

Discovery 2: Manage Device Inventory

Introduction

In this lab, you will familiarize yourself with the Cisco NSO device inventory. You will discover the configuration structure of the device inventory essential parts and practice onboarding new devices and creating device groups.

You have successfully created a hierarchy of named logical device groups. Now you can request NSO to perform bulk device *actions* on any of those groups, for example, *check-sync*, *connect*, *scp-to*, and so on, or you can apply *device configuration templates* to groups.

Scenario

You have been hired as a junior network engineer at a company that uses Cisco NSO to automate device configuration management and network service activation tasks. Your manager requires that you learn how to use the NSO device inventory by accomplishing simple activities, such as onboarding a new device and creating a hierarchy of device groups. You are asked to use a lab with an installed local NSO instance and a few virtual routers mimicking a small segment of the production network.

Activity Objective

To accomplish the task that your manager assigned to you, you will use a Linux-based virtual machine with the NSO software installed on it in your home directory.

After completing this activity, you will be able to meet the following objectives:

- Verify the current state of the device inventory in Cisco NSO
- Understand the configuration structure of authentication groups
- Understand the essential attributes of a device inventory entry
- Onboard a new device in Cisco NSO
- Understand the configuration structure of device groups
- Configure device group
- Verify device group membership

Job Aid

Device Information

Device	Description	IP Address	Credentials
Student DevBox	Linux Ubuntu VM	10.10.20.50	developer, C1sco12345
R1 (dist-rtr01)	Virtual Router, IOS XE - Amsterdam-17.3.4	10.10.20.175	cisco, cisco
R2 (dist-rtr02)	Virtual Router, IOS XE - Amsterdam-17.3.4	10.10.20.176	cisco, cisco
R3 (internet-rtr01)	Virtual Router, IOS XE - Amsterdam-17.3.4	172.21.1.181	cisco, cisco

Task 1: Onboard a New Device in Cisco NSO

In this task, you will verify the current state of the device inventory in your local NSO instance, which includes the device list and authgroup configuration. You will then onboard a new device in NSO and make it ready for management from the orchestrator.

Activity

For this activity, complete the following steps:

Step 1 Connect to the Student DevBox.

On the topology diagram, click the **Student DevBox**.

Step 2 On the Student DevBox, launch the NSO CLI as admin in the Cisco-style mode.

Open the Terminal application on the Student DevBox and launch the **ncs_cli** as the NSO local user **admin** indicating that you want to use the Cisco style immediately.

```
developer@devbox:~$ ncs_cli -Cu admin

User admin last logged in 2022-06-25T20:45:06.453164+00:00, to
student-vm, from 100.65.0.11 using cli-ssh
admin connected from 100.65.0.11 using ssh on student-vm
admin@ncs#
```

To start NSO CLI (**ncs_cli** shell) in the Cisco mode, you need to use the **-C** option with it. You require the **-u admin** option to indicate that you will act as the admin user. In the Linux shell, you can either separate the options with space characters (**-C -u admin**) or concatenate the options together as in the preceding example (**-Cu admin**).

Note Make sure that you do not mistype the username **admin**, otherwise, some data or actions in your NSO CLI session might become unavailable because of the RBAC restrictions.

Step 3 On the Student DevBox, in NSO CLI, inspect the inventory of managed network devices.

In the same Terminal application window or tab, in NSO CLI, run the **show devices list** command:

```
admin@ncs# show devices list

NAME    ADDRESS      DESCRIPTION  NED ID                ADMIN STATE
R1      10.10.20.175 -            cisco-ios-cli-6.67    unlocked
```

```
R2      10.10.20.176  -                cisco-ios-cli-6.67  unlocked
admin@ncs#
```

The command output shows that there are *two* network devices, R1 and R2 routers respectively, onboarded and available for management from the local NSO instance using the NED cisco-ios-cli-6.67.

Step 4 On the Student DevBox, in NSO CLI, inspect the essential inventory attributes of the router R1.

In the same Terminal application window or tab, in NSO CLI, run the **show running-config devices device R1 | de-select config** command:

```
admin@ncs# show running-config devices device R1 | de-select config
devices device R1
  address      10.10.20.175
  authgroup lab
  device-type cli ned-id cisco-ios-cli-6.67
  device-type cli protocol telnet
  state admin-state unlocked
!
admin@ncs#
```

The **| de-select config** pipe commands remove the less important sections of the output from the display. As you can see in the command response, the router R1 has the following inventory attributes:

- The device name (**R1**) that is unique across the entire inventory.
- The management IP address (**10.10.20.175**) on which the device listens for incoming northbound telnet connections.
- The device type (**cli**) and the NED identifier (**cisco-ios-cli-6.67**) tell NSO how to communicate with the device and which data models to use to store its configuration in the CDB.
- The reference to the authentication parameters and credentials (the authgroup **lab**).
- The setting that administratively unlocks the device for modifications (the admin-state **unlocked**).

These attributes provide enough information for NSO to onboard and manage the device R1. You can use the inventory entry configuration of the R1 device as a sample to create an entry for onboarding another device in your local NSO instance.

Step 5 On the Student DevBox, in NSO CLI, inspect the configuration of the authgroup **lab**.

In the same Terminal application window or tab, in NSO CLI, run the **show running-config devices authgroups group lab** command:

```
admin@ncs# show running-config devices authgroups group lab
devices authgroups group lab
  default-map remote-name    cisco
  default-map remote-password
$9$tomlONRngFlv7U7MobWJuuLtKml5O/2dx0QA7rWdUyw=
  default-map remote-secondary-password
$9$Qt1yjHRu9CnLKL7VeH82Ut2ghiAlh7lO6ooCyzzeas=
!
admin@ncs#
```

The command displays the credentials for device access stored in the CDB. The authgroup named **lab** stores the username, password, and the enable secret for the virtual routers in your lab and makes them available to any user of your local NSO instance.

Note The passwords are stored in encrypted form. In your lab, the encrypted password strings may be different from those in the preceding output example.

Step 6 In the NSO CLI config mode, create a device inventory entry to onboard a *new* router named **R3** by using the parameters from the following table:

Device Inventory Attribute	Value
Device Name	R3
Management IP address	10.10.20.181
Device Type	cli
NED Identifier	cisco-ios-cli-6.67
Authentication Group	lab
Protocol	telnet
Administrative State	unlocked

In the same Terminal application window or tab, in NSO CLI, switch to the configuration mode by using the **config** command and then enter the following commands line by line:

```
devices device R3
  address 10.10.20.181
  authgroup lab
  device-type cli ned-id cisco-ios-cli-6.67 protocol telnet
  state admin-state unlocked
```

Afterward, commit the configuration to the CDB to activate the settings by using the **commit** command, as in the following example:

```
admin@ncs# config
Entering configuration mode terminal
admin@ncs(config)# devices device R3
admin@ncs(config-device-R3)# address 10.10.20.181
admin@ncs(config-device-R3)# authgroup lab
admin@ncs(config-device-R3)# device-type cli ned-id cisco-ios-cli-6.67 protocol telnet
admin@ncs(config-device-R3)# state admin-state unlocked
admin@ncs(config-device-R3)#
admin@ncs(config-device-R3)# commit
Commit complete.
admin@ncs(config-device-R3)#
```

Note You can use the R1 router configuration from Step 4 as a sample to create the entry for the R3 device. Copy the R1 config into a text editor, modify the lines accordingly with the table, and paste the result back into the NSO CLI config session.

Step 7 On the Student DevBox, in NSO CLI, verify the CDB synchronization status for all the devices in the inventory.

In the same Terminal application window or tab, in NSO CLI, run the **devices check-sync** command:

```
admin@ncs# devices check-sync
sync-result {
  device R1
  result in-sync
}
sync-result {
```

```
device R2
  result in-sync
}
sync-result {
  device R3
  result unknown
}
```

The result *unknown* displayed for the device R3 is an indication that the device has never been synchronized after its onboarding. You can leave the device in that state now and resolve the issue at any time later by using the sync-from action.

Note Remember that the Device Manager requires the devices to be in-sync with the CDB before you start making configuration changes to them.

You have successfully verified the current state of the device inventory in your local NSO instance, which includes the device list and authgroup configuration. You have onboarded a new device in NSO and made it ready for management from the orchestrator.

Task 2: Create Device Groups and Add Devices to Them

In this task, you will organize your network devices into a hierarchy of named logical device groups. You will learn how to use the list syntax in the NSO config mode and how to resolve the group names into the lists of device names.

Step 1 On the Student DevBox, in NSO CLI, create the device group named **Headquarters** and add the **R1** device to that group.

In the same Terminal application window or tab, in NSO CLI, switch to the configuration mode by using the **config** command, and then enter the following commands line by line:

```
devices device-group Headquarters
  device-name R1
```

Commit the entered configuration by using the **commit** command and navigate to the topmost level of the config data tree by entering the **top** command as in the following example:

```

admin@ncs# config
Entering configuration mode terminal
admin@ncs(config)# devices device-group Headquarters
admin@ncs(config-device-group-Headquarters)# device-name ?
Description: Device within group
Possible completions:
  R1  R2  R3  [
admin@ncs(config-device-group-Headquarters)# device-name R1
admin@ncs(config-device-group-Headquarters)#
admin@ncs(config-device-group-Headquarters)# commit
Commit complete.
admin@ncs(config-device-group-Headquarters)# top
admin@ncs(config)#

```

Note To minimize potential input errors, you can use the NSO CLI context help and autocompletion features by typing the question mark (?), **Tab**, or **Space** key when uncertain about the correct way to complete a command.

Step 2 On the Student DevBox, in the NSO CLI config mode, create the device group that includes the **R2** and **R3** routers, and name that group **Branches**.

In the same Terminal application window or tab, in the NSO CLI config mode, enter the following commands line by line:

```

devices device-group Branches
device-name [ R2 R3 ]

```

Commit the entered configuration by using the **commit** command and navigate to the topmost level of the config data tree by entering the **top** command as in the following example:

```

admin@ncs(config)# devices device-group Branches
admin@ncs(config-device-group-Branches)# device-name [ R2 R3 ]
admin@ncs(config-device-group-Branches)#
admin@ncs(config-device-group-Branches)# commit
Commit complete.
admin@ncs(config-device-group-Branches)# top
admin@ncs(config)#

```


When you need to include multiple devices in a group, you can use the list syntax, where multiple names are enclosed in square brackets [], and the space character is used as a delimiter. Alternatively, you can enter the **device-name** command multiple times to get the same result, for example:

```
admin@ncs (config) # devices device-group Branches
admin@ncs (config-device-group-Branches) # device-name R2
admin@ncs (config-device-group-Branches) # device-name R3
admin@ncs (config-device-group-Branches) #
admin@ncs (config-device-group-Branches) # top
admin@ncs (config) #
admin@ncs (config) # show configuration
devices device-group Branches
  device-name [ R2 R3 ]
!
admin@ncs (config) #
admin@ncs (config) # commit
Commit complete.
admin@ncs (config) #
```

Note Even with the *unknown* sync status of the R3 device, you can successfully create and commit the device-group configurations because those configurations do *not* modify anything in the devices themselves and there are no out-of-sync conflicts.

Step 3 On the Student DevBox, in the NSO CLI config mode, create the device group named **All-Routers** that includes both groups: **Headquarters** and **Branches**.

In the same Terminal application window or tab, in the NSO CLI config mode, enter the following commands line by line:

```
devices device-group All-Routers
  device-group [ Headquarters Branches ]
```

Commit the entered configuration by using the **commit** command and exit the config session by using the **end** command or **Ctrl+Z** key combination:

```
admin@ncs (config) # devices device-group All-Routers
```

```

admin@ncs (config-device-group-All-Routers) # device-group [
Headquarters Branches ]
admin@ncs (config-device-group-All-Routers) #
admin@ncs (config-device-group-All-Routers) # commit
Commit complete.
admin@ncs (config-device-group-All-Routers) # end
admin@ncs #

```

Step 4 On the Student DevBox, in NSO CLI, verify the configuration of all the device groups.

In the same Terminal application window or tab, in NSO CLI, run the **show running-config devices device-group** command:

```

admin@ncs# show running-config devices device-group
devices device-group All-Routers
  device-group [ Branches Headquarters ]
!
devices device-group Branches
  device-name [ R2 R3 ]
!
devices device-group Headquarters
  device-name [ R1 ]
!
admin@ncs#

```

Make sure that all the device groups that you have configured in this Task are present in the command output. Note that some device names or group names in the lists are reordered compared to how you have entered them. This is expected because the system is controlling the order of items in this case.

Step 5 On the Student DevBox, in NSO CLI, check the names of all the device names that are members of the **All-Routers** group.

In the same Terminal application window or tab, in NSO CLI, run the **show devices device-group All-Routers member** command:

```

admin@ncs# show devices device-group All-Routers member
member [ R1 R2 R3 ]
admin@ncs#

```

The command effectively resolves the group name All-Routers to the list of all the device names that are included in the group itself and all its children device-groups.

You have successfully created a hierarchy of named logical device groups. Now you can request NSO to perform bulk device *actions* on any of those groups, such as *check-sync*, *connect*, *scp-to*, and so on, or you can apply *device configuration templates* to groups.

Review Questions

Question 1:

Which authentication group attribute in NSO stores the enable secret for Cisco CLI-managed devices?

- a) remote-enable-password
- b) remote-enable-secret
- c) **remote-secondary-password**
- d) remote-secondary-secret

Answers: The correct answer is **remote-secondary-password**.

Question 2:

Which is the correct output of the **show devices device-group Branches member** NSO CLI command, based on the configurations that you have created in this lab?

- a) member [R1]
- b) member [R1 R2]
- c) member [R1 R2 R3]
- d) **member [R2 R3]**

Answers: The correct answer is **member [R2 R3]**.