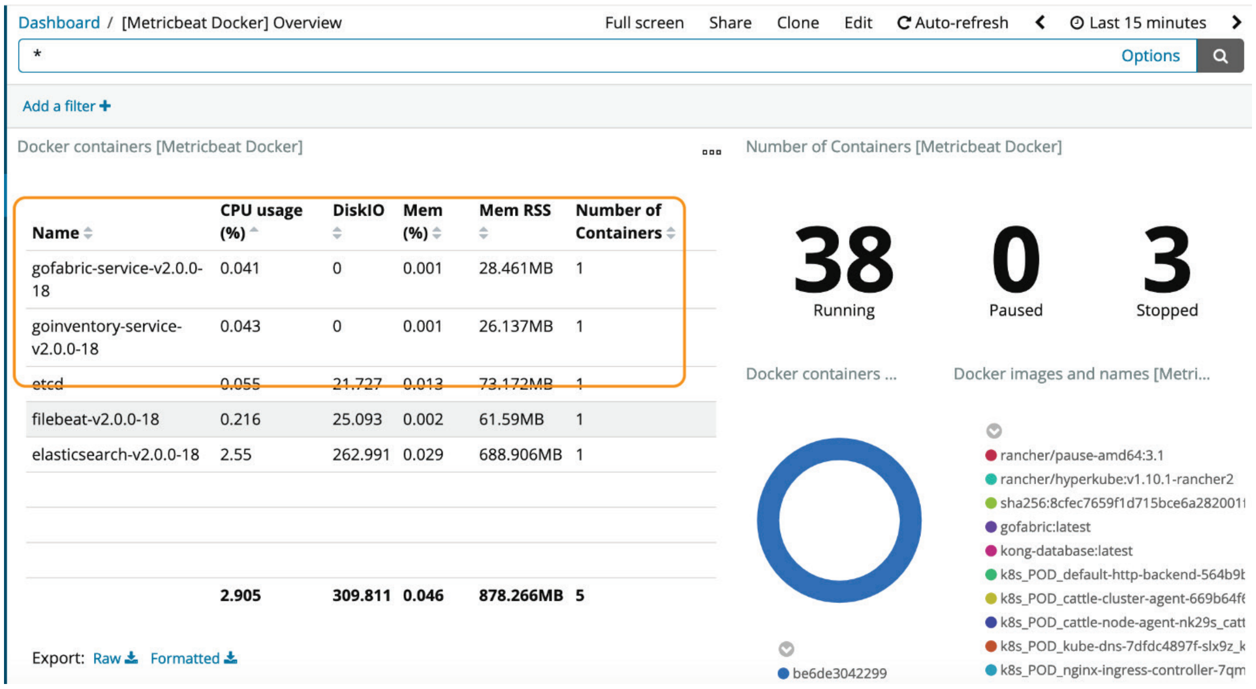
Log in to Kibana and click on “Dashboard” to view the Metricbeat dashboards:



Title	Description
[Metricbeat Docker] Overview	Overview of docker containers
[Metricbeat Apache] Overview	Overview of Apache server status
[Metricbeat System] Containers overview	Overview of container metrics
[Metricbeat Golang] Overview	Overview of Go profiling information
[Metricbeat HAProxy] HTTP backend	HAProxy HTTP backend metrics
[Metricbeat HAProxy] HTTP server	HAProxy metrics for HTTP mode
[Metricbeat HAProxy] Backend	HAProxy backend metrics
[Metricbeat HAProxy] HTTP frontend	HAProxy frontend metrics
[Metricbeat HAProxy] Frontend	HAProxy frontend metrics
[Metricbeat System] Host overview	Overviw of host metrics
[Metricbeat Kafka] Overview	Kafka analysis of topics and consumer

The following screenshots that show the container overview, CPU usage, and memory usage for containers.

Container overview



Dashboard / [Metricbeat Docker] Overview
Full screen
Share
Clone
Edit
Auto-refresh
Last 15 minutes
*
Options
Add a filter
Docker containers [Metricbeat Docker]
Number of Containers [Metricbeat Docker]
Docker containers ...
Docker images and names [Metri...
Export: Raw Formatted

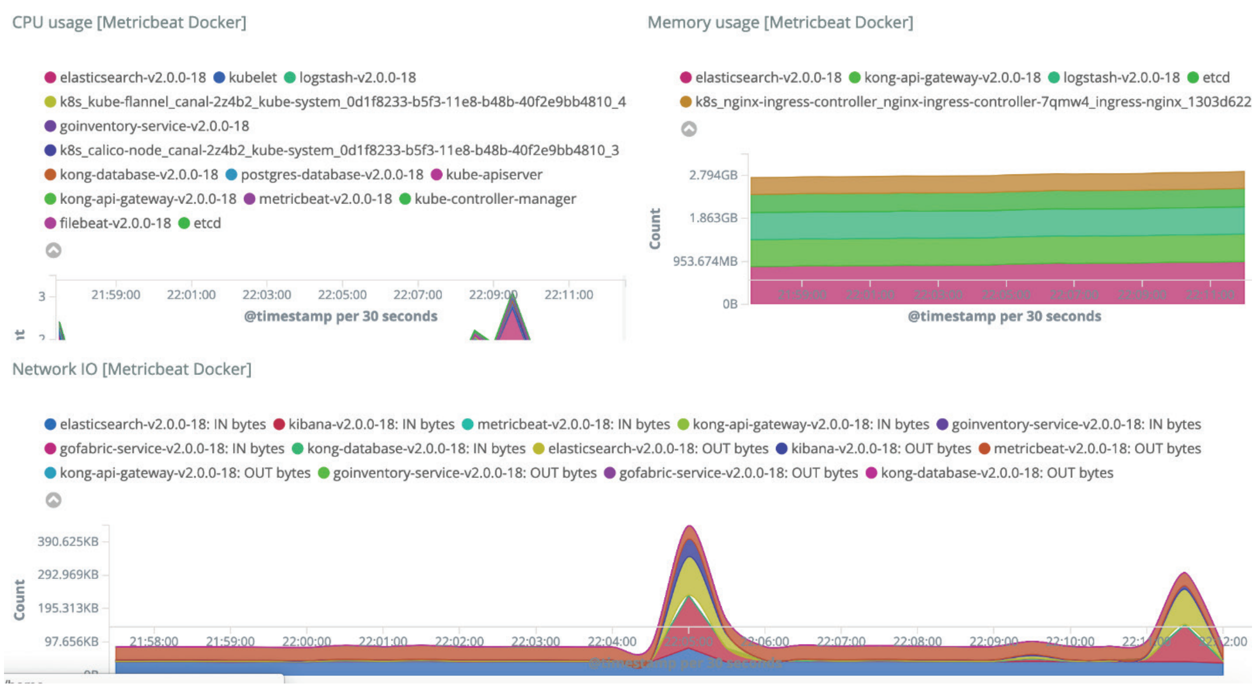
Name	CPU usage (%)	DiskIO	Mem (%)	Mem RSS	Number of Containers
gofabric-service-v2.0.0-18	0.041	0	0.001	28.461MB	1
goinventory-service-v2.0.0-18	0.043	0	0.001	26.137MB	1
etcd	0.055	21.727	0.013	73.172MB	1
filebeat-v2.0.0-18	0.216	25.093	0.002	61.59MB	1
elasticsearch-v2.0.0-18	2.55	262.991	0.029	688.906MB	1
	2.905	**309.811**	**0.046**	**878.266MB**	**5**

38	0	3
Running	Paused	Stopped

● be6de3042299

● rancher/pause-amd64:3.1
● rancher/hyperkube:v1.10.1-rancher2
● sha256:8cfec7659f1d715bce6a282001
● gofabric:latest
● kong-database:latest
● k8s_POD_default-http-backend-564b9b
● k8s_POD_cattle-cluster-agent-669b64f
● k8s_POD_cattle-node-agent-nk29s_catt
● k8s_POD_kube-dns-7dfdc4897f-slx9z_k
● k8s_POD_nginx-ingress-controller-7qm

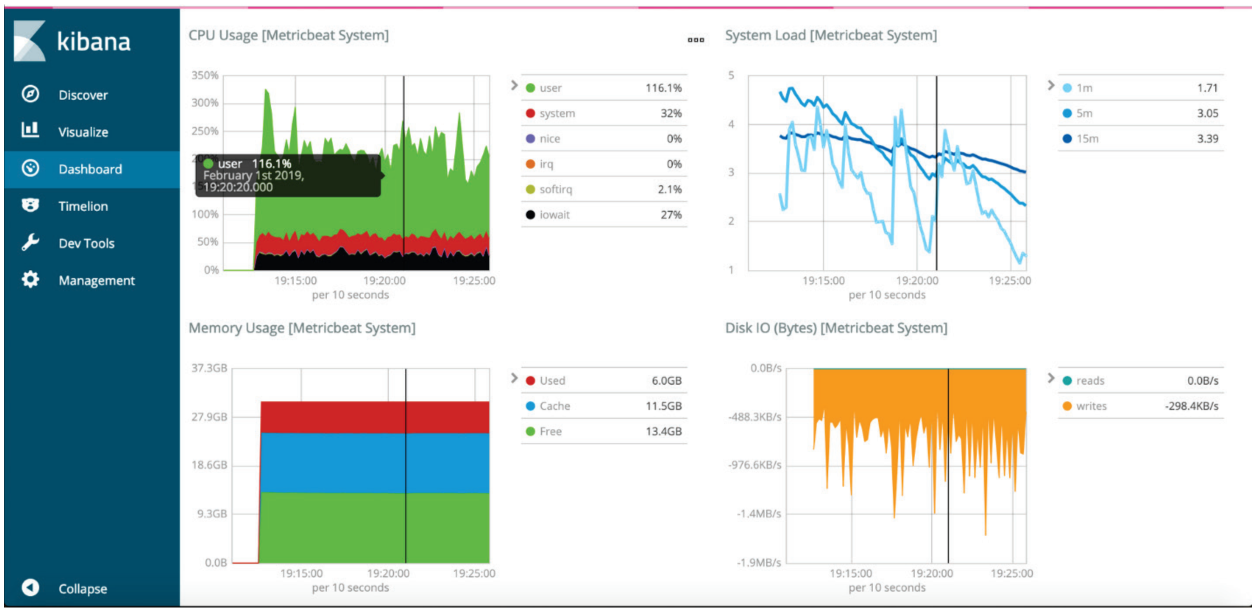
CPU and memory usage



CPU usage legend: ● elasticsearch-v2.0.0-18 ● kubelet ● logstash-v2.0.0-18 ● k8s_kube-flannel_canal-2z4b2_kube-system_0d1f8233-b5f3-11e8-b48b-40f2e9bb4810_4 ● goinventory-service-v2.0.0-18 ● k8s_calico-node_canal-2z4b2_kube-system_0d1f8233-b5f3-11e8-b48b-40f2e9bb4810_3 ● kong-database-v2.0.0-18 ● postgres-database-v2.0.0-18 ● kube-apiserver ● kong-api-gateway-v2.0.0-18 ● metricbeat-v2.0.0-18 ● kube-controller-manager ● filebeat-v2.0.0-18 ● etcd

Memory usage legend: ● elasticsearch-v2.0.0-18 ● kong-api-gateway-v2.0.0-18 ● logstash-v2.0.0-18 ● etcd ● k8s_nginx-ingress-controller_nginx-ingress-controller-7qmw4_ingress-nginx_1303d622

Network IO legend: ● elasticsearch-v2.0.0-18: IN bytes ● kibana-v2.0.0-18: IN bytes ● metricbeat-v2.0.0-18: IN bytes ● kong-api-gateway-v2.0.0-18: IN bytes ● goinventory-service-v2.0.0-18: IN bytes ● gofabric-service-v2.0.0-18: IN bytes ● kong-database-v2.0.0-18: IN bytes ● elasticsearch-v2.0.0-18: OUT bytes ● kibana-v2.0.0-18: OUT bytes ● metricbeat-v2.0.0-18: OUT bytes ● kong-api-gateway-v2.0.0-18: OUT bytes ● goinventory-service-v2.0.0-18: OUT bytes ● gofabric-service-v2.0.0-18: OUT bytes ● kong-database-v2.0.0-18: OUT bytes



● user	116.1%
● system	32%
● nice	0%
● irq	0%
● softirq	2.1%
● iowait	27%

● 1m	1.71
● 5m	3.05
● 15m	3.39

● Used	6.0GB
● Cache	11.5GB
● Free	13.4GB

● reads	0.0B/s
● writes	-298.4KB/s

Appendix A: Fabric Service CLIs

This appendix presents the CLI used to execute the implementation of various topologies.

3-Stage Clos automation

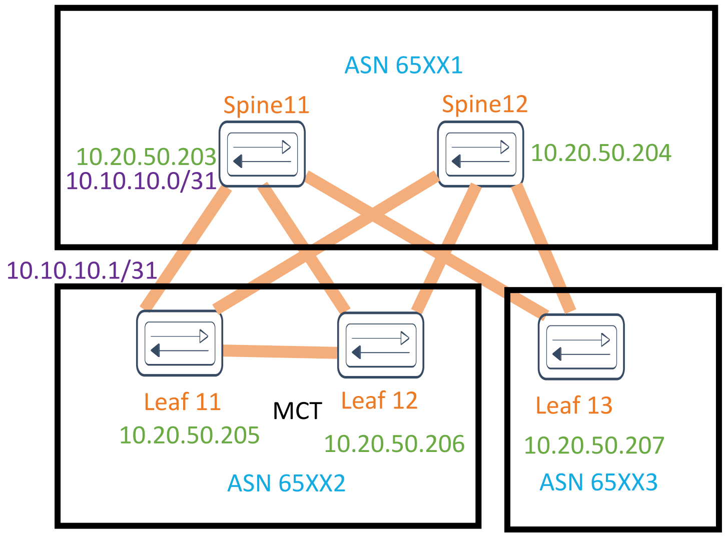


Figure A1. 3-stage Clos automation

Create a Fabric

CLI	**dca fabric create --name *<fabric-name>* [--stage { 3| 5 } --description *<description>*]**
Field Description	**--name** *string* : Name of the Fabric. **--description** *string* : Description of the Fabric. **--stage** *int* : Stage of the Fabric. Default = 3.

Example:

```
$ dca fabric create --name BLR_FABRIC_1 --stage 3 --description
BLR_FABRIC_1
```

Add a device to the Fabric

A device must be registered with Inventory Service before being added to a Fabric. Fabric Service supports IP numbered configuration.

- IP numbered: Each interface on every link between leaf and spine is assigned an IP address, and eBGP peering use these IP addresses. Number of IP addresses per device = Number of links.

CLI	**dca fabric device add --name *<fabric-name>* --ip *<device-ip>* --role { leaf | spine | super-spine} [leaf-type { single-homed | multi-homed} --hostname *<hostname>* --asn *<local-asn>* --vtep-loopback *<id>* --loopback *<id>* --pod *<name>* --username *<username>* --password *<password>*]**
Behavior	Adds a device to an existing Fabric. If user provides “username” and “password”, then the device is autoregistered with Inventory Service. If user does not provide “username” and “password”, then user must register the device explicitly with Inventory Service.
Field Description	**--name** *string* : Name of the Fabric **--ip** *string* : Device IP address **--role** : Device role: leaf, spine, or super-spine **--leaf-type** : Leaf type: single-homed or multi-homed **--hostname** *string* : Host name **--asn** *string* : ASN **--vtep-loopback** *string* : VTEP loopback ID **--loopback** *string* : Loopback port number **--pod** *string* : Name of the PoD **--username** *string* : Username for the device **--password** *string* : Password for the device

Example:

```
$ dca fabric device add --name BLR_FABRIC_1 --ip 10.20.50.203 --role
spine --hostname Spine11 --username admin --password password
$ dca fabric device add --name BLR_FABRIC_1 --ip 10.20.50.204 --role
spine --hostname Spine12 --username admin --password password
$ dca fabric device add --name BLR_FABRIC_1 --ip 10.20.50.205 --role
leaf --leaf-type multi-homed --hostname Leaf11 --username admin --
password password
$ dca fabric device add --name BLR_FABRIC_1 --ip 10.20.50.206 --role
leaf --leaf-type multi-homed --hostname Leaf12 --username admin --
password password
$ dca fabric device add --name BLR_FABRIC_1 --ip 10.20.50.207 --role
leaf --hostname Leaf13 --username admin --password password
```

Add multiple devices to a Fabric

CLI	**Fabric device add-bulk --name *<Fabric-name>* [--leaf *<list-of-leaf-ips>* --spine *<list-of-spine-ips>* --super-spine *<list-of-super-spine-ips>* --three-stage-pod *<pod-name>* --five-stage-pod-name *<pod-name>* --username *<username>* --password *<password>*]**
Behavior	Adds multiple devices to an existing Fabric. If user provides "username" and "password", then the devices are autoregistered with Inventory Service. If user does not provide "username" and "password", then user must register the devices explicitly with Inventory Service. A single "three-stage-pod" and "five-stage-pod" can be provided per CLI execution.
Field Description	**--name** *string* : Name of the Fabric **--leaf** *string* : Comma separated list of leaf IP addresses/host names **--three-stage-pod** *string* : Name of the leaf/spine PoD **--five-stage-pod** *string* : Name of the super-spine PoD **--spine** *string* : Comma separated list of spine IP addresses/host names **--super-spine** *string* : Comma separated list of super spine IP addresses/host names **--username** *string* : Username for the list of devices **--password** *string* : Password for the list of devices

Example:

```
$ dca fabric device add-bulk --name BLR_FABRIC_1 --leaf
10.20.50.205,10.20.50.206,10.20.50.207 --spine
10.20.50.203,10.20.50.204 --username admin --password password
```

Validate the Fabric topology

During the addition of a device to a Fabric and during Fabric configuration, Clos topology validations are performed. If the validation errors out, errors are reported to the user, based on which user can correct the topology. The encountered Fabric topology errors can be exported to a CSV/DOT file as well. Below are the topology validations:

1. Leaf nodes must connected to all the spine nodes.
2. A spine node must be connected to all the leaf nodes.
3. No more than two leaf nodes must be connected to each other.
4. Spine nodes must not be connected to each other.
5. Super-spine nodes must not be connected to each other
6. If a leaf node is marked as "multi-homed", then the node must have an MCT peer.
7. If a leaf node is marked as "single-homed", then the node must not be connected to other leaf nodes.
8. Device role (leaf/spine/super-spine) must be validated for a given device model (e.g. the SLX 9840 cannot be added as a leaf.)

NOTE: A management cluster is brought up on the MCT nodes forming the leaf pairs. Once the management cluster is operational, a logical VTEP is instantiated on the MCT nodes through the management cluster principal node. A logical VTEP IP needs to be consistent on both the MCT nodes. Transitioning MCT (multi-homed) nodes to non-MCT (single-homed) nodes and vice versa is not allowed and is an error condition.

Configure Fabric on the device

If the addition of devices to a Fabric is successful, then the underlay/overlay configuration can be configured on all the devices of the Fabric by means of the following CLI.

CLI	**dca fabric configure --name <fabric-name> [--force]**
Behavior	Configures underlay/overlay on the FDabric devices. If the **--force** option is used, then the all the devices are removed and added back to the Fabric, which can result in a configuration remove and add on all the devices.
Field Description	**--name** *string* : Name of the Fabric **--force** : Forces the configuration on the devices

Example:

```
$ dca fabric configure --name BLR_FABRIC_1
$ dca fabric configure --name BLR_FABRIC_1 --force
```

Remove multiple devices from the Fabric

Removal of device(s) from the Fabric results in deconfiguration of the underlay/overlay from the device and the device membership is removed from the Fabric.

CLI	**dca fabric device remove --name *<fabric-name>* --ip *<list-of-device-ips>* [--no-device-cleanup]**
Behavior	Removes existing device(s) from a Fabric. If the **--no-device-cleanup** option is used, then the configuration pushed by the automation engine is not cleaned up from the Fabric device(s). Removal of a device from the Fabric does not delete the device from inventory. He user must explicitly delete the device from inventory.
Field Description	**--name** *string* : Name of the Fabric **--ip** *string* : Device IP **--no-device-cleanup** : Prevents cleanup of the configuration on the devices

Example:

```
$ dca fabric device remove --name BLR_FABRIC_1 --ip 10.20.50.205,
10.20.50.206,10.20.50.207
```

Fabric settings

The user can update the Fabric settings to overwrite the “default” Fabric settings, by using the following CLI. Defaults are shown in parentheses ( ).

CLI	**dca fabric settings update --attribute-type *<attribute-value>***
Attributes	**mtu** : The MTU size in bytes <Number:1548-9216> (9216) **ip-mtu** : IPV4/IPV6 MTU size in bytes <Number:1300-9194> (9100) **bfd-enable** : BFD enabled Yes/No (No) **bfd-tx** : BFD desired min transmit interval in milliseconds <NUMBER: 50-30000> (300) **bfd-rx** : BFD desired min receive interval in milliseconds <NUMBER: 50-30000> (300) **bfd-multiplier** : BFD detection time multiplier <NUMBER: 3-50> (3) **bgp-multihop** : Allow EBGP neighbors not on directly connected networks <Number:1-255> (2) **max-paths** : Forward packets over multiple paths<Number:1-64> allow-as-in : Disables the AS_PATH check of the routes learned from the AS<Number:1-10> (8) **p2p-link-range**: IP address pool to be used for leaf-to-spine links (10.10.0.0/23) **loopback-ip-range**: IP Address Pool for Loopback interface, to be used for unnumbered and VTEP IP (172.31.254.0/24) **loopback-port-number** : Loopback ID on the device to be used as donor IP interface for the link between leaf and spine. (1) **vtep-loopback-port-number** : Loopback ID on the device to be used as VTEP IP interface (2) **leaf-asn-block** : ASN pool for leaf nodes (4200000000-4200010000) **spine-asn-block** : ASN pool for spine nodes (4210000000-4210005000) **super-spine-asn-block** : ASN pool for super-spine nodes (4220000000-4220001000) **leaf-peer-group** : Leaf peer group name <WORD: 1-58> (leaf-group) **spine-peer-group** : Spine peer group name <WORD: 1-58> (spine-group) **super-spine-peer-group** : Super-spine peer group name <WORD: 1-58> (super-spine-group)

	anycast-mac-address : IPV4 ANY CAST MAC address.mac address HHHH.HHHH.HHHH (0201.0101.0101) **ipv6-anycast-mac-address** : IPV6 ANY CAST MAC address.mac address HHHH.HHHH.HHHH (0201.0101.0102) **conversational-arp-aging-timeout**: Determines how long an ARP entry stays in cache (300) **mac-aging-timeout** : MAC Aging Timeout <NUMBER: 0|60-100000> (1800) **mac-aging-conversation-timeout** : MAC Conversational Aging time in seconds<NUMBER: 0|60-100000> (300) **mac-move-limit** : MAC move detect limit <NUMBER: 5-500> (20) **duplicate-mac-timer** : Duplicate MAC timer (5) **duplicate-mac-timer-max-count** : Duplicate MAC timer maximum count (3) **mctlink-ip-range** : IP address pool to be used for MCT peering (10.20.20.0/24) **mct-port-channel** : Port-channel interface ID <NUMBER: 1-64> to be used as MCT peer-interface (64) **control-vlan** : VLAN ID <NUMBER: 1-4090> to be used as MCT cluster control VLAN (4090) **control-ve** : VE ID <NUMBER: 1-4090> to be used as MCT cluster control VE (4090) **configure-overlay-gateway** : ConfigureOverlayGateway Enabled Yes/No (Yes) **vni-auto-map** : VTEP VLAN/BD to VNI Mode Auto (Yes/No) (Yes)

5-stage Clos automation

Refer to the following figure.

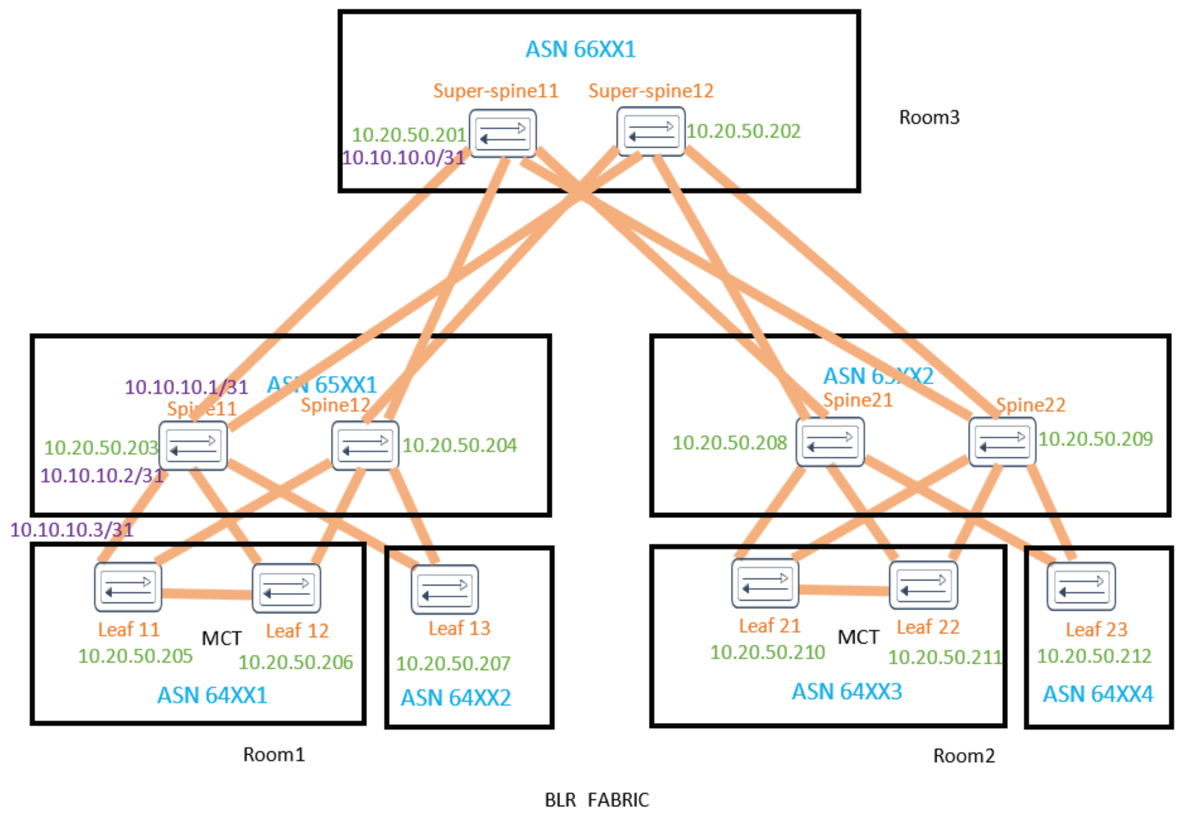


Figure A2. 5-stage Clos automation

Examples:

Non-bulk CLI

```
$ dca fabric create --name BLR_FABRIC --stage 5

$ dca fabric device add --name BLR_FABRIC --ip 10.20.50.201 --role
super-spine --hostname Super-spine11 --pod Room3 --username admin --
password password

$ dca fabric device add --name BLR_FABRIC --ip 10.20.50.202 --role
super-spine --hostname Super-spine12 --pod Room3 --username admin --
password password

$ dca fabric device add --name BLR_FABRIC --ip 10.20.50.203 --role
spine --hostname Spine11 --pod Room1 --username admin --password
password
```

```
$ dca fabric device add --name BLR_FABRIC --ip 10.20.50.204 --role
spine --hostname Spine12 --pod Room1 --username admin --password
password

$ dca fabric device add --name BLR_FABRIC --ip 10.20.50.205 --role
leaf --hostname Leaf11 --leaf-type multi-homed --pod Room1 --username
admin --password password

$ dca fabric device add --name BLR_FABRIC --ip 10.20.50.206 --role
leaf --hostname Leaf12 --leaf-type multi-homed --pod Room1 --username
admin --password password

$ dca fabric device add --name BLR_FABRIC --ip 10.20.50.207 --role
leaf --hostname Leaf13 --leaf-type single-homed --pod Room1 --username
admin --password password

$ dca fabric device add --name BLR_FABRIC --ip 10.20.50.208 --role
spine --hostname Spine21 --pod Room2 --username admin --password
password

$ dca fabric device add --name BLR_FABRIC --ip 10.20.50.209 --role
spine --hostname Spine22 --pod Room2 --username admin --password
password

$ dca fabric device add --name BLR_FABRIC --ip 10.20.50.210 --role
leaf --hostname Leaf21 --leaf-type multi-homed --pod Room2 --username
admin --password password

$ dca fabric device add --name BLR_FABRIC --ip 10.20.50.211 --role
leaf --hostname Leaf22 --leaf-type multi-homed --pod Room2 --username
admin --password password

$ dca fabric device add --name BLR_FABRIC --ip 10.20.50.212 --role
leaf --hostname Leaf23 --leaf-type single-homed --pod Room2 --username
admin --password password

$ dca fabric configure --name BLR_FABRIC
```

Bulk CLI

```
$ dca fabric create --name BLR_FABRIC --stage 5

$ dca fabric device add-bulk --name BLR_FABRIC --leaf
10.20.50.205,10.20.50.206-207 --spine 10.20.50.203-204 --super-spine
10.20.50.201-202 --three-stage-pod Room1 --five-stage-pod Room3

$ dca fabric device add-bulk --name BLR_FABRIC --leaf 10.20.50.210-212
--spine 10.20.50.208-209 --three-stage-pod Room2

$ dca fabric configure --name BLR_FABRIC
```

Multi-Fabric automation

Fabric Service supports the automation of multiple Clos Fabrics. The following shows two disjoint 3-stage Clos networks to be automated by Fabric Service.

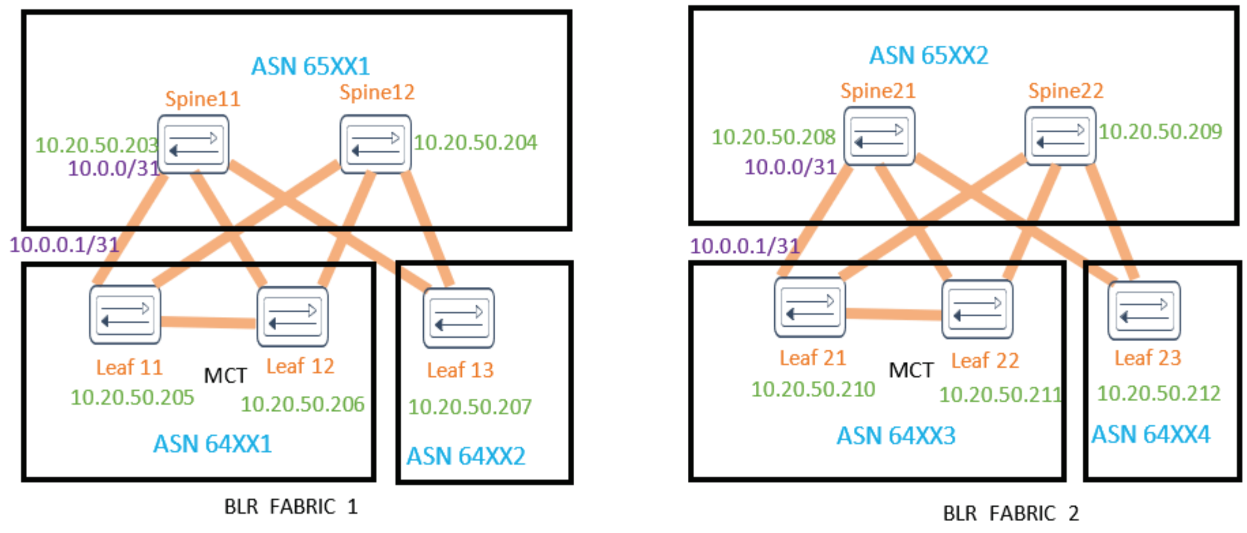


Figure A3. Multi-Fabric automation

Create a Fabric

CLI	**dca fabric create --name <fabric-name> [--stage {3 | 5 } --description *<description>*]**
Behavior	Creates a Fabric.
Field Description	**--name** *string* : Name of the Fabric **--description** *string* : Description of the Fabric **--stage** *int* : Stage of the Fabric (Default = 3)

Example:

```
$ dca fabric create --name BLR_FABRIC_1 --stage 3 --description
BLR_FABRIC_1
```

Delete a Fabric

CLI	**dca fabric delete --name <fabric-name> [--force]**
Behavior	Deletes a Fabric. Deletion of Fabric is not allowed if the Fabric has one or more devices. User must delete all the devices from the Fabric prior to deleting the Fabric. Forced deletion of Fabric removes the devices from Fabric but not from inventory.
Field Description	**--name** *string* : Name of the Fabric **--force** : Forces the deletion of Fabric even if the Fabric has devices

Example:

```
$ dca fabric delete --name BLR_FABRIC_1
```

Clone a Fabric

CLI	**dca fabric clone { --source *<source-fabric-name>* --destination *<destination-fabric-name>* }**
Behavior	Creates a clone of a source Fabric. Clones all the Fabric properties (type, stage, description, Fabric settings), but not the devices.
Field Description	**--source** *string*: Specifies name of the Fabric to be cloned **--destination** *string* : Specifies name of the cloned Fabric

Example:

```
$ dca fabric clone --source BLR_FABRIC_1 --destination
SJ_FABRIC_1
```

Appendix B: Asset Service CLIs

Asset Service exposes the following operations to Fabric Service through CLI and REST endpoints:

- Device registration
- Device deletion
- Device update
- Key-value store
- Persist device configuration
- Execute CLI
- List registered device
- Compare and Replace

NOTE: Device registration operations are combined with Fabric Service CLIs and are not additionally required to provision an IP Fabric.

Device register

CLI	**dca inventory device register --ip *<string>* --username *<string>* --password *<string>***
Behavior	Registers devices to Asset Service. This includes discovery of Assets such as physical interface, logical interfaces, LLDP links, BGP, VRF, Overlay, MCT information.
Field Description	**--ip** *string* Comma separated range of device IP addresses. Example: 1.1.1.1-3,1.1.1.2,2.2.2.2 **--username** *string* : Username to connect to the device **--password** *string* : Password to connect to the device

Example:

```
$ dca inventory device register --ip 10.24.85.74,10.24.85.76,10.24.80.136-137
--username admin --password password
+----+--------------+-----------+-------+-----------------+-----------+---------+--------+
| ID |  IP Address  | Host Name | Model |  Chassis Name   | Firmware  | Status  | Reason |
+----+--------------+-----------+-------+-----------------+-----------+---------+--------+
| 3  | 10.24.80.137 | SLX       | 3000  | BR-SLX9240      | 18s.1.01a | Success |        |
+----+--------------+-----------+-------+-----------------+-----------+---------+--------+
| 1  | 10.24.85.74  | SLX       | 3006  | EN-SLX-9030-48S | 18x.1.00a | Success |        |
+----+--------------+-----------+-------+-----------------+-----------+---------+--------+
| 2  | 10.24.85.76  | SLX       | 3007  | EN-SLX-9030-48T | 18x.1.00a | Success |        |
+----+--------------+-----------+-------+-----------------+-----------+---------+--------+
| 4  | 10.24.80.136 | SLX       | 3000  | BR-SLX9240      | 18s.1.01a | Success |        |
+----+--------------+-----------+-------+-----------------+-----------+---------+--------+
Device Details
--- Time Elapsed: 17.4935791s ---
```

Device delete

CLI	**dca inventory device delete --ip <*string*>**
Behavior	Deletes a device from Asset service, and also sends notification to Fabric Service and other services.
Field Description	**--ip** *string* Comma separated range of device IP addresses. Example: 1.1.1.1-3,1.1.1.2,2.2.2.2 **--fabric** string Fabric name

Example:

```
$ dca inventory device delete --ip 10.24.85.76,10.24.85.74,10.24.80.136-137
+----+--------------+-----------+-------+-----------------+-----------+--------+---------+--------+
| ID |  IP Address  | Host Name | Model |  Chassis Name   | Firmware  | Fabric | Status  | Reason |
+----+--------------+-----------+-------+-----------------+-----------+--------+---------+--------+
| 1  | 10.24.85.74  | SLX       | 3006  | EN-SLX-9030-48S | 18x.1.00a |        | Success |        |
+----+--------------+-----------+-------+-----------------+-----------+--------+---------+--------+
| 2  | 10.24.85.76  | SLX       | 3007  | EN-SLX-9030-48T | 18x.1.00a |        | Success |        |
+----+--------------+-----------+-------+-----------------+-----------+--------+---------+--------+
| 3  | 10.24.80.137 | SLX       | 3000  | BR-SLX9240      | 18s.1.01a |        | Success |        |
+----+--------------+-----------+-------+-----------------+-----------+--------+---------+--------+
| 4  | 10.24.80.136 | SLX       | 3000  | BR-SLX9240      | 18s.1.01a |        | Success |        |
+----+--------------+-----------+-------+-----------------+-----------+--------+---------+--------+
Device Details
--- Time Elapsed: 245.9984ms ---
```

Device update

Device update ensures that the inventory database is in sync with the device. Asset Service acts on the Fabric events and auto update occurs when the device is provisioned or unprovisioned.

The user must manually update the device in some scenarios. In those cases the user has the option to update one device at a time or all devices in a Fabric. Also, single device update can be used to update the device credentials by means of the **--username** and **--password** options.

After a successful device update, Inventory Service sends a notification of the changed event for all the Assets that have been modified.

CLI	**dca inventory device update --ip <*string*> [--username <*string*> --password <*string*>] --fabric <*string*>**
Behavior	Updates Asset information for a given device or all devices in the Fabric. This CLI can be used to update device credentials.
Field Description	**--ip** *string* : IP Address of the device to update Asset details of **--fabric** *string* : Devices from the Fabric to update Asset details of **--username** *string* : Username to connect to the device **--password** *string* : Password to connect to the device

Key-value store

Asset Service provides a key-value (KV) store where the user can store key-value pairs required for integration. The values stored here can be encrypted. DCA uses this KV store to store the device credentials. If the user needs to update the device credentials of an existing Fabric, then the KV store CLIs is use.

Create KV store

CLI	**dca inventory kvstore create --key <*string*> --value <*string*> [--encrypt]**
Behavior	Creates a key-value pair, with option to encrypt the values.
Field Description	**--key** *string* Key name **--value** *string* Value for the key **--encrypt** Specifies encryption

Delete KV store

CLI	**dca inventory kvstore delete --key <*string*>**
Behavior	Deletes a key-value pair.
Field Description	**--key** *string* Key name

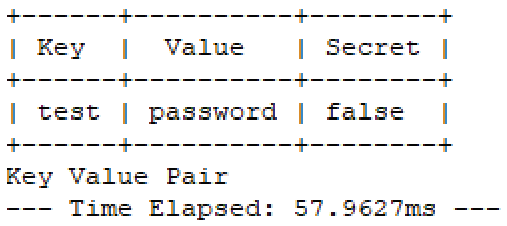
List KV store

CLI	**dca inventory kvstore list [--key *<string>* | --prefix *<string>*] [--decrypt]**
Summary	Displays all key-value pairs, and also filters views based on key, prefix, with option to decode the encrypted value.
Field Description	**--decrypt** : Decrypts the secret fields **--key** *string* : Returns the KV pair matching the key **--prefix** *string* : Retrieves list of KV pairs matching the prefix

Examples

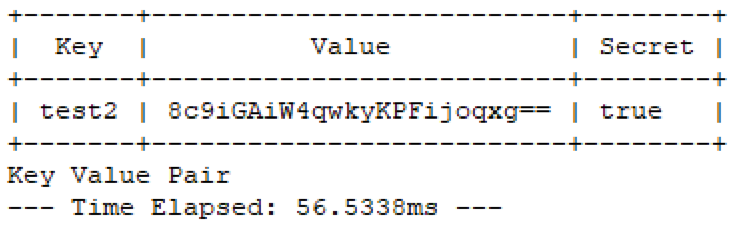
These examples create or update key-value pairs with and without encryption.

```
$ dca inventory kvstore create --key test --value password
```



```
+------+----------+--------+
| Key  |  Value   | Secret |
+------+----------+--------+
| test | password | false  |
+------+----------+--------+
Key Value Pair
--- Time Elapsed: 57.9627ms ---
```

```
$ dca inventory kvstore create --key test2 --value secret --encrypt
```



```
+-------+--------------------------+--------+
|  Key  |          Value           | Secret |
+-------+--------------------------+--------+
| test2 | 8c9iGAiW4qwkyKPFijoqxg== | true   |
+-------+--------------------------+--------+
Key Value Pair
--- Time Elapsed: 56.5338ms ---
```

These examples list key-value pairs.

```
$ dca inventory kvstore list
```

```
+-------------------------------+--------------------------+--------+
|              Key              |          Value           | Secret |
+-------------------------------+--------------------------+--------+
| switch.10.20.50.205.password  | aC6p+gbmOIki6KOQJ6rSDw== | true   |
+-------------------------------+--------------------------+--------+
| switch.10.20.50.205.user      | admin                    | false  |
+-------------------------------+--------------------------+--------+
| switch.10.20.50.212.password  | aC6p+gbmOIki6KOQJ6rSDw== | true   |
+-------------------------------+--------------------------+--------+
| switch.10.20.50.212.user      | admin                    | false  |
+-------------------------------+--------------------------+--------+
| switch.10.20.50.213.password  | aC6p+gbmOIki6KOQJ6rSDw== | true   |
+-------------------------------+--------------------------+--------+
| switch.10.20.50.213.user      | admin                    | false  |
+-------------------------------+--------------------------+--------+
| switch.1.2.2.2.user           | root                     | false  |
+-------------------------------+--------------------------+--------+
| test                          | password                 | false  |
+-------------------------------+--------------------------+--------+
| test2                         | 8c9iGAiW4qwkyKPFijoqxg== | true   |
+-------------------------------+--------------------------+--------+
Keystore Details
--- Time Elapsed: 51.9304ms ---
```

```
$ dca inventory kvstore list --key test
```

```
+------+----------+--------+
| Key  |  Value   | Secret |
+------+----------+--------+
| test | password | false  |
+------+----------+--------+
Keystore Details
--- Time Elapsed: 33.0059ms ---
```

```
$ dca inventory kvstore list --key test2
```

```
+-------+--------------------------+--------+
|  Key  |          Value           | Secret |
+-------+--------------------------+--------+
| test2 | 8c9iGAiW4qwkyKPFijoqxg== | true   |
+-------+--------------------------+--------+
Keystore Details
--- Time Elapsed: 30.6644ms ---
```

```
$ dca inventory kvstore list --prefix test --decrypt

+-------+----------+--------+
|  Key  |  Value   | Secret |
+-------+----------+--------+
| test  | password | false  |
+-------+----------+--------+
| test2 | secret   | true   |
+-------+----------+--------+
Keystore Details
--- Time Elapsed: 62.9851ms ---
```

This example deletes key-value pairs.

```
$ dca inventory kvstore delete --key test

Key test deleted successfully.
--- Time Elapsed: 61.9647ms ---
```

Persist device configuration

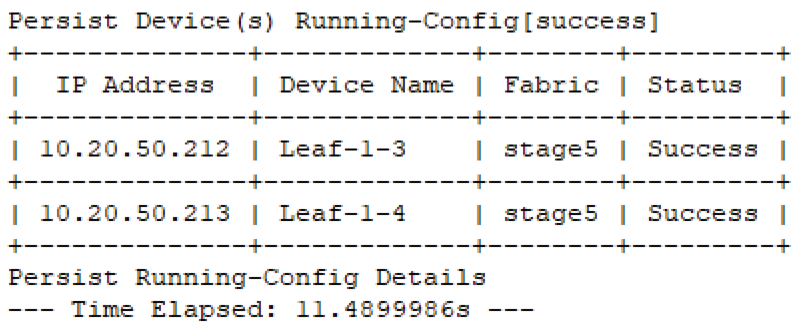
Device configurations configured by Fabric Service and Tenant Service do not automatically persist on the devices. To persist the running configuration on a device, Asset Service provides CLI/REST endpoints.

CLI	**dca inventory device running-config persist [--ip *<list of ips>* | --fabric *<string>*]**
Behavior	Execute CLI on the device.
Field Description	**--ip** *string* : Comma separated list of device IP address/hostnames **--fabric** *string* : Devices from the Fabric

These examples persist configurations.

```
$ dca inventory device running-config persist --ips
10.20.50.212,10.20.50.213

Persist Device(s) Running-Config[success]
+--------------+-------------+--------+---------+
|  IP Address  | Device Name | Fabric | Status  |
+--------------+-------------+--------+---------+
| 10.20.50.212 | Leaf-1-3    | stage5 | Success |
+--------------+-------------+--------+---------+
| 10.20.50.213 | Leaf-1-4    | stage5 | Success |
+--------------+-------------+--------+---------+
Persist Running-Config Details
--- Time Elapsed: 12.2902836s ---
```

```
$ dca inventory device running-config persist --fabric stage5
```



```
Persist Device(s) Running-Config[success]
+--------------+-------------+--------+---------+
|  IP Address  | Device Name | Fabric | Status  |
+--------------+-------------+--------+---------+
| 10.20.50.212 | Leaf-1-3    | stage5 | Success |
+--------------+-------------+--------+---------+
| 10.20.50.213 | Leaf-1-4    | stage5 | Success |
+--------------+-------------+--------+---------+
Persist Running-Config Details
--- Time Elapsed: 11.4899986s ---
```

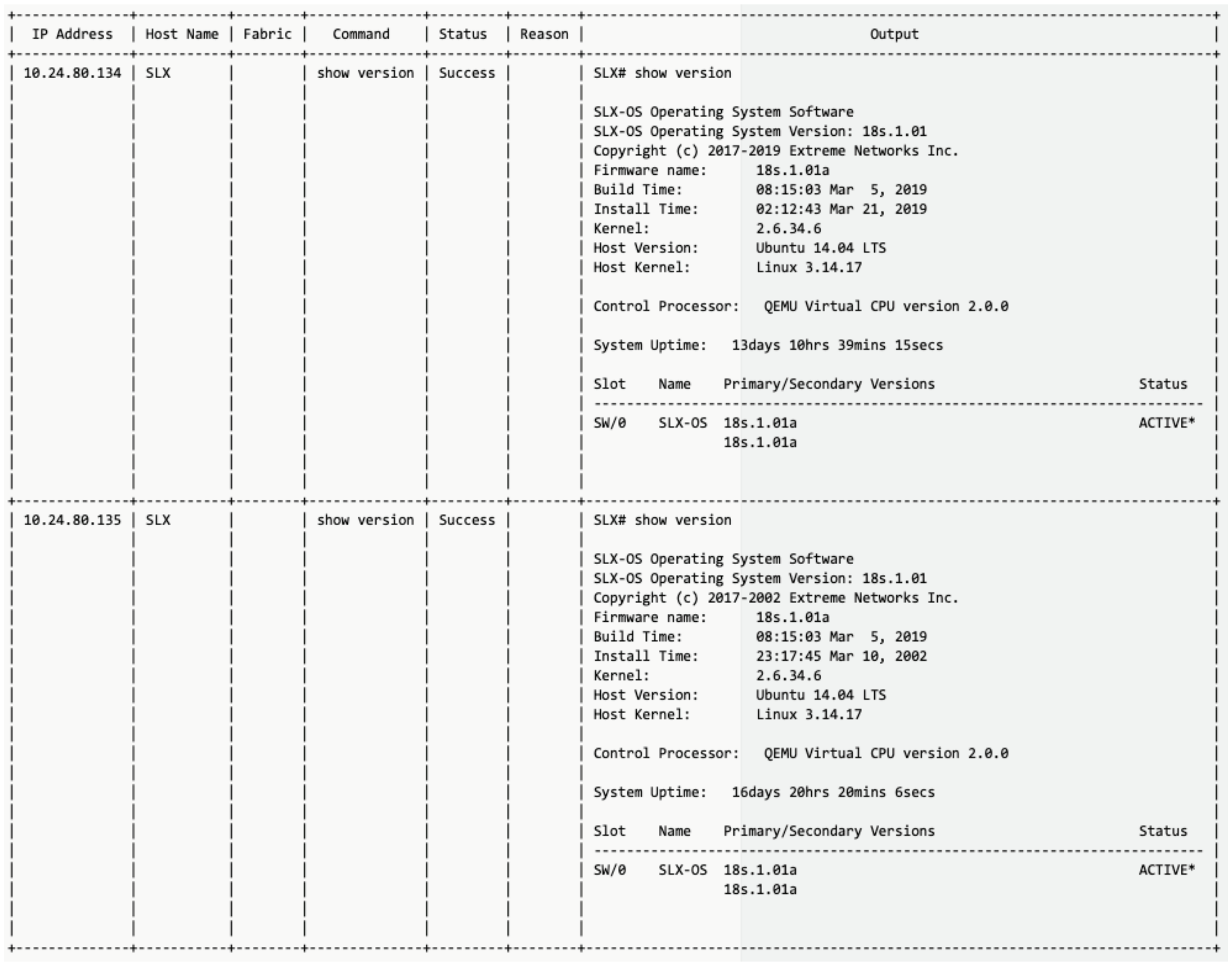
Execute CLI

Certain operations that are not supported via the Fabric and Tenant services can still be accomplished by the execute-cli option. To execute a cli on the devices, the Asset Service provides CLI/REST endpoints.

CLI	**dca inventory device execute-cli [--ip *<list of ips>* | --fabric *<string>*][--command <comma separated string> -–config]**
Behavior	Persists the running configuration on the device to the startup configuration.
Field Description	**--ip** *string* : Comma separated list of device IP address/hostnames **--fabric** *string* : Devices from the Fabric **--command** Comma/Semi-colon separated list of CLI commands to execute on the device(s) **--config** Flag to indicate whether the command is a config command or not.

These examples persist configurations.

```
$ dca inventory device execute-cli --ip 10.24.80.134,10.24.80.135 --
command “show version”
```



```
+--------------+-----------+--------+---------------+---------+--------+----------------------------------------------------------------------------+
| IP Address   | Host Name | Fabric |    Command    | Status  | Reason |                                   Output                                   |
+--------------+-----------+--------+---------------+---------+--------+----------------------------------------------------------------------------+
| 10.24.80.134 | SLX       |        | show version  | Success |        | SLX# show version                                                          |
|              |           |        |               |         |        |                                                                            |
|              |           |        |               |         |        | SLX-OS Operating System Software                                           |
|              |           |        |               |         |        | SLX-OS Operating System Version: 18s.1.01                                  |
|              |           |        |               |         |        | Copyright (c) 2017-2019 Extreme Networks Inc.                              |
|              |           |        |               |         |        | Firmware name:      18s.1.01a                                              |
|              |           |        |               |         |        | Build Time:         08:15:03 Mar  5, 2019                                  |
|              |           |        |               |         |        | Install Time:       02:12:43 Mar 21, 2019                                  |
|              |           |        |               |         |        | Kernel:             2.6.34.6                                               |
|              |           |        |               |         |        | Host Version:       Ubuntu 14.04 LTS                                       |
|              |           |        |               |         |        | Host Kernel:        Linux 3.14.17                                          |
|              |           |        |               |         |        |                                                                            |
|              |           |        |               |         |        | Control Processor:   QEMU Virtual CPU version 2.0.0                        |
|              |           |        |               |         |        |                                                                            |
|              |           |        |               |         |        | System Uptime:   13days 10hrs 39mins 15secs                                |
|              |           |        |               |         |        |                                                                            |
|              |           |        |               |         |        | Slot    Name    Primary/Secondary Versions                         Status  |
|              |           |        |               |         |        | ---------------------------------------------------------------------------|
|              |           |        |               |         |        | SW/0    SLX-OS  18s.1.01a                                          ACTIVE* |
|              |           |        |               |         |        |                 18s.1.01a                                                  |
|              |           |        |               |         |        |                                                                            |
|              |           |        |               |         |        |                                                                            |
+--------------+-----------+--------+---------------+---------+--------+----------------------------------------------------------------------------+
| 10.24.80.135 | SLX       |        | show version  | Success |        | SLX# show version                                                          |
|              |           |        |               |         |        |                                                                            |
|              |           |        |               |         |        | SLX-OS Operating System Software                                           |
|              |           |        |               |         |        | SLX-OS Operating System Version: 18s.1.01                                  |
|              |           |        |               |         |        | Copyright (c) 2017-2002 Extreme Networks Inc.                              |
|              |           |        |               |         |        | Firmware name:      18s.1.01a                                              |
|              |           |        |               |         |        | Build Time:         08:15:03 Mar  5, 2019                                  |
|              |           |        |               |         |        | Install Time:       23:17:45 Mar 10, 2002                                  |
|              |           |        |               |         |        | Kernel:             2.6.34.6                                               |
|              |           |        |               |         |        | Host Version:       Ubuntu 14.04 LTS                                       |
|              |           |        |               |         |        | Host Kernel:        Linux 3.14.17                                          |
|              |           |        |               |         |        |                                                                            |
|              |           |        |               |         |        | Control Processor:   QEMU Virtual CPU version 2.0.0                        |
|              |           |        |               |         |        |                                                                            |
|              |           |        |               |         |        | System Uptime:   16days 20hrs 20mins 6secs                                 |
|              |           |        |               |         |        |                                                                            |
|              |           |        |               |         |        | Slot    Name    Primary/Secondary Versions                         Status  |
|              |           |        |               |         |        | ---------------------------------------------------------------------------|
|              |           |        |               |         |        | SW/0    SLX-OS  18s.1.01a                                          ACTIVE* |
|              |           |        |               |         |        |                 18s.1.01a                                                  |
|              |           |        |               |         |        |                                                                            |
|              |           |        |               |         |        |                                                                            |
+--------------+-----------+--------+---------------+---------+--------+----------------------------------------------------------------------------+
```

List registered devices

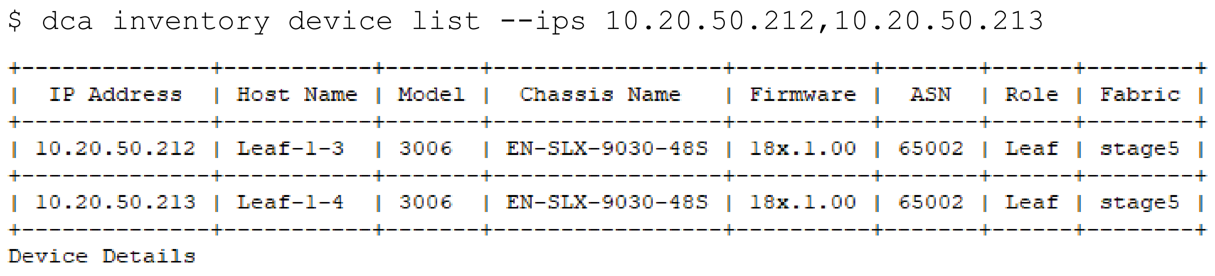
CLI	**dca inventory device list [--orphan | --fabric <*string*> | --role { leaf | spine | super-spine } | --ips <*list of ips*>]**
Behavior	Displays the devices registered to Asset Service. Displays all devices if these are not specified.
Field Description	**--orphan** Lists devices not associated to a Fabric **--fabric** *string* Fabric name **--role** Specifies device role **--ips** *stringArray* Comma-separated device IPs

These examples list inventories.

```
$ dca inventory device list

+--------------+-----------+-------+-----------------+----------+-------+------+--------+
|  IP Address  | Host Name | Model |  Chassis Name   | Firmware |  ASN  | Role | Fabric |
+--------------+-----------+-------+-----------------+----------+-------+------+--------+
| 10.20.50.205 | LEAF-2-1  | 3001  | BR-SLX9140      | 18s.1.01 |       |      |        |
+--------------+-----------+-------+-----------------+----------+-------+------+--------+
| 10.20.50.212 | Leaf-1-3  | 3006  | EN-SLX-9030-48S | 18x.1.00 | 65002 | Leaf | stage5 |
+--------------+-----------+-------+-----------------+----------+-------+------+--------+
| 10.20.50.213 | Leaf-1-4  | 3006  | EN-SLX-9030-48S | 18x.1.00 | 65002 | Leaf | stage5 |
+--------------+-----------+-------+-----------------+----------+-------+------+--------+
Device Details
--- Time Elapsed: 85.9462ms ---
```

```
$ dca inventory device list --orphan

+--------------+-----------+-------+--------------+----------+-----+------+--------+
|  IP Address  | Host Name | Model | Chassis Name | Firmware | ASN | Role | Fabric |
+--------------+-----------+-------+--------------+----------+-----+------+--------+
| 10.20.50.205 | LEAF-2-1  | 3001  | BR-SLX9140   | 18s.1.01 |     |      |        |
+--------------+-----------+-------+--------------+----------+-----+------+--------+
Device Details
--- Time Elapsed: 56.0216ms ---
```

```
$ dca inventory device list --fabric stage5 --role leaf

+--------------+-----------+-------+-----------------+----------+-------+------+--------+
|  IP Address  | Host Name | Model |  Chassis Name   | Firmware |  ASN  | Role | Fabric |
+--------------+-----------+-------+-----------------+----------+-------+------+--------+
| 10.20.50.212 | Leaf-1-3  | 3006  | EN-SLX-9030-48S | 18x.1.00 | 65002 | Leaf | stage5 |
+--------------+-----------+-------+-----------------+----------+-------+------+--------+
| 10.20.50.213 | Leaf-1-4  | 3006  | EN-SLX-9030-48S | 18x.1.00 | 65002 | Leaf | stage5 |
+--------------+-----------+-------+-----------------+----------+-------+------+--------+
Device Details
--- Time Elapsed: 87.9664ms ---
```

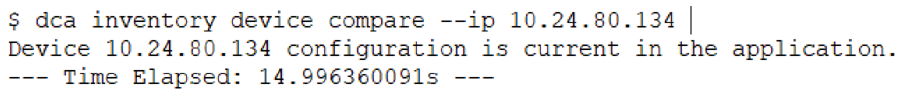


```
$ dca inventory device list --ips 10.20.50.212,10.20.50.213
+--------------+-----------+-------+-----------------+----------+-------+------+--------+
|  IP Address  | Host Name | Model |  Chassis Name   | Firmware |  ASN  | Role | Fabric |
+--------------+-----------+-------+-----------------+----------+-------+------+--------+
| 10.20.50.212 | Leaf-1-3  | 3006  | EN-SLX-9030-48S | 18x.1.00 | 65002 | Leaf | stage5 |
+--------------+-----------+-------+-----------------+----------+-------+------+--------+
| 10.20.50.213 | Leaf-1-4  | 3006  | EN-SLX-9030-48S | 18x.1.00 | 65002 | Leaf | stage5 |
+--------------+-----------+-------+-----------------+----------+-------+------+--------+
Device Details
```

Compare and Replace device

Compare cli is a tool to indicate to the user if the switch configuration has drifted from what the application has stored

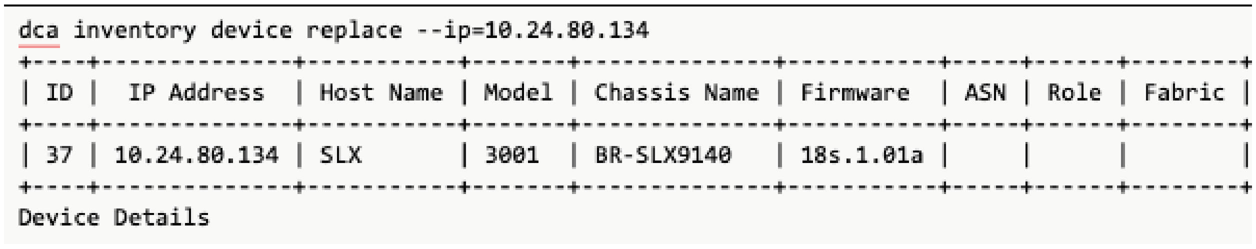
CLI	**dca inventory device compare --ip *<IP Address of the device>***
Behavior	Displays if there are any configuration drifts from what the Application has saved or whether the configuration on the device is current
Field Description	**--ip** *string* Device IP for which we want to check the current configuration



```
$ dca inventory device compare --ip 10.24.80.134
Device 10.24.80.134 configuration is current in the application.
--- Time Elapsed: 14.996360091s ---
```

Replace CLI is meant to be used in case of RMA. This will help the users replace the device from the tool, if the fabric and tenant configuration on the new device are the same as the device its replacing

CLI	**dca inventory device replace --ip *<IP Address of the device>*]**
Behavior	Allows users to replace the Device if the configuration in the Fabric and Tenant service match what the application has stored.
Field Description	**--ip** *string* IP of the Device to be replaced



```
dca inventory device replace --ip=10.24.80.134
+----+--------------+-----------+-------+--------------+-----------+-----+------+--------+
| ID |  IP Address  | Host Name | Model | Chassis Name | Firmware  | ASN | Role | Fabric |
+----+--------------+-----------+-------+--------------+-----------+-----+------+--------+
| 37 | 10.24.80.134 | SLX       | 3001  | BR-SLX9140   | 18s.1.01a |     |      |        |
+----+--------------+-----------+-------+--------------+-----------+-----+------+--------+
Device Details
```

Appendix C: Tenant Service CLIs

This appendix presents the CLIs used to execute the implementation of various topologies.

> **NOTE**: The samples provided here are using WORKFLOW. The same functionality can be achieved by using the Advanced CLIs.

Automating L2 and L3 extension between racks

This use case addresses the L2 and L3 extension of networks across leaf nodes in an IP Fabric

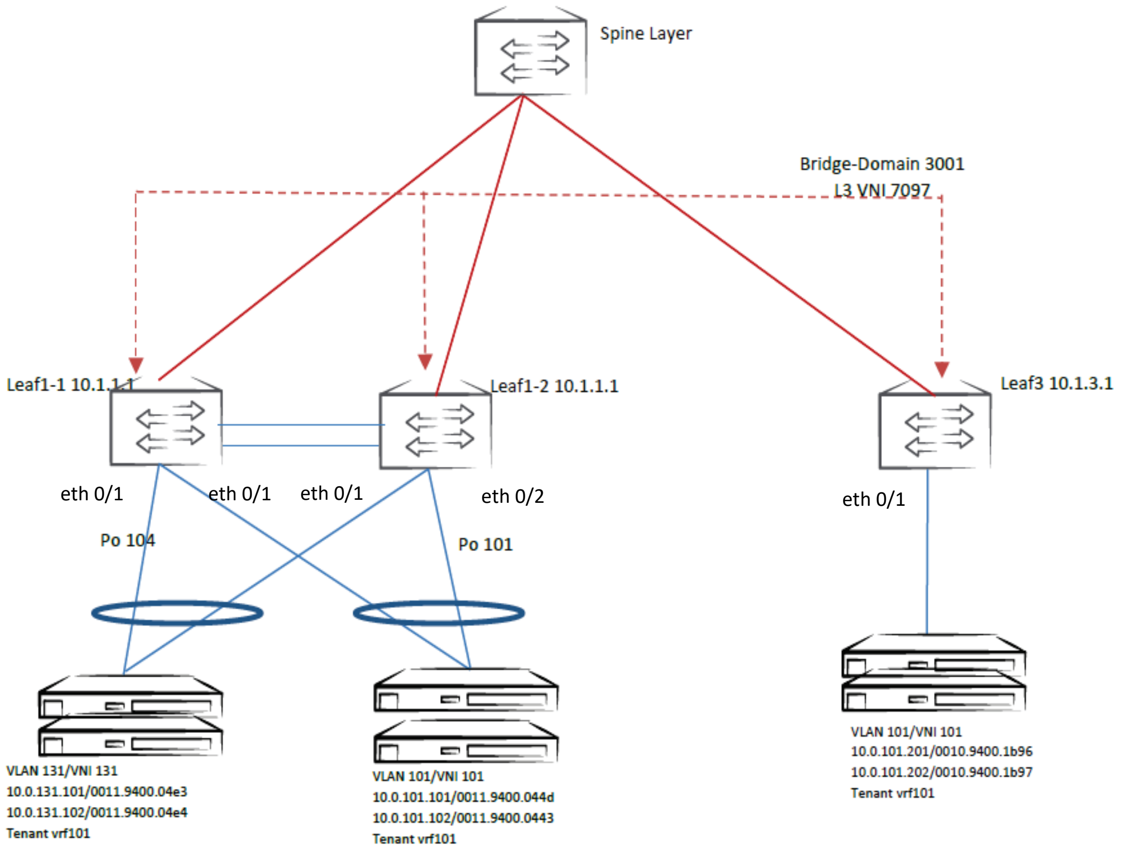


Figure A4. L2 and L3 extension between racks

Create a VRF

Default values are shown in parentheses ( ). The VRF RD value is auto-generated based on the router-id configured on the device. The RT can be either provided as input or auto-generated if not provided).

CLI	**dca tenant vrf create --name *<vrf-name>* [--rt-type { import | export | both } --rt *<rt >***
Field Description	**--name** *string* : Name of the vrf. **--rt-type** string : Route Target VPN Community. Valid values are **both** | **import** |**export**. (**both**) **--rt** *string* : A unique number for setting for forming Route Target and Route Distinguisher. Accepted format is nn:nn. --**tenant** string Name of the tenant

Example:

```
dca tenant vrf create --name --vrf vrf101
```

Create Tenant network (using workflow)

Default values are shown in parentheses ( ).

CLI	**dca *tenant* workflow network create --name *<network-name>***
Behavior	Creates port-channels and the channel groups on the interfaces. Creates EPGs with the port-channel and the Advanced ports. Creates the Tenant network.
Field Description	**--name** string **: Name of the Tenant network** **--tenant** string : Name of the tenant (default "default-tenant") **--po-name** stringArray : Name of the port-channel **--po-speed** stringArray : Speed for the port-channel and its member ports. <**100Mbps**| **1Gbps** | **10Gbps** | **25Gbps** | **40Gbps** | **100Gbps**> **--po-ports** stringArray : Comma-separated list of ports forming a port-channel. Supported format is < *ipaddress* [*ports*] >. Ports can be single or comma-separated ports or a range of ports. **--po-ctag** stringArray : Ctag value for port-channels. <**1-4090**> --**ports** stringArray : Comma-separated list of ports. Supported format < *ipaddress* [*ports*]>. Ports can be single or comma-separated ports or a range of ports. **--port-ctag** stringArray : Ctag value for ports. --**ctag** string : Ctag appearing on all the ports and port-channels. --**mode** string : Configures switchport mode on the interfaces. < **trunk** | **access**| **trunk_no_default_active** >(**trunk**) --**enable**-**bd** : Enables bridge domain if the option is provided. --**enable-ept** : Enables endpoint tracking on the interfaces if the option is provided. --**vrf** string : Name of the VRF of which this network is a part. --**anycast-ip** string : Configures anycast IPv4 address on the interface Ve.

Example:

```
$dca tenant workflow network create --name network131 --po-name
po131 --po-speed 10Gbps --po-ports Leaf-1-ip[0/1], Leaf-2-ip[0/1]
--ctag 131 --enable-bd --vrf vrf101 --anycast-ip 10.0.131.254/22

$ dca tenant workflow network create --name network101 --po-name
po101 --po-speed 10Gbps --po-ports Leaf-1-ip[0/2], Leaf-2-ip[0/2]
--ports Leaf-3-ip[0/1] --ctag 101 --enable-bd --vrf vrf101
--anycast-ip 10.0.101.254/22
```

Examples: (supported port formats)

```
$ dca tenant workflow network create --name network101 --po-name
po101 --po-speed 10Gbps --po-ports Leaf-1-ip[0/2-10], Leaf-2-
ip[0/2-10] --ports Leaf-3-ip[0/1-10] --ctag 101 --enable-bd --vrf
vrf101 --anycast-ip 10.0.101.254/22

$ dca tenant workflow network create --name network101 --po-name
po101 --po-speed 10Gbps --po-ports Leaf-1-ip[0/2,0/3,0/4], Leaf-2-
ip[0/2,0/3-4] --ports Leaf-3-ip[0/1-2,0/3] --ctag 101 --enable-bd
--vrf vrf101 --anycast-ip 10.0.101.254/22
```

NOTE: To turn on more features on port-channel, EPGs, and Tenant networks, Advanced CLIs must be used.

Tenant network creation goes through the following stages before completion:

- Validation of the resources allocated to the Tenant network.
- Allocation of free resources such as BD, IRB VE , MCT client ID , VRF RD&RT.
- Pushing the configuration to the SLX devices.
- If the configuration is successful on all the devices, the Tenant network is moved to "READY" state.
- Any device-level and port-level failures are marked as "ERROR" state.

Automating VLAN scoping at the ToR level

This use case addresses how multiple CTAGs can be mapped to a bridge domain at the ToR level.

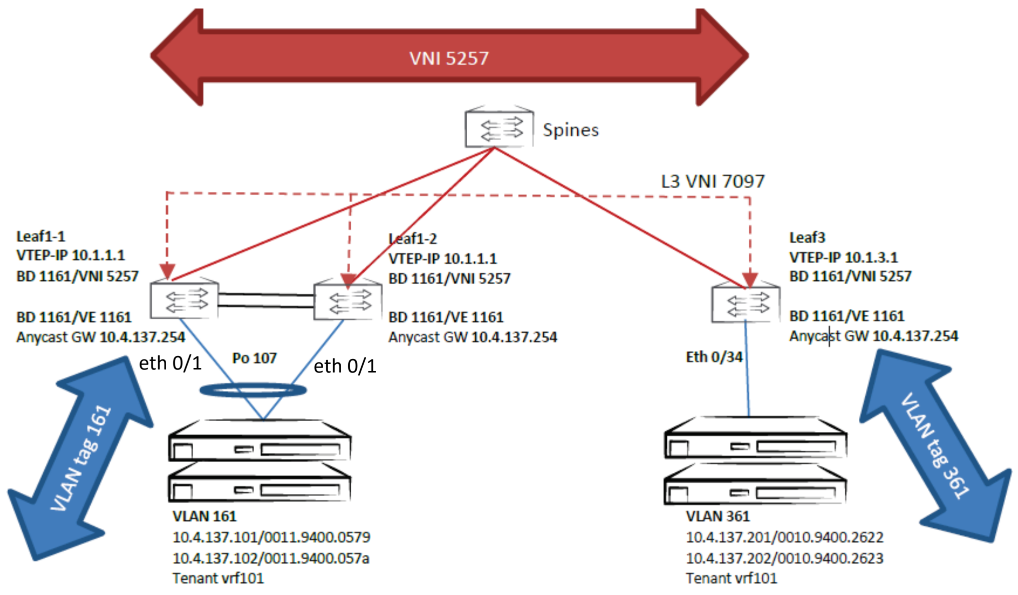


Figure A4. VLAN scoping at ToR

Example:

```
$ dca tenant vrf create --name vrf101

$ dca tenant workflow network create --name netToR --po-name po107
--po-speed 10Gbps --po-ports Leaf-1-ip[0/1], Leaf-2-ip[0/1] --po-
ctag 161 --ports Leaf-3-ip[0/34] --ctag 361  --vrf vrf101
--anycast-ip 10.4.137.254/22  --enable-bd
```

Automating VLAN scoping at the port level within a ToR

This use case addresses how multiple CTAGs can be mapped to a bridge-domain at the port level within a ToR level.

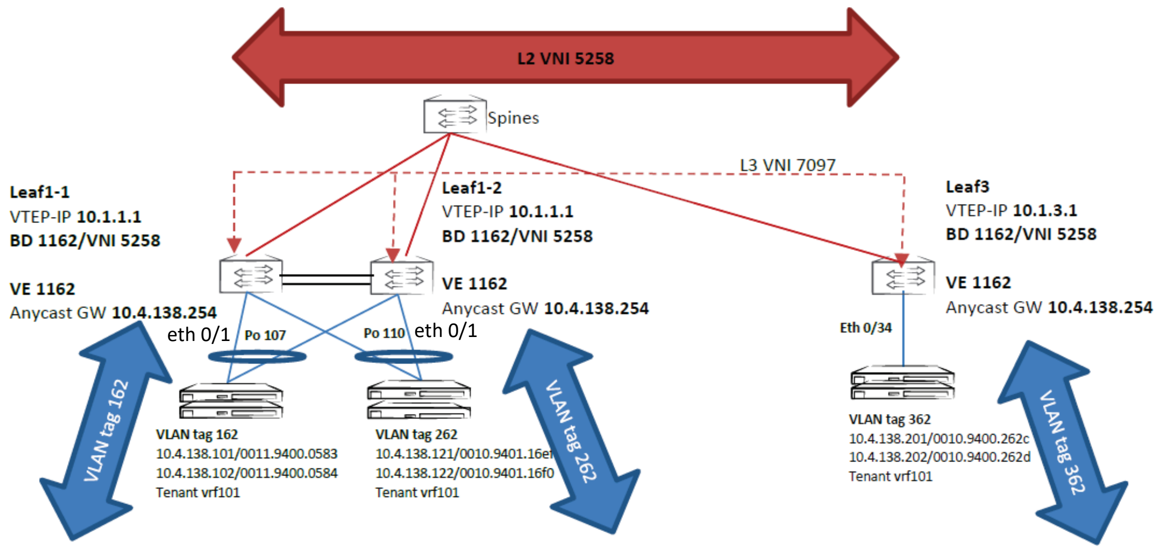


Figure A4. VLAN scoping at the port level with a ToR

Example:

```
$ dca tenant vrf create --name vrf101

$ dca tenant workflow network create --name netPortToR --po-name
po162 --po-speed 10Gbps --po-ports Leaf-1-ip[0/1], Leaf-2-ip[0/1]
--po-ctag 162 --po-name po262 --po-speed 10Gbps --po-ports Leaf-1-
ip[0/2], Leaf-2-ip[0/2] --po-ctag 262 --ports Leaf-3-ip[0/34]
--ctag 362  --vrf vrf101 --anycast-ip 10.4.138.254/22  --enable-bd
```

Update operations

All the update operations are supported only through the Advanced CLIs

Update Tenant network

Default values are shown in parentheses ( ).

CLI	**dca tenant network update --name *<network-name>***
Behavior	Based on the operation type, the delta L2/L3 configurations will be added or removed from the devices
Field Description	**--name** string **:** Name of the Tenant network. **--tenant string : tenant name** **--op-code** string : Update operation type to be performed. < **epg_add** | **epg_delete** | **router_add | router_delete**> **--epg** strings : Comma-separated EPG names to be attached to the network. **--vrf** string : Name of the VRF. --**anycast-ip** string : Configures anycast IPv4 address on the interface Ve.

- Add a new EPG to the existing Tenant network:

```
$ dca tenant network update --name netPortToR --op-code epg_add
--epg epg399
```

- Delete an existing EPG from the Tenant network:

```
$ dca tenant network update --name netPortToR --op-code
epg_delete --epg epg300
```

- Update an existing L2 Tenant network to L3 Tenant network:

```
$ dca tenant network update --name netPortToR --op-code
router_add --vrf vrf101 --anycast-ip 10.4.138.254/22
```

Update endpoint group

Default values are shown in parentheses ( ).

CLI	**dca tenant epg update --name *<epg-name>***
Behavior	Add or delete ports to the existing EPG. If the EPG is part of any Tenant network, based on the op-code type, the delta configurations are added or deleted from the devices.
Field Description	**--name** string **:** Name of the end point group. **--tenant string :tenant name** **--op-code** string : Add or delete operation on the ports. < **port_add** | **port_delete | po_add | po_delete** > **--po** stringArray : List of port channels on which tenant network will be configured. Example: po1 or po1, po2 **--port** stringArray : List of physical ports of device on which Tenant network will be configured. **--ept-status** : Enable or disable endpoint tracking on the EPG. < **enable** | **disable** >.**(disable)**

	--force	: Force delete the configurations from devices

- Add a new port to the existing EPG:

```
$ dca tenant epg update --name epg-101 --op-code port_add --port
Leaf-3-ip[0/10]
```

- Delete an existing port from an existing EPG:

```
$ dca tenant epg update --name epg-101 --op-code port_delete
--port Leaf-3-ip[0/2]
```

Update Port-channel

Default values are shown in parentheses ( ).

CLI	**dca tenant po update --name *<portchannel-name>***
Behavior	Add or delete ports to the existing port channel group. Based on the op-code type, the delta configurations will be added or deleted from the interfaces.
Field Description	**--name** string **:** Name of the port channel **--tenant string** **:**tenant name **--op-code** string : Add or Delete the ports from the port channel < add|delete> --**port** stringArray :Device ip along with ethernet port details

- Add a new port to the existing EPG:

```
$ dca tenant po update --name po-101 --op-code add --port Leaf-1-
ip[0/3]
```

- Delete an existing port from an existing EPG:

```
$ dca tenant po update --name po-101 --op-code delete --port
Leaf-3-ip[0/1]
```

Update Asset

Default values are shown in parentheses ( ).

CLI	**dca tenant asset update --name *<asset-name>***
Behavior	Add or delete ports to the existing asset group. Based on the op-code type, the asset ports are added/deleted from the existing asset. If **–force** option is provided along with op-code **delete**, the port is deleted from all the epgs/pos/tenant networks.
Field Description	**--name** string Name of the Asset **--port** stringArray List of physical ports of devices which will be reserved for the asset. Example SW1_IP[0/1],SW2_IP[0/5] **--op-code** string Operation code. Valid values are add|delete. --force Force the Update on Asset if the option is provided

- Add a new port to the existing Asset:

```
$ dca tenant asset update --name Asset-Group-1 --op-code add
--port Leaf-1-ip[0/33]
```

- Delete an existing port from an existing Asset:

```
$ dca tenant asset update --name Asset-Group-1 --op-code delete
--port Leaf-3-ip[0/11]
```

Update Tenant

Default values are shown in parentheses ( ).

CLI	**dca tenant update --name *<tenant-name>***
Behavior	Attach or detach an asset from tenant by providing op-codes \`asset_add/asset_delete\`. Update the vni pool that the tenant owns using the option \`vni_update\`. If –force option is provided with \`asset_delete\` any attached networks/pos/epgs to the tenant are deleted.
Field Description	**--name** string Name of the tenant **--l2-vni-range string** Range of L2 Virtual Network Identifiers(VNI) reserved for tenant.Valid values are <1-16777215>. **--l3-vni-range string** Range of L3 Virtual Network Identifiers(VNI) reserved for tenant.Valid values are <1-16777215> **--l2-vni-count** string Total number of L2 Virtual Network Identifiers(VNI) reserved for tenant.Valid values are from <1> to <16777215> **--l3-vni-count** string Total number of L3 Virtual Network Identifiers(VNI)s reserved for tenant.Valid values are from <1> to <16777215> **--op-code** string Operation code. Valid values are asset_add|asset_delete|vni_update. **--asset** string Asset name reserved for this tenant. **--port** stringArray List of physical ports of devices which will be reserved for the asset. Example SW1_IP[0/1],SW2_IP[0/5] **--force** Force the asset deletion on the Tenant if the option is provided

- Attach a new asset to the existing Tenant:

```
 $ dca tenant update --name Tenant-Sales –asset Asset-Group-2 --
op-code asset_add
```

- Detach an asset from an existing Asset:

```
 $ dca tenant asset update --name Tenant-Sales ---Asset-Group-2 --
op-code delete
```

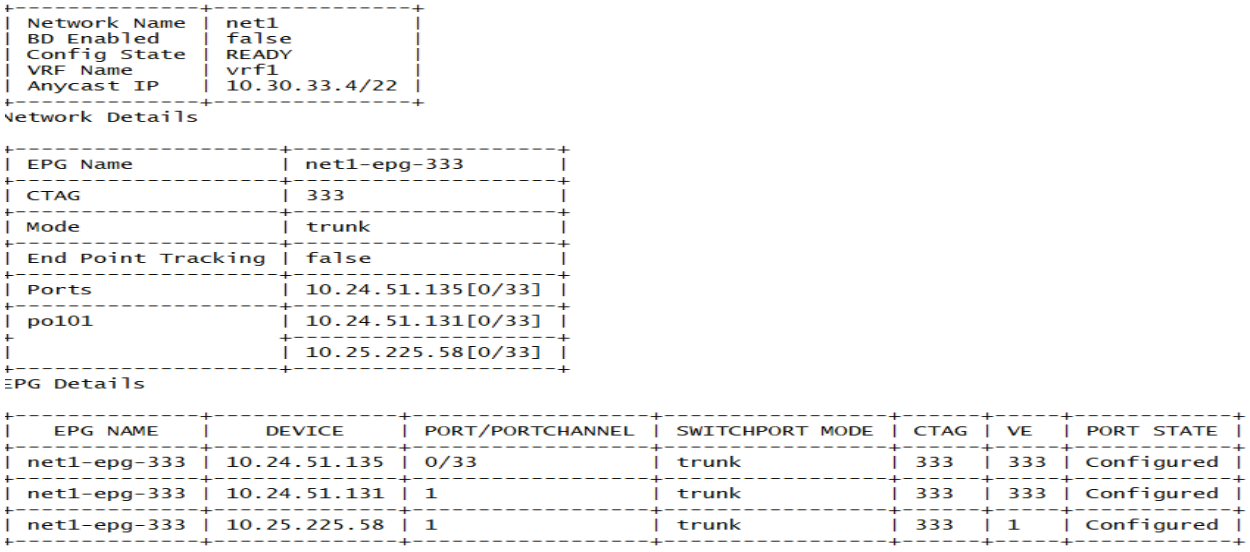
Get operations

Get Tenant network (workflow CLI)

CLI	**dca tenant workflow network show**
Behavior	Displays the summary of all the Tenant networks when --**name** option is not provided. Displays the summary of a given Tenant network when --**name** and **--detailed** options are provided.
Field Description	**--name** string **:** Name of the Tenant network. **--detailed** **:** Displays the Tenant network details such as EPGs, network properties, and port-level configurations **--tenant string** :tenant name **--all** : Show Networks for all Tenants

Example:

```
$ dca tenant workflow network show --name net1 --detailed
```



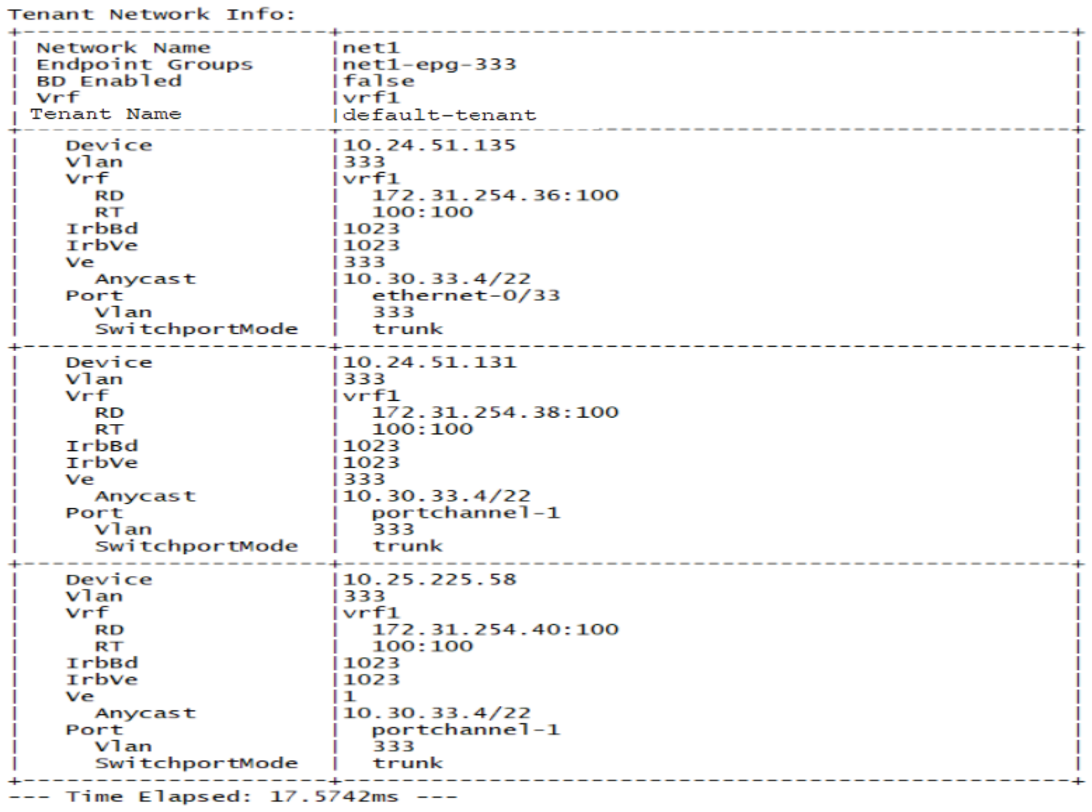
```
+--------------+---------------+
| Network Name | net1          |
| BD Enabled   | false         |
| Config State | READY         |
| VRF Name     | vrf1          |
| Anycast IP   | 10.30.33.4/22 |
+--------------+---------------+
Network Details

+---------------------+--------------------+
| EPG Name            | net1-epg-333       |
+---------------------+--------------------+
| CTAG                | 333                |
+---------------------+--------------------+
| Mode                | trunk              |
+---------------------+--------------------+
| End Point Tracking  | false              |
+---------------------+--------------------+
| Ports               | 10.24.51.135[0/33] |
+---------------------+--------------------+
| po101               | 10.24.51.131[0/33] |
+                     +--------------------+
|                     | 10.25.225.58[0/33] |
+---------------------+--------------------+
EPG Details

+--------------+--------------+-------------------+------------------+------+-----+-------------+
|   EPG NAME   |    DEVICE    | PORT/PORTCHANNEL  | SWITCHPORT MODE  | CTAG | VE  | PORT STATE  |
+--------------+--------------+-------------------+------------------+------+-----+-------------+
| net1-epg-333 | 10.24.51.135 | 0/33              | trunk            | 333  | 333 | Configured  |
+--------------+--------------+-------------------+------------------+------+-----+-------------+
| net1-epg-333 | 10.24.51.131 | 1                 | trunk            | 333  | 333 | Configured  |
+--------------+--------------+-------------------+------------------+------+-----+-------------+
| net1-epg-333 | 10.25.225.58 | 1                 | trunk            | 333  | 1   | Configured  |
+--------------+--------------+-------------------+------------------+------+-----+-------------+
```

Get Tenant network (Advanced CLI)

CLI	**dca tenant network show**
Behavior	Displays the summary of all the Tenant networks when --**all** option is provided. Displays the summary of Tenant network when --**name** and **--config** options are provided owned by default tenant. If –tenant is provided, networks owned by that tenant will be shown.
Field Description	**--name** string : Name of the Tenant network **--config** **:** Displays the Tenant network details like EPGs, network properties, and port-level configurations. **--all** **: Show Networks for all Tenants** **--tenant string** **:tenant name**

Example:

```
$ dca tenant network show --name net1 --config
```

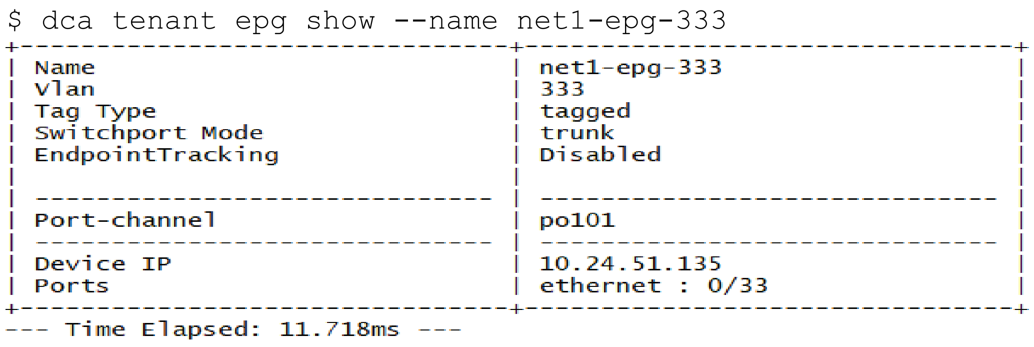


```
Tenant Network Info:
+------------------------+------------------------------------------------------+
| Network Name           |net1                                                  |
| Endpoint Groups        |net1-epg-333                                          |
| BD Enabled             |false                                                 |
| Vrf                    |vrf1                                                  |
| Tenant Name            |default-tenant                                        |
+------------------------+------------------------------------------------------+
|    Device              |10.24.51.135                                          |
|    Vlan                |333                                                   |
|    Vrf                 |vrf1                                                  |
|      RD                |  172.31.254.36:100                                   |
|      RT                |  100:100                                             |
|    IrbBd               |1023                                                  |
|    IrbVe               |1023                                                  |
|    Ve                  |333                                                   |
|      Anycast           |10.30.33.4/22                                         |
|    Port                |  ethernet-0/33                                       |
|      Vlan              |  333                                                 |
|      SwitchportMode    |  trunk                                               |
+------------------------+------------------------------------------------------+
|    Device              |10.24.51.131                                          |
|    Vlan                |333                                                   |
|    Vrf                 |vrf1                                                  |
|      RD                |  172.31.254.38:100                                   |
|      RT                |  100:100                                             |
|    IrbBd               |1023                                                  |
|    IrbVe               |1023                                                  |
|    Ve                  |333                                                   |
|      Anycast           |10.30.33.4/22                                         |
|    Port                |  portchannel-1                                       |
|      Vlan              |  333                                                 |
|      SwitchportMode    |  trunk                                               |
+------------------------+------------------------------------------------------+
|    Device              |10.25.225.58                                          |
|    Vlan                |333                                                   |
|    Vrf                 |vrf1                                                  |
|      RD                |  172.31.254.40:100                                   |
|      RT                |  100:100                                             |
|    IrbBd               |1023                                                  |
|    IrbVe               |1023                                                  |
|    Ve                  |1                                                     |
|      Anycast           |10.30.33.4/22                                         |
|    Port                |  portchannel-1                                       |
|      Vlan              |  333                                                 |
|      SwitchportMode    |  trunk                                               |
+------------------------+------------------------------------------------------+
--- Time Elapsed: 17.5742ms ---
```

Get endpoint group

CLI	dca tenant epg show
Behavior	Displays the summary of all the EPGs when --**all** option is provided. Displays the summary of a given end point group when --**name** option is provided along with –tenant option.
Field Description	--**name** string : Name of the EPG. --**all** : Show EPGs for all Tenants **--tenant string** : tenant name

Example:

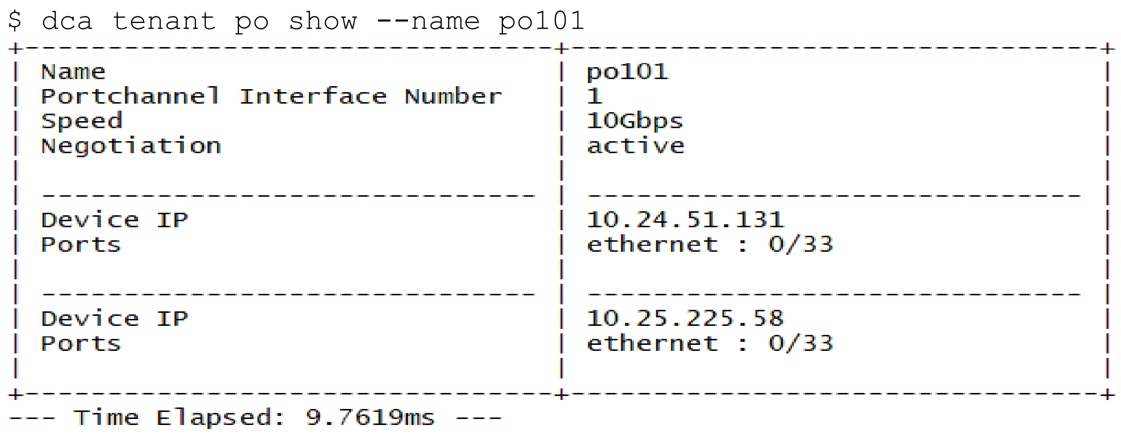


```
$ dca tenant epg show --name net1-epg-333
+--------------------------------+--------------------------------+
| Name                           | net1-epg-333                   |
| Vlan                           | 333                            |
| Tag Type                       | tagged                         |
| Switchport Mode                | trunk                          |
| EndpointTracking               | Disabled                       |
|                                |                                |
| ------------------------------ | ------------------------------ |
| Port-channel                   | po101                          |
| ------------------------------ | ------------------------------ |
| Device IP                      | 10.24.51.135                   |
| Ports                          | ethernet : 0/33                |
+--------------------------------+--------------------------------+
--- Time Elapsed: 11.718ms ---
```

Get port-channel group

CLI	dca Tenant po show
Behavior	Displays the summary of all port-channels when the --**all** option is provided. Displays the summary of a given port-channel group when the --**name** option is provided along with –tenant option.
Field Description	--**name** string : Name of the port-channel. --**all** : Show port channels for all Tenants **--tenant string** : tenant name

Example:



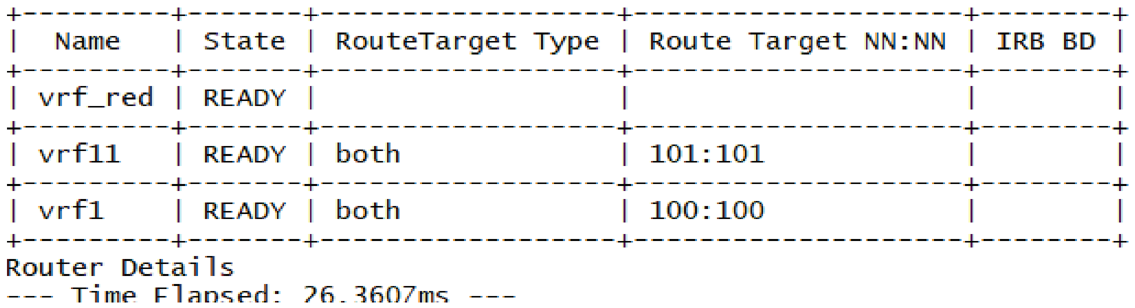
```
$ dca tenant po show --name po101
+--------------------------------+--------------------------------+
| Name                           | po101                          |
| Portchannel Interface Number   | 1                              |
| Speed                          | 10Gbps                         |
| Negotiation                    | active                         |
|                                |                                |
| ------------------------------ | ------------------------------ |
| Device IP                      | 10.24.51.131                   |
| Ports                          | ethernet : 0/33                |
|                                |                                |
| ------------------------------ | ------------------------------ |
| Device IP                      | 10.25.225.58                   |
| Ports                          | ethernet : 0/33                |
|                                |                                |
+--------------------------------+--------------------------------+
--- Time Elapsed: 9.7619ms ---
```

Get VRF

CLI	**dca tenant vrf show**
Behavior	Displays the summary of all the VRFs.
Field Description	**--all** **:** Show vrfs for all Tenants **--tenant string** **:** Tenant name

Example:

```
$ dca tenant vrf show
```



```
+----------+-------+------------------+--------------------+--------+
|  Name    | State | RouteTarget Type | Route Target NN:NN | IRB BD |
+----------+-------+------------------+--------------------+--------+
| vrf_red  | READY |                  |                    |        |
+----------+-------+------------------+--------------------+--------+
| vrf11    | READY | both             | 101:101            |        |
+----------+-------+------------------+--------------------+--------+
| vrf1     | READY | both             | 100:100            |        |
+----------+-------+------------------+--------------------+--------+
Router Details
--- Time Elapsed: 26.3607ms ---
```

Get Tenant

CLI	**dca tenant show**
Behavior	Displays the summary of all the tenants.
Field Description	**--name** string **:** Name of the Tenant.

Get Asset

CLI	**dca tenant asset show**
Behavior	Displays the summary of all the assets
Field Description	**--name** string **:** Name of the Asset.

Delete operations

Delete Tenant network (workflow CLI)

CLI	**dca tenant workflow network delete**
Behavior	Deletes the Tenant network, including the configurations from the device, associated EPGs, and the port-channels if--**name** is provided. Deletes the Tenant network, including the configurations from the device if --**name** and **--force** options are provided. (Ignores any device errors while deleting the configurations from the devices)
Field Description	**--name** string **:** Comma-separated list of Tenant network names. **--force** **:** Force delete the configurations from devices. **--tenant** string : Name of the tenant (default "default-tenant")

Example:

```
$ dca tenant workflow network delete --name net1
```

Delete Tenant network (Advanced CLI)

CLI	**dca tenant network delete**
Behavior	Deletes the Tenant network, including the configurations from the device if the --**name** option is provided. Associated EPGs and port-channels will not be deleted. Deletes the Tenant network, including the configurations from the device if --**name** and --**force** options are provided. (Ignores any device errors while deleting the configurations from the devices)
Field Description	**--name** string **:** Name of the Tenant network. **--force** **:** Force delete the configurations from devices. **--tenant** string **:**tenant name

Example:

```
$ dca tenant network delete --name net1
```

Delete end point group

CLI	**dca tenant epg delete**
Behavior	Delete an EPG and its Tenant network configurations from the device if --**name** and **--force** options are provided. Delete EPG only if it is not attached to any Tenant network if --**name** is provided.
Field Description	**--name** string **:** Name of the EPG **--force** **:** Force delete the EPGs and its associated Tenant networks. **--tenant** string : Tenant Name

Example:

```
$ dca tenant epg delete --name net1-epg-333
```

Delete port-channel

CLI	**dca tenant po delete**
Behavior	Delete a port-channel and its Tenant network configurations from the device (if the port-channel is attached to any EPG) if --**name** and--**force** options are provided. Delete a port-channel only if it is not attached to any Tenant network if --**name** is provided.
Field Description	**--name** string **:** Name of the port channel. **--force** **:** Force delete the port-channel and its associated Tenant networks. **--tenant** string : Tenant Name

Example:

```
$ dca tenant po delete --name po11
```

Delete VRF

CLI	**dca tenant vrf delete**
Behavior	Delete a VRF only if it is not attached to any Tenant network if--**name** is provided.
Field Description	**--name** string **:** Name of the VRF. **--tenant** string :Tenant Name

Example:

```
$ dca tenant vrf delete --name vrf101
```

Delete Asset

CLI	**dca tenant asset delete**
Behavior	Delete Asset will delete the asset from the database. Delete operation with "force" option will delete all the networks, port-channels and endpoint groups from the database and device configurations.
Field Description	**--name** string : Name of the asset. **--force** : Force delete the asset and its associated Tenant networks.

Delete Tenant

CLI	**dca tenant delete**
Behavior	Delete Tenant will delete the tenant from the database. Delete operation with "force" option will delete all the networks, port-channels and endpoint groups from the database and device configurations.
Field Description	**--name** string : Name of the tenant. **--force** : Force delete the tenant and its associated Tenant networks.

Bulk operations

Bulk creation or deletion of tenant networks on a collection of physical/port channel interfaces can be achieved by using the tenant network workflow. The number of networks created is based on the ctag range provided.

NOTE: Bulk creation/deletion is supported only for L2 networks

Bulk create

CLI	**dca tenant workflow network bulk-create**
Behavior	Creates multiple tenant networks for the given ctag range.
Field Description	**--net-prefix** string **:** Prefix of the network **--tenant** string :Tenant Name **--po-name** stringArray **:** Name of the port-channel **--po-speed** stringArray **:** Speed for the port-channel and its member ports. **<100Mbps|1Gbps|10Gbps|25Gbps|40Gbps|100Gbps>** **--po-ports** stringArray **:** Comma-separated list of ports forming a port-channel **--ports** stringArray **:** Comma-separated list of physical ports **--ctags** string **:** Comma-separated Ctag values appearing on all the ports and port-channels **--mode** string **:** Configures switchport mode on the interfaces. Valid values are **trunk|access|trunk-no-default-native.** (default is "trunk") **--enable-ept** **:** Enable endpoint tracking

Bulk delete

CLI	**dca tenant workflow network bulk-delete**
Behavior	Deletes the Tenant network, including the configurations from the device, associated EPGs, and the port-channels if --**net-prefix string** and **ctags** are provided. Deletes the Tenant network, including the configurations from the device if -- **net-prefi, ctags**, and **--force** options are provided (ignores any device errors while deleting the configurations from the devices).
Field Description	**--net-prefix string:** Prefix of the network **--ctags string :** Comma-separated Ctag values appearing on all the ports and port-channels **−−force :** Force the deletion on the Tenant network if the option is provided

Example:

```
$ dca tenant workflow network bulk-delete --net-prefix N1  --
ctags 100-105
```

The above command does the following:

- Deletes all the networks starting with the network prefix provided and the underlying EPGs and port-channels

Appendix D: Database Backup and Restore

Overview

This section provides the steps for customers/developers to restore the DCApp services, such as goInventory-service, goFabric-service, and goTenant-service, in case the DCApp database becomes corrupted or the user wants to move back to the previously saved configurations. This is a two-step process:

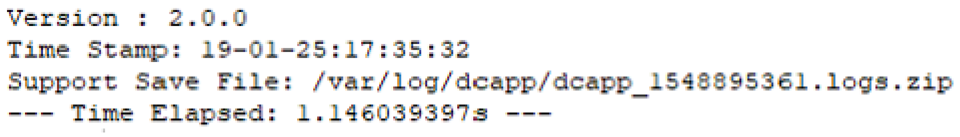
1. Backup the database
2. Restore the database

Backup the Database

All three Inventory, Fabric, and Tenant Service databases are backed up as part of supportSave, so users can run the **dca supportsave** command to back up the databases.

Example

$ dca supportsave



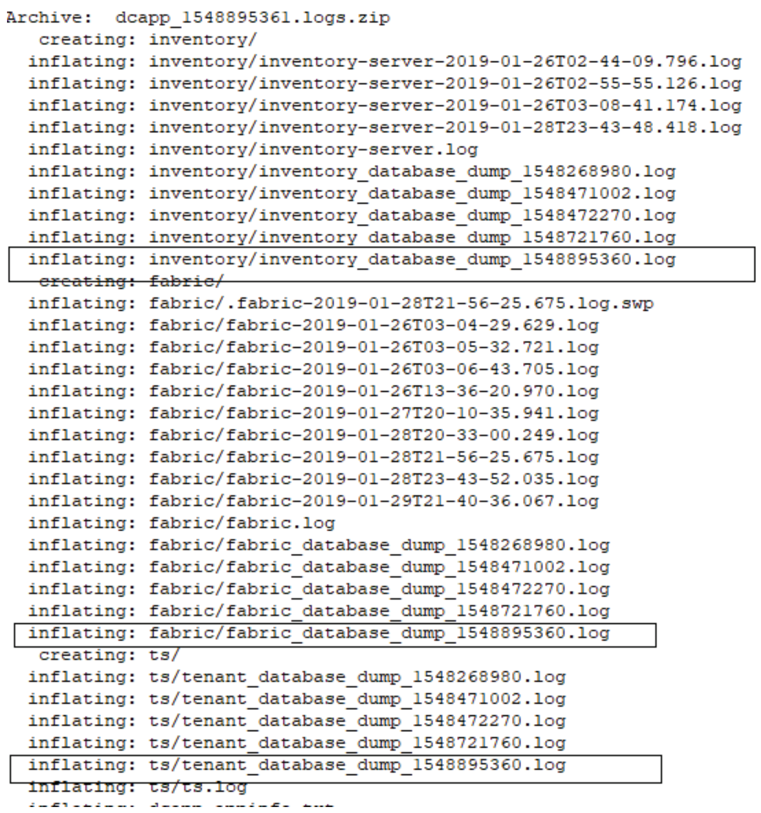
```
Version : 2.0.0
Time Stamp: 19-01-25:17:35:32
Support Save File: /var/log/dcapp/dcapp_1548895361.logs.zip
--- Time Elapsed: 1.146039397s ---
```

Restore the database

Do the following to restore the database.

1. Unzip the supportSave log to get the backup databases
   NOTE: If multiple supportSaves were captured, select latest database file for restoration.

   $ unzip dcapp_1548895361.logs.zip



```
Archive:  dcapp_1548895361.logs.zip
   creating: inventory/
  inflating: inventory/inventory-server-2019-01-26T02-44-09.796.log
  inflating: inventory/inventory-server-2019-01-26T02-55-55.126.log
  inflating: inventory/inventory-server-2019-01-26T03-08-41.174.log
  inflating: inventory/inventory-server-2019-01-28T23-43-48.418.log
  inflating: inventory/inventory-server.log
  inflating: inventory/inventory_database_dump_1548268980.log
  inflating: inventory/inventory_database_dump_1548471002.log
  inflating: inventory/inventory_database_dump_1548472270.log
  inflating: inventory/inventory_database_dump_1548721760.log
  inflating: inventory/inventory_database_dump_1548895360.log
   creating: fabric/
  inflating: fabric/.fabric-2019-01-28T21-56-25.675.log.swp
  inflating: fabric/fabric-2019-01-26T03-04-29.629.log
  inflating: fabric/fabric-2019-01-26T03-05-32.721.log
  inflating: fabric/fabric-2019-01-26T03-06-43.705.log
  inflating: fabric/fabric-2019-01-26T13-36-20.970.log
  inflating: fabric/fabric-2019-01-27T20-10-35.941.log
  inflating: fabric/fabric-2019-01-28T20-33-00.249.log
  inflating: fabric/fabric-2019-01-28T21-56-25.675.log
  inflating: fabric/fabric-2019-01-28T23-43-52.035.log
  inflating: fabric/fabric-2019-01-29T21-40-36.067.log
  inflating: fabric/fabric.log
  inflating: fabric/fabric_database_dump_1548268980.log
  inflating: fabric/fabric_database_dump_1548471002.log
  inflating: fabric/fabric_database_dump_1548472270.log
  inflating: fabric/fabric_database_dump_1548721760.log
  inflating: fabric/fabric_database_dump_1548895360.log
   creating: ts/
  inflating: ts/tenant_database_dump_1548268980.log
  inflating: ts/tenant_database_dump_1548471002.log
  inflating: ts/tenant_database_dump_1548472270.log
  inflating: ts/tenant_database_dump_1548721760.log
  inflating: ts/tenant_database_dump_1548895360.log
  inflating: ts/ts.log
```

2. Stop only the services whose databases you want to restore, or all three Inventory, Fabric, and Tenant Service containers.
   NOTE: Postgres-DB services must be running.

   $ docker ps
   $ docker stop goinventory-service-v2.0.0
   $ docker stop goFabric-service-v2.0.0
   $ docker stop goTenant-service-v2.0.0

3. Delete the databases you want to restore, or all three Inventory, Fabric, and Tenant Service databases, and recreate the deleted empty databases.

   a. Connect to the database.

      ```
      $ psql -U postgres -p 5432 -h localhost --W
      ```

   b. Delete the database.

      ```
      postgres=# DROP DATABASE dcapp_Fabric;
      DROP DATABASE

      postgres=# DROP DATABASE dcapp_Asset;
      DROP DATABASE


      postgres=# DROP DATABASE dcapp_Tenant;
      DROP DATABASE
      ```

   c. Recreate the empty database.

      ```
      postgres=# CREATE DATABASE dcapp_Asset OWNER Asset;
      CREATE DATABASE

      postgres=# CREATE DATABASE dcapp_Fabric OWNER Fabric;
      CREATE DATABASE

      postgres=# CREATE DATABASE dcapp_Tenant OWNER Tenant;
      CREATE DATABASE
      ```

   d. Create pgcrypto extension

      ```
      $ psql -U postgres -p 5432 -h localhost -W -d dcapp_asset

        dcapp_asset=#CREATE EXTENSION pgcrypto;
      ```

4. Restore the databases from the backup DBs.
   a. Restore the Inventory DB.

      ```
      $ pg_restore -Fc -d dcapp_Asset -U Asset -h localhost -p
              5432 -v inventory/inventory_database_dump_1548895360.log
              pg_restore: connecting to database for restore
              Password:
              pg_restore: creating SCHEMA "public"
              pg_restore: creating COMMENT "SCHEMA public"
              pg_restore: creating EXTENSION "plpgsql"
              pg_restore: creating COMMENT "EXTENSION plpgsql"
      ```

b. Restore the Fabric DB.

```
$ pg_restore -Fc -d dcapp_Fabric -U Fabric -h localhost -p 5432 -v
Fabric/Fabric_database_dump_1548895360.log

pg_restore: connecting to database for restore
Password:
pg_restore: creating SCHEMA "public"
pg_restore: creating COMMENT "SCHEMA public"
pg_restore: creating EXTENSION "plpgsql"
pg_restore: creating COMMENT "EXTENSION plpgsql"
```

c. Restore the Tenant DB.

```
$ pg_restore -Fc -d dcapp_Tenant -U Tenant -h localhost -p 5432 -v
ts/Tenant_database_dump_1548895360.log

pg_restore: connecting to database for restore
Password:
pg_restore: creating SCHEMA "public"
pg_restore: creating COMMENT "SCHEMA public"
pg_restore: creating EXTENSION "plpgsql"
pg_restore: creating COMMENT "EXTENSION plpgsql"
```

5. Verify that all the databases are restored by connecting to the databases.
   Restart the stopped containers and use **dca** CLI to confirm that all three service DBs are restored.

```
$ docker ps
$ docker start goinventory-service-v2.0.0
$ docker start goFabric-service-v2.0.0
$ docker start goTenant-service-v2.0.0
```

Appendix E: SLX-OS Device Firmware Update

Overview

This section guides the user to upgrade SLX-OS firmware after successfully deploying DCA. This procedure involves updating both DCA and the SLX-OS firmware. The basic steps are as follows:

1. Persist the configuration.
2. Back up the databases.
3. Update device SLX-OS firmware.
4. Update the devices in Asset Service (refer to Device Update).
5. Verify the update.

Persist the configuration

The user must persist the Fabric configuration before updating SLX-OS firmware. The switch is rebooted as part of a firmware update, which erases all unsaved configurations from the switch.

```
$ dca inventory device running-config persist --fabric stage3
```

Back up the DCA databases

In case anything goes wrong as part of the firmware update, DCA can be restored from the backup database.

```
$ dca supportsave
```

SLX-OS firmware update on the device

Refer to the SLX-OS software upgrade guide at
https://documentation.extremenetworks.com/slxos/SW/18rx/slxr-18.1.00-upgradeguide.pdf
for details specific to device type and release.

Update the inventory

Update the inventory Fabric level or device level. This updates the inventory with updated firmware version.

```
$ dca inventory device update --fabric stage3
```

Verify the firmware update

The new firmware version should be updated in the inventory and Fabric should remain in the same state as it was before the firmware update.

```
$ dca fabric show
$ dca inventory device list
```

Appendix F: Device Replacement and Compare

As part of the RMA process, the user must be able to replace a device in the application and confirm that there is no impact to the network or configurations. This section addresses these issues.

There are two possible scenarios for device replacement:

1. The device being replaced has the same configuration as the RMAed device.
2. The device being replaced has a configuration that is different from the device that was RMAed

Both options are addressed below.

Device replacement with the same configuration

The prerequisite is that you must ensure that the configuration that existed on the device is copied over to the new device.

For MCT leaf nodes assign node id 1 to device with least IP address and node id 2 for the other device
Please refer switch admin guide for configuring MCT node id.

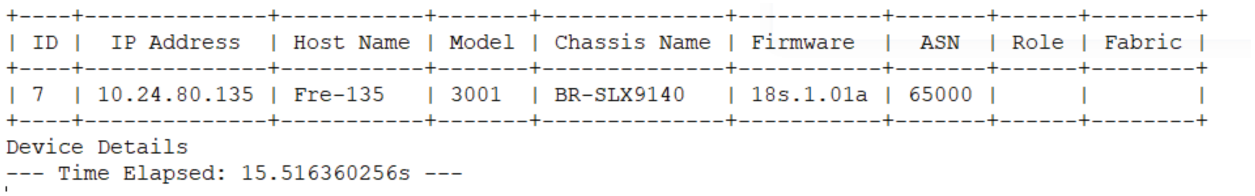
You must also ensure that the device information that is maintained in DCA is current, by executing the following command.

dca inventory device update –ip *<IP address of the device being replaced>*

This ensures that the Asset Service has the latest information. If the "older" device is not reachable or responding and the configuration being replayed on the replacement device does not match the details in the Asset Service, , you should treat this as option (2) above. – Even if the update operation were automated as part of the replacement, there is no guarantee that the device is reachable and in the correct state.

NOTE: If all the configuration changes to the device are done through DCA, then the above step is not necessary. Execute the following command.

$ dca inventory device replace –ip=10.24.80.135

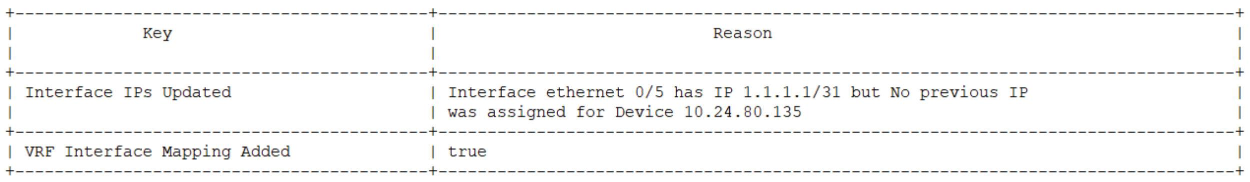


```
+----+--------------+-----------+-------+--------------+-----------+-------+------+--------+
| ID |  IP Address  | Host Name | Model | Chassis Name | Firmware  |  ASN  | Role | Fabric |
+----+--------------+-----------+-------+--------------+-----------+-------+------+--------+
| 7  | 10.24.80.135 | Fre-135   | 3001  | BR-SLX9140   | 18s.1.01a | 65000 |      |        |
+----+--------------+-----------+-------+--------------+-----------+-------+------+--------+
Device Details
--- Time Elapsed: 15.516360256s ---
```

Any failures   due to configuration mismatch would be indicated as follows:

$ dca inventory device replace --ip 10.24.80.135

Device replacement failure



```
+-----------------------------------------+------------------------------------------------------------------------------+
|            Key                          |                                  Reason                                      |
|                                         |                                                                              |
+-----------------------------------------+------------------------------------------------------------------------------+
| Interface IPs Updated                   | Interface ethernet 0/5 has IP 1.1.1.1/31 but No previous IP                  |
|                                         | was assigned for Device 10.24.80.135                                         |
+-----------------------------------------+------------------------------------------------------------------------------+
| VRF Interface Mapping Added             | true                                                                         |
+-----------------------------------------+------------------------------------------------------------------------------+
```

Note the following additional examples of failures.

$ dca inventory device replace --ip 10.24.80.136   [13:25:41]

```
Device Replacement Failure
+------------------------------+--------------------------------------------------------------+
|             Key              |                            Reason                            |
+------------------------------+--------------------------------------------------------------+
| Local AS Updated             |                                                              |
+------------------------------+--------------------------------------------------------------+
| Interface IPs Updated        | Interface ethernet 0/28 has IP 10.10.10.56/31 but No         |
|                              | previous IP was assigned for Device 10.24.80.136   Interface |
|                              | ethernet 0/25:1 has IP 10.10.10.85/31 but No previous IP     |
|                              | was assigned for Device 10.24.80.136   Interface ethernet    |
|                              | 0/25:2 has IP 10.10.10.89/31 but No previous IP was assigned |
|                              | for Device 10.24.80.136   Interface ethernet 0/25:3 has      |
|                              | IP 10.10.10.13/31 but No previous IP was assigned for        |
|                              | Device 10.24.80.136   Interface ethernet 0/26:3 has IP       |
|                              | 10.10.10.15/31 but No previous IP was assigned for Device    |
|                              | 10.24.80.136   Interface ethernet 0/27 has IP 10.10.10.66/31 |
|                              | but No previous IP was assigned for Device 10.24.80.136      |
|                              |   Interface ethernet 0/26:1 has IP 10.10.10.87/31 but No     |
|                              | previous IP was assigned for Device 10.24.80.136   Interface |
|                              | ethernet 0/26:2 has IP 10.10.10.91/31 but No previous IP     |
|                              | was assigned for Device 10.24.80.136   Interface ethernet    |
|                              | 0/32 has IP 10.10.10.3/31 but No previous IP was assigned    |
|                              | for Device 10.24.80.136   Interface ethernet 0/31 has IP     |
|                              | 10.10.10.1/31 but No previous IP was assigned for Device     |
|                              | 10.24.80.136                                                 |
+------------------------------+--------------------------------------------------------------+
| Added Interfaces             | loopback 1                                                   |
+------------------------------+--------------------------------------------------------------+
| BGP Global Added             | 64512                                                        |
+------------------------------+--------------------------------------------------------------+
| VRF Updated                  | true                                                         |
+------------------------------+--------------------------------------------------------------+
| VRF Interface Mapping Added  | true                                                         |
+------------------------------+--------------------------------------------------------------+
Error Details
--- Time Elapsed: 12.232735111s ---
```

Device replacement with different configuration

Device replacement when the configuration of the device being replaced is not the same as that on the new device is handled as follows.

1) Remove the device from DCA, by using the following command.

   dca fabric device remove –name *<Fabric name>* **--ip** *<IP address of the device>*

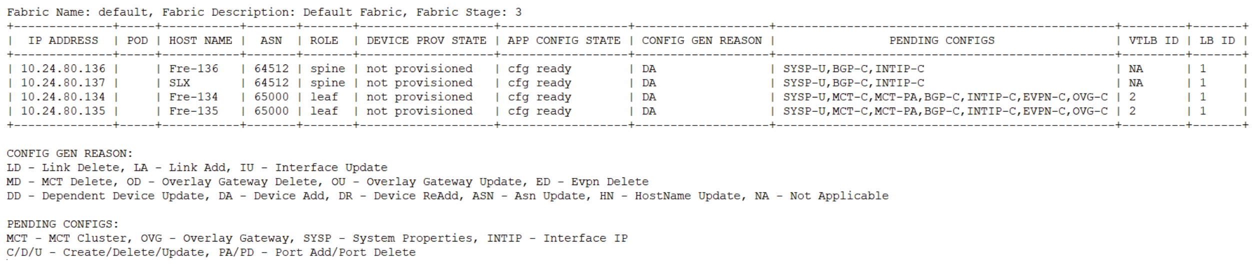
   The above command ensures that the device is removed (decommissioned from the Fabric) and all the relevant neighbors are also cleaned up.
   NOTE: - This also cleans up the subconfigurations from the MCT and BGP configurations.

2) Add the new device to DCA, by using the following command.

   dca fabric device add-bulk –name *<Fabric name>* **--leaf** *<IP address of the device if it is a leaf>* **--spine***<IP address of the device if it is a spine>* **--super-spine** *<IP address of the device if it is a super spine>*

3) Once this is done, you must ensure that the device shows up in the Fabric, by means of the following command.

   dca fabric show



```
Fabric Name: default, Fabric Description: Default Fabric, Fabric Stage: 3
+--------------+-----+-----------+-------+-------+-------------------+------------------+-------------------+-------------------------------------------------+---------+-------+
|  IP ADDRESS  | POD | HOST NAME |  ASN  | ROLE  | DEVICE PROV STATE | APP CONFIG STATE | CONFIG GEN REASON |                 PENDING CONFIGS                 | VTLB ID | LB ID |
+--------------+-----+-----------+-------+-------+-------------------+------------------+-------------------+-------------------------------------------------+---------+-------+
| 10.24.80.136 |     | Fre-136   | 64512 | spine | not provisioned   | cfg ready        | DA                | SYSP-U,BGP-C,INTIP-C                            | NA      | 1     |
| 10.24.80.137 |     | SLX       | 64512 | spine | not provisioned   | cfg ready        | DA                | SYSP-U,BGP-C,INTIP-C                            | NA      | 1     |
| 10.24.80.134 |     | Fre-134   | 65000 | leaf  | not provisioned   | cfg ready        | DA                | SYSP-U,MCT-C,MCT-PA,BGP-C,INTIP-C,EVPN-C,OVG-C  | 2       | 1     |
| 10.24.80.135 |     | Fre-135   | 65000 | leaf  | not provisioned   | cfg ready        | DA                | SYSP-U,MCT-C,MCT-PA,BGP-C,INTIP-C,EVPN-C,OVG-C  | 2       | 1     |
+--------------+-----+-----------+-------+-------+-------------------+------------------+-------------------+-------------------------------------------------+---------+-------+

CONFIG GEN REASON:
LD - Link Delete, LA - Link Add, IU - Interface Update
MD - MCT Delete, OD - Overlay Gateway Delete, OU - Overlay Gateway Update, ED - Evpn Delete
DD - Dependent Device Update, DA - Device Add, DR - Device ReAdd, ASN - Asn Update, HN - HostName Update, NA - Not Applicable

PENDING CONFIGS:
MCT - MCT Cluster, OVG - Overlay Gateway, SYSP - System Properties, INTIP - Interface IP
C/D/U - Create/Delete/Update, PA/PD - Port Add/Port Delete
```

To see the reason for an application or device error, execute the **dca fabric error show** command..

To see the reason for the configuration refresh, execute the **dca fabric debug config-gen-reason** command.

4) Configure the Fabric by using the following command.

   dca fabric configure –name *<name of the Fabric>*

   NOTE: You must rerun all the Tenant configurations after the device is added to the Fabric and configured.

Device compare

This feature allows users to get a preview of the configurations on the device that are out of sync with what is in the Asset Service. This is a helper utility that displays a summary of the information to be updated in the Asset database. Execute the following command.

dca inventory device compare –ip *<IP address of the device>*

```
$ dca inventory device compare --ip 10.24.80.134 |
Device 10.24.80.134 configuration is current in the application.
--- Time Elapsed: 14.996360091s ---
```

If there are configuration differences, the output is as follows

```
$ dca inventory device compare --ip 10.24.80.135
+-----------------------------+-------------------------------------------------------------+
|             Key             |                           Reason                            |
+-----------------------------+-------------------------------------------------------------+
| Interface IPs Updated       | Interface ethernet 0/5 has IP 1.1.1.1/31 but No previous IP |
|                             | was assigned for Device 10.24.80.135                        |
+-----------------------------+-------------------------------------------------------------+
| VRF Interface Mapping Added | true                                                        |
+-----------------------------+-------------------------------------------------------------+
```

Execute-cli

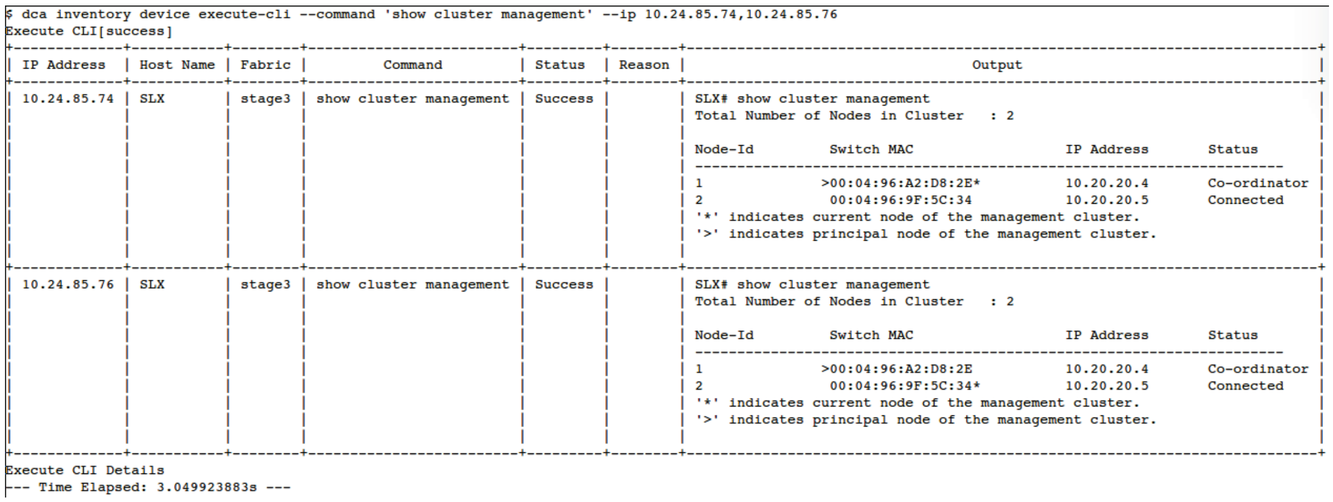
This feature allows users to execute CLIs on the device(s) that are registered in the Asset Service. This is a convenient helper utility to troubleshoot issues on the device(s).

The --command input parameter can be multiple CLIs delimited by comma or semicolon. The comma delimiter will keep the current sub-mode context of the device whereas the semicolon will start at the top level device context.

Execute the following command.

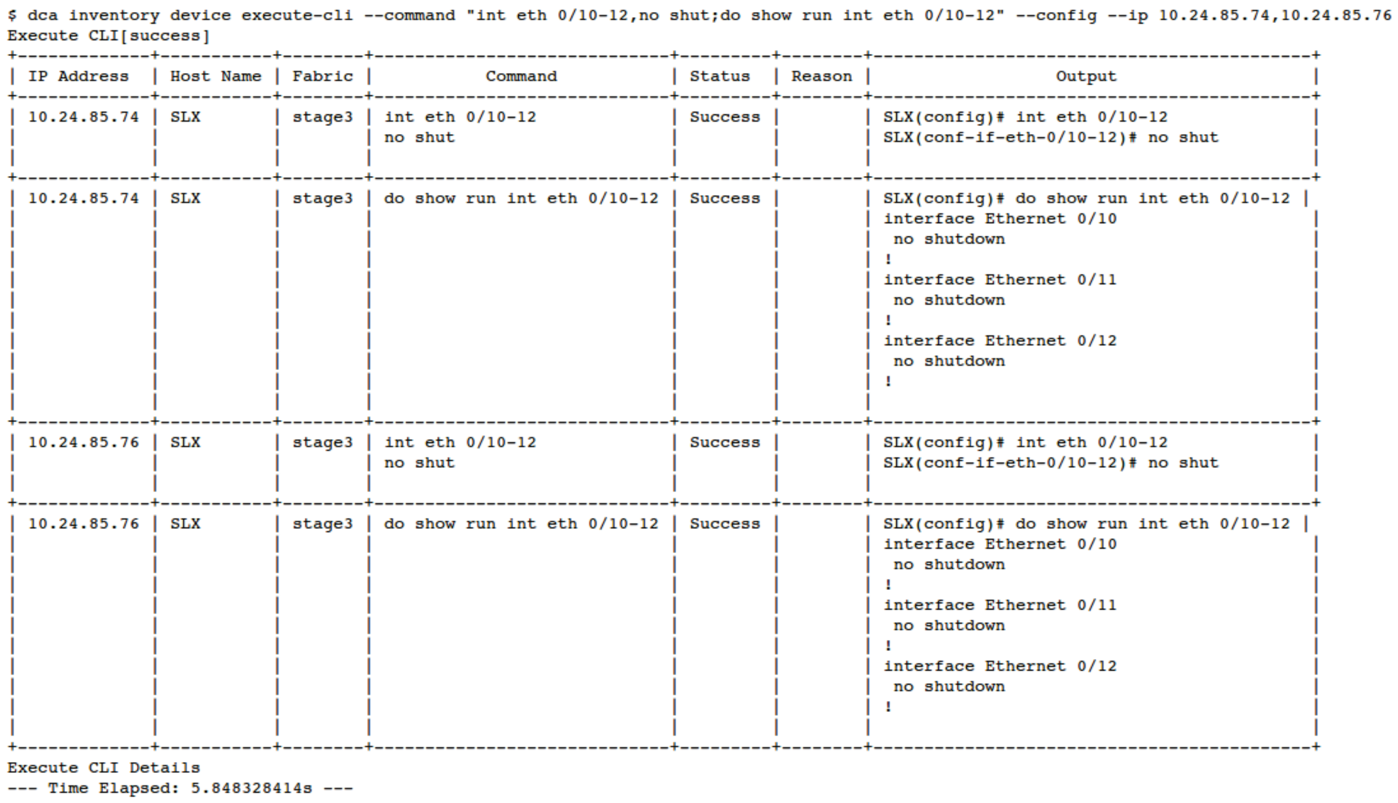
dca inventory device execute-cli --command *<"CLI to be executed on the device(s)"*> **[--config] --ip** *<IP address(es) of the device(s)>* **| --fabric** *<name of fabric>*

Exec-mode command example:



```
$ dca inventory device execute-cli --command 'show cluster management' --ip 10.24.85.74,10.24.85.76
Execute CLI[success]
+-------------+-----------+--------+-------------------------+---------+--------+----------------------------------------------------------------------------+
| IP Address  | Host Name | Fabric |         Command         | Status  | Reason |                                   Output                                   |
+-------------+-----------+--------+-------------------------+---------+--------+----------------------------------------------------------------------------+
| 10.24.85.74 | SLX       | stage3 | show cluster management | Success |        | SLX# show cluster management                                               |
|             |           |        |                         |         |        | Total Number of Nodes in Cluster   : 2                                      |
|             |           |        |                         |         |        |                                                                            |
|             |           |        |                         |         |        | Node-Id         Switch MAC                  IP Address       Status        |
|             |           |        |                         |         |        | ----------------------------------------------------------------------     |
|             |           |        |                         |         |        | 1              >00:04:96:A2:D8:2E*         10.20.20.4       Co-ordinator  |
|             |           |        |                         |         |        | 2               00:04:96:9F:5C:34          10.20.20.5       Connected     |
|             |           |        |                         |         |        | '*' indicates current node of the management cluster.                      |
|             |           |        |                         |         |        | '>' indicates principal node of the management cluster.                    |
|             |           |        |                         |         |        |                                                                            |
+-------------+-----------+--------+-------------------------+---------+--------+----------------------------------------------------------------------------+
| 10.24.85.76 | SLX       | stage3 | show cluster management | Success |        | SLX# show cluster management                                               |
|             |           |        |                         |         |        | Total Number of Nodes in Cluster   : 2                                      |
|             |           |        |                         |         |        |                                                                            |
|             |           |        |                         |         |        | Node-Id         Switch MAC                  IP Address       Status        |
|             |           |        |                         |         |        | ----------------------------------------------------------------------     |
|             |           |        |                         |         |        | 1              >00:04:96:A2:D8:2E          10.20.20.4       Co-ordinator  |
|             |           |        |                         |         |        | 2               00:04:96:9F:5C:34*         10.20.20.5       Connected     |
|             |           |        |                         |         |        | '*' indicates current node of the management cluster.                      |
|             |           |        |                         |         |        | '>' indicates principal node of the management cluster.                    |
|             |           |        |                         |         |        |                                                                            |
+-------------+-----------+--------+-------------------------+---------+--------+----------------------------------------------------------------------------+
Execute CLI Details
--- Time Elapsed: 3.049923883s ---
```

Config-mode command example:



```
$ dca inventory device execute-cli --command "int eth 0/10-12,no shut;do show run int eth 0/10-12" --config --ip 10.24.85.74,10.24.85.76
Execute CLI[success]
+-------------+-----------+--------+-----------------------------+---------+--------+------------------------------------------+
| IP Address  | Host Name | Fabric |           Command           | Status  | Reason |                  Output                  |
+-------------+-----------+--------+-----------------------------+---------+--------+------------------------------------------+
| 10.24.85.74 | SLX       | stage3 | int eth 0/10-12             | Success |        | SLX(config)# int eth 0/10-12             |
|             |           |        | no shut                     |         |        | SLX(conf-if-eth-0/10-12)# no shut        |
|             |           |        |                             |         |        |                                          |
+-------------+-----------+--------+-----------------------------+---------+--------+------------------------------------------+
| 10.24.85.74 | SLX       | stage3 | do show run int eth 0/10-12 | Success |        | SLX(config)# do show run int eth 0/10-12 |
|             |           |        |                             |         |        | interface Ethernet 0/10                  |
|             |           |        |                             |         |        |  no shutdown                             |
|             |           |        |                             |         |        | !                                        |
|             |           |        |                             |         |        | interface Ethernet 0/11                  |
|             |           |        |                             |         |        |  no shutdown                             |
|             |           |        |                             |         |        | !                                        |
|             |           |        |                             |         |        | interface Ethernet 0/12                  |
|             |           |        |                             |         |        |  no shutdown                             |
|             |           |        |                             |         |        | !                                        |
|             |           |        |                             |         |        |                                          |
+-------------+-----------+--------+-----------------------------+---------+--------+------------------------------------------+
| 10.24.85.76 | SLX       | stage3 | int eth 0/10-12             | Success |        | SLX(config)# int eth 0/10-12             |
|             |           |        | no shut                     |         |        | SLX(conf-if-eth-0/10-12)# no shut        |
|             |           |        |                             |         |        |                                          |
+-------------+-----------+--------+-----------------------------+---------+--------+------------------------------------------+
| 10.24.85.76 | SLX       | stage3 | do show run int eth 0/10-12 | Success |        | SLX(config)# do show run int eth 0/10-12 |
|             |           |        |                             |         |        | interface Ethernet 0/10                  |
|             |           |        |                             |         |        |  no shutdown                             |
|             |           |        |                             |         |        | !                                        |
|             |           |        |                             |         |        | interface Ethernet 0/11                  |
|             |           |        |                             |         |        |  no shutdown                             |
|             |           |        |                             |         |        | !                                        |
|             |           |        |                             |         |        | interface Ethernet 0/12                  |
|             |           |        |                             |         |        |  no shutdown                             |
|             |           |        |                             |         |        | !                                        |
|             |           |        |                             |         |        |                                          |
+-------------+-----------+--------+-----------------------------+---------+--------+------------------------------------------+
Execute CLI Details
--- Time Elapsed: 5.848328414s ---
```