The bridge to possible

# Models management in Cisco NSO

## NED migrations deep dive

Abdellah Sabry, Software Consulting Engineer
@Abdellah.SABRY

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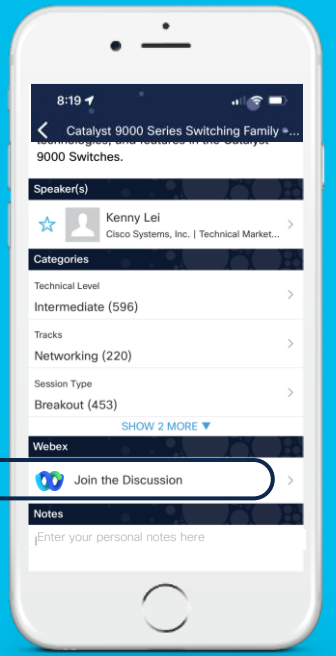
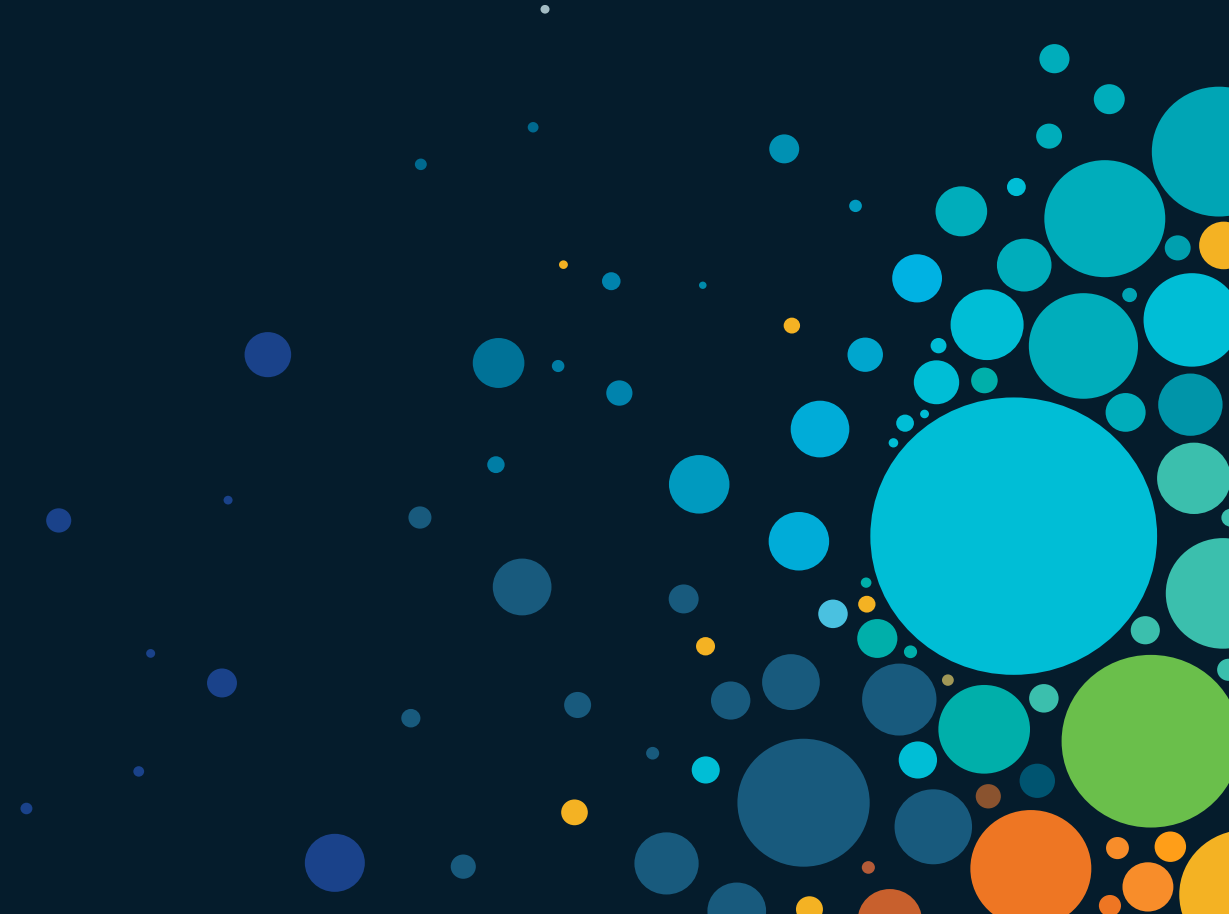


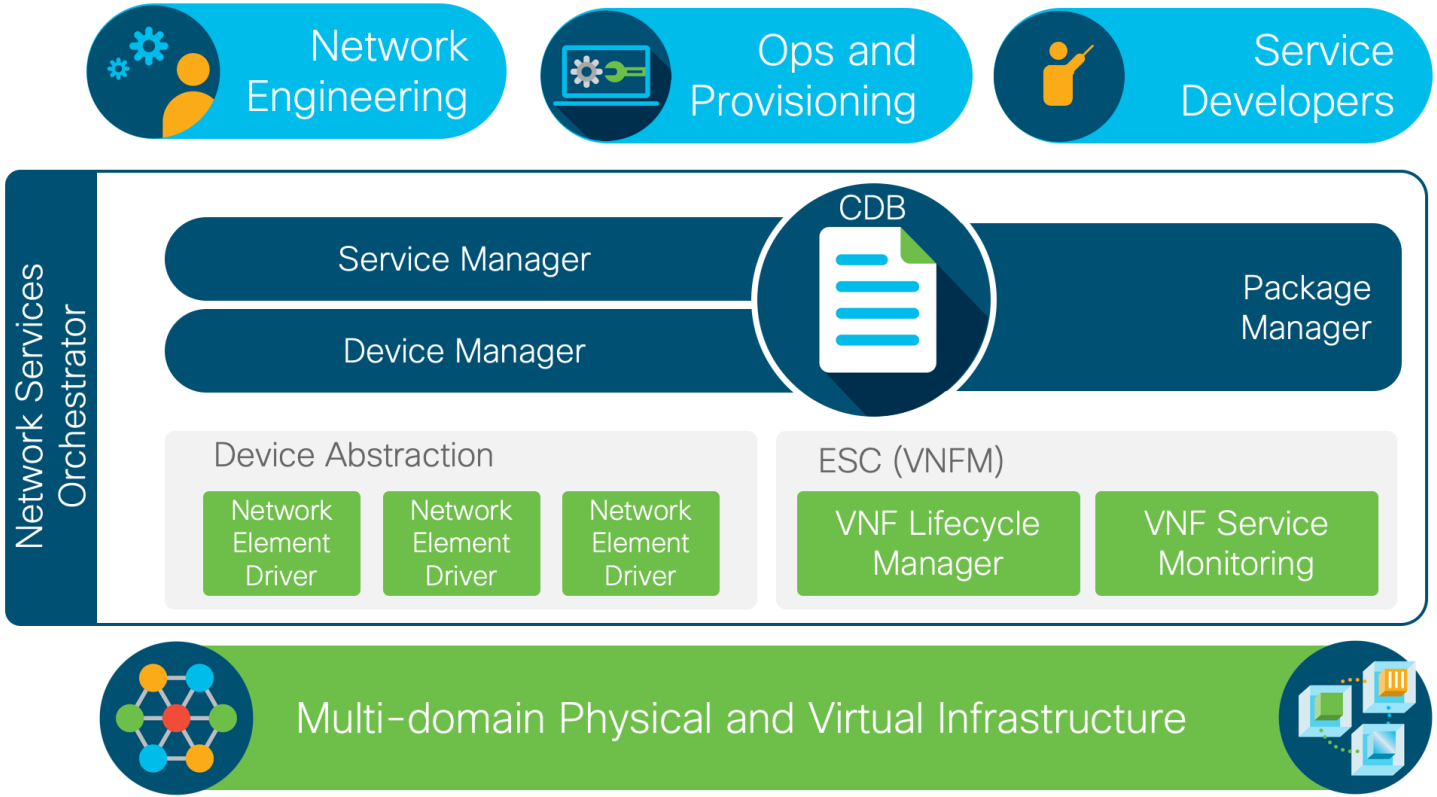
# Agenda

- Introduction
- Common Data Models (CDM)
- NED migration process
- Scenarios and issues
- Prechecks and postchecks
- NED Migration Utility

# Introduction



# Cisco NSO architecture

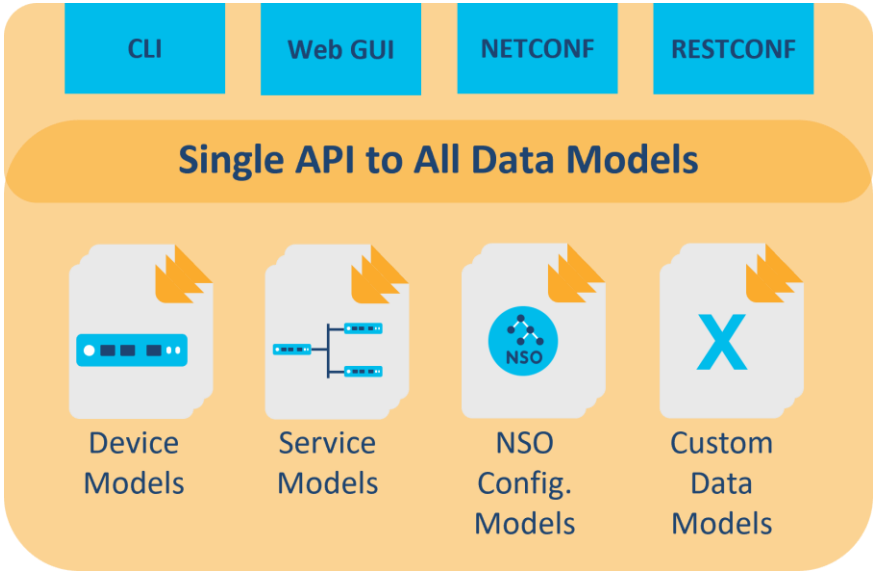


# Common Data Models (CDM)

# NSO Yang Models

In Cisco NSO

everything is a model!

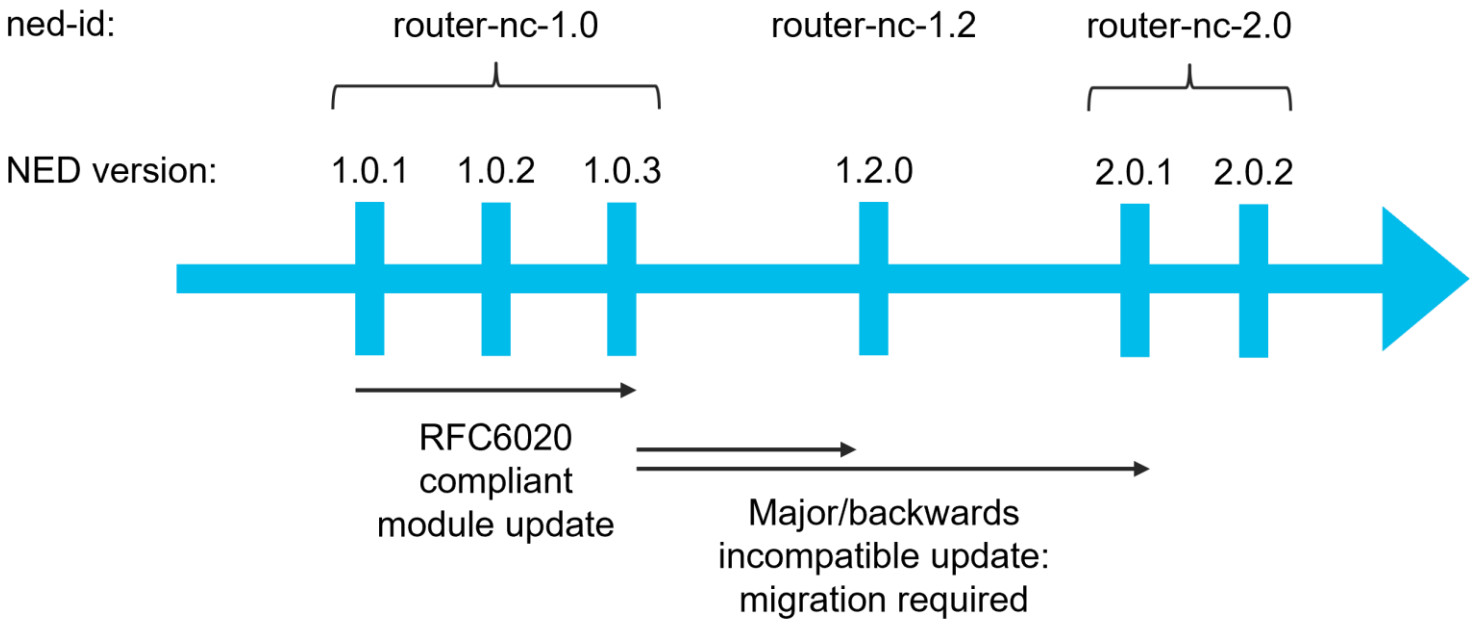
# Common Data Models (CDM)

## In Cisco NSO

## everything is a model!


- 5.x Namespace identifier:
  - Called Crunched namespace
  - XML namespace + Mount-id
- YANG Schema Mount:
  - RFC 8528
  - Mount-id
- Unique ned-id

# Device models versioning



# NED migration process

# NED migration action

- Device Action
- Tool to migrate between backwards incompatible NED versions
- The action migrates all configuration and service meta-data
- Reads & writes

# NED Migration Process

- Installing new NED package
- Checking difference:
  - Migrate dry-run
  - CHANGES files
- Prechecks
- Update service
- NED migrate
- Postchecks
- Redeploy if needed
- Deleting old NED package

# Scenarios and issues

# Scenarios and issues

- Dry-run verbose
- Affected services
- Out of sync devices
- If-ned-id
- Yang references
- Locked devices
- Redeploying services
- Changes file
- NSO upgrades & NED migrations
- LSA

# Dry-run verbose

```
absabry@ncs# devices device device-0 migrate new-ned-id cisco-ios-cli-6.79 dry-run verbose

modified-path {
                    path /ios:radius-server/vsa/send/authentication
                    info node type has changed from empty leaf to leaf
}
modified-path {
   path /ios:radius-server/vsa/send/accounting
   info node type has changed from empty leaf to leaf
}
  .
  .
  .
modified-path {
   path /ios:ptp/r-dti/clock-port/ethernet
   info leaf/leaf-list type has changed
}
modified-path {
   path /ios:config-register
   info leaf/leaf-list type has changed
}
affected-services [ /services/simple-service:simple-service[device='device-0'] ]
```

# Affected services

```
absabry@ncs# devices device device-0 migrate new-ned-id cisco-ios-cli-6.79 dry-run verbose
 modified-path {
    path /ios:radius-server/vsa/send/authentication
    info node type has changed from empty leaf to leaf
 }
 modified-path {
    path /ios:radius-server/vsa/send/accounting
    info node type has changed from empty leaf to leaf
 }


affected-services [ /services/simple-service:simple-service[device='device-0'] ]
```

```
<radius-server xmlns="urn:ios">
  <vsa>
    <send>
      <accounting />
      <authentication />
    </send>
  </vsa>
</radius-server>
```

# Migration action: Reading from device

```
<DEBUG> device=device-1 show
<DEBUG> device=device-1 send NED show
<DEBUG> device=device-1 package=cisco-ios-cli-6.77 reading config
<DEBUG> device=device-1 package=cisco-ios-cli-6.77 reading config: ok (0.523 s)
<DEBUG> device=device-1 package=cisco-ios-cli-6.77 transforming input
<DEBUG> device=device-1 package=cisco-ios-cli-6.77 transforming input: ok (0.002 s)
<DEBUG> device=device-1 package=cisco-ios-cli-6.77 extended parsing
<DEBUG> device=device-1 package=cisco-ios-cli-6.77 extended parsing: ok (0.017 s)
<DEBUG> device=device-1 package=cisco-ios-cli-6.77 populating cdb
<DEBUG> device=device-1 package=cisco-ios-cli-6.77 populating cdb: ok (0.084 s)
<DEBUG> device=device-1 show: ok (0.727 s)
```

# Out of sync devices: no-networking

```
absabry@ncs# devices device device-0 migrate new-ned-id cisco-ios-cli-6.79 dry-run verbose no-networking
 modified-path {
                    path /ios:radius-server/vsa/send/authentication
                    info node type has changed from empty leaf to leaf
 }
 modified-path {
    path /ios:radius-server/vsa/send/accounting
    info node type has changed from empty leaf to leaf
 }


affected-services [ /services/simple-service:simple-service[device='device-0'] ]
```

```
<INFO>  device=device-0 migrating
<DEBUG> device=device-0 taking device lock
<DEBUG> device=device-0 taking device lock: ok (0.000 s)
<INFO>  device=device-0 migrating device configuration
<INFO>  device=device-0 migrating device configuration: ok (0.015 s)
<INFO>  device=device-0 finding affected services
<INFO>  device=device-0 finding affected services: ok (0.001 s)
<DEBUG> device=device-0 releasing device lock
<INFO> device=device-0 migrating: ok (0.020 s)
```

# if-ned-id

```
<?if-ned-id cisco-ios-cli-6.77:cisco-ios-cli-6.77?>
<interface xmlns="urn:ios">
  <GigabitEthernet>
    <name>{/intf}</name>
    <description>{/version}</description>
    <negotiation>
      <auto>true</auto>
    </negotiation>
    <duplex>full</duplex>
  </GigabitEthernet>
</interface>
```

```
absabry@ncs# services simple-service device-0 get-modifications
cli {
   local-node {
      data
   }
}
```

# Yang references

Makefile:

```
YANGPATH += ../../cisco-ios-cli-6.77/src/ncsc-out/modules/yang
```

Yang Model:

```
import tailf-ned-cisco-ios {
    prefix ios;
}
. . .
leaf version {
  type leafref{
     path "/ncs:devices/ncs:device[ncs:name=current()/../device] /ncs:config/ios:version";
  }
}
```

NED migration:

```
modified-path {
   path /ios:version
   info leaf/leaf-list type has changed
}
```

# Locked devices

```
absabry@ncs# devices device device-2 migrate new-ned-id cisco-ios-cli-6.79 verbose dry-run
Error: Device device-2 is locked
absabry@ncs# devices device device-3 migrate new-ned-id cisco-ios-cli-6.79 verbose dry-run
Error: Device device-3 is southbound locked
```

```
absabry@ncs# devices device device-3 migrate new-ned-id cisco-ios-cli-6.79 dry-run verbose no-networking
 modified-path {
    path /ios:radius-server/vsa/send/authentication
    info node type has changed from empty leaf to leaf
 }
 modified-path {
    path /ios:radius-server/vsa/send/accounting
    info node type has changed from empty leaf to leaf
 }
```

# Fastmap-private data

ncs.conf

```
<hide-group>
    <name>debug</name>
</hide-group>
<hide-group>
    <name>full</name>
</hide-group>
<hide-group>
    <name>fastmap-private</name>
</hide-group>
```

```
absabry@ncs# show running-config simple-service private ned-id-list

simple-service device-2

 private ned-id-list [ cisco-ios-cli-6.77:cisco-ios-cli-6.77 ]

!

absabry@ncs#
```

# Redeploying services

It is important to re-deploy all affected services touching the device after the device migration, even though there are no backwards incompatible data model changes affecting the service. When reading the reverse/forward diffset of a service, NCS will detect changes to the NED identity of a device touched by the service and migrate the diffset on the fly. Thus the diffsets are still valid, but until the new diffset is written (typically through a re-deploy) this migration procedure will add extra time in handling the reverse/forward diffset

- ncs: NSO does no longer require all affected services to be re-deployed

after a NED migration before removing the old NED package.

(ENG-23172, RT:40465, PS-35547, SR:688252357)

# Redeploying services

```
absabry@ncs# services simple-service device-2 get-modifications
cli {
    local-node {
        data  devices {
                    device device-2 {
                        config {
                            ip {
                                icmp {
                                    rate-limit {
                                        unreachable {
            +                               DF;
                                        }
                                    }
                                }
                            }
                            interface {
            +                   GigabitEthernet 0/1 {
            +                       negotiation {
            +                           auto true;
            +                       }
            +                       duplex full;
            +                   }
                            }
                            radius-server {
                                vsa {
                                    send {
            +                           accounting;
            +                           authentication;
                                    }
                                }
                            }
            +               routing-default-optimize false;
                        }
                    }
                }
```

# Redeploying services

```
absabry@ncs# show running-config devices device device
-2 config radius-server | display service-meta-data
devices device device-2
 config
  ! Refcount: 1
  ! Backpointer: [ /ncs:services/simple-service:simple
-service[simple-service:device='device-2'] ]
  radius-server vsa send accounting
  ! Refcount: 1
  ! Backpointer: [ /ncs:services/simple-service:simple
-service[simple-service:device='device-2'] ]
  radius-server vsa send authentication
 !
```

```
modified-path {
    path /ios:radius-server/vsa/send/authentication
    info node type has changed from empty leaf to leaf
}
modified-path {
    path /ios:radius-server/vsa/send/accounting
    info node type has changed from empty leaf to leaf
}
```

```
absabry@ncs# show running-config devices device device
-2 config radius-server | display service-meta-data
devices device device-2
 config
  radius-server vsa send accounting
  radius-server vsa send authentication
 !
!
```

# Redeploying services

```
<?if-ned-id cisco-ios-cli-6.79:cisco-ios-cli-6.79?>
<radius-server xmlns="urn:ios">
  <vsa>
    <send>
      <accounting>true</accounting>
      <authentication>true</authentication>
    </send>
  </vsa>
</radius-server>
<?end ?>
```

```
absabry@ncs# services simple-service device-2 re-deploy dry-run
cli {
}
absabry@ncs#
```

```
absabry@ncs# show running-config devices device devic
e-2 config radius-server | display service-meta-data
devices device device-2
 config
  ! Refcount: 2
  ! Originalvalue: true
  radius-server vsa send accounting
  ! Refcount: 2
  ! Originalvalue: true
  radius-server vsa send authentication
 !
!
absabry@ncs#
```

# Redeploying services

```
absabry@ncs# show running-config devices device device-2
config radius-server | display service-meta-data
devices device device-2
 config
  ! Refcount: 1
  radius-server vsa send accounting
  ! Refcount: 1
  radius-server vsa send authentication
 !
!
absabry@ncs#
```

# CHANGES files

ncs-run > packages > cisco-ios-cli-6.77 > CHANGES

```
cisco-ios v6.79 [2022-03-04]
================================================================================
Changes that might affect a package upgrade from version 6.78:
  NOTE: The below YANG model changes are not backwards compatible:

  Incompatible nodes:
  /radius-server/vsa/send/accounting
  /radius-server/vsa/send/authentication


Corrections:

  - API CHANGE:
     radius-server vsa send accounting|authentication
      Changed from type empty to type boolean due to IOS inconsiste
    (CISCOIOS-2362 / PS-43497 / RT48385)

  - Fixed interface order dependency, correct order is:
     no vrrp *
     no vrf forwarding
    (CISCOIOS-2379 / PS-43905 / RT48790)

```

# NSO 6 update!

```
modified-path {
  path /r:sys/syslog/server/selector/option/pid
  info sub-tree has been deleted
  backward-compatible false
}
modified-path {
  path /r:sys/syslog/server/selector/option
  info node type has changed from non-presence container to leaf-list
  backward-compatible false
  affected-service {
    id /services/sls:syslog
  }
}
```

# NSO upgrades & NED migrations

1. Recompiling packages in target version
2. Upgrading NSO
3. NED migrations

Or:

1. NED migrations
2. Upgrading NSO

# LSA

- An NSO RFS is a device!
- Post NSO 5.4.x
- ned-id:
  - lsa-netconf
  - cisco-nso-nc-x.y

# Prechecks and postchecks

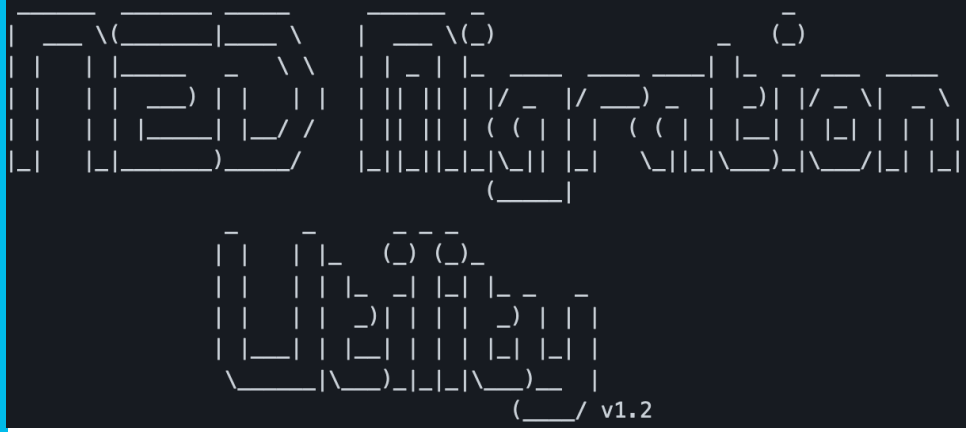
# Necessary checks

- Collecting the services metadata before the NED migration
- Collecting the services metadata after the NED migration
- Comparing both contents and act upon result

# The NED Migration Utility (NMU)

cisco Live!

# NMU




- Runs batch NED migrations
- Uses Prechecks
- Executes the ‘safe’ migrations
- Improves visibility
- Generates migrations reports

# Prechecks

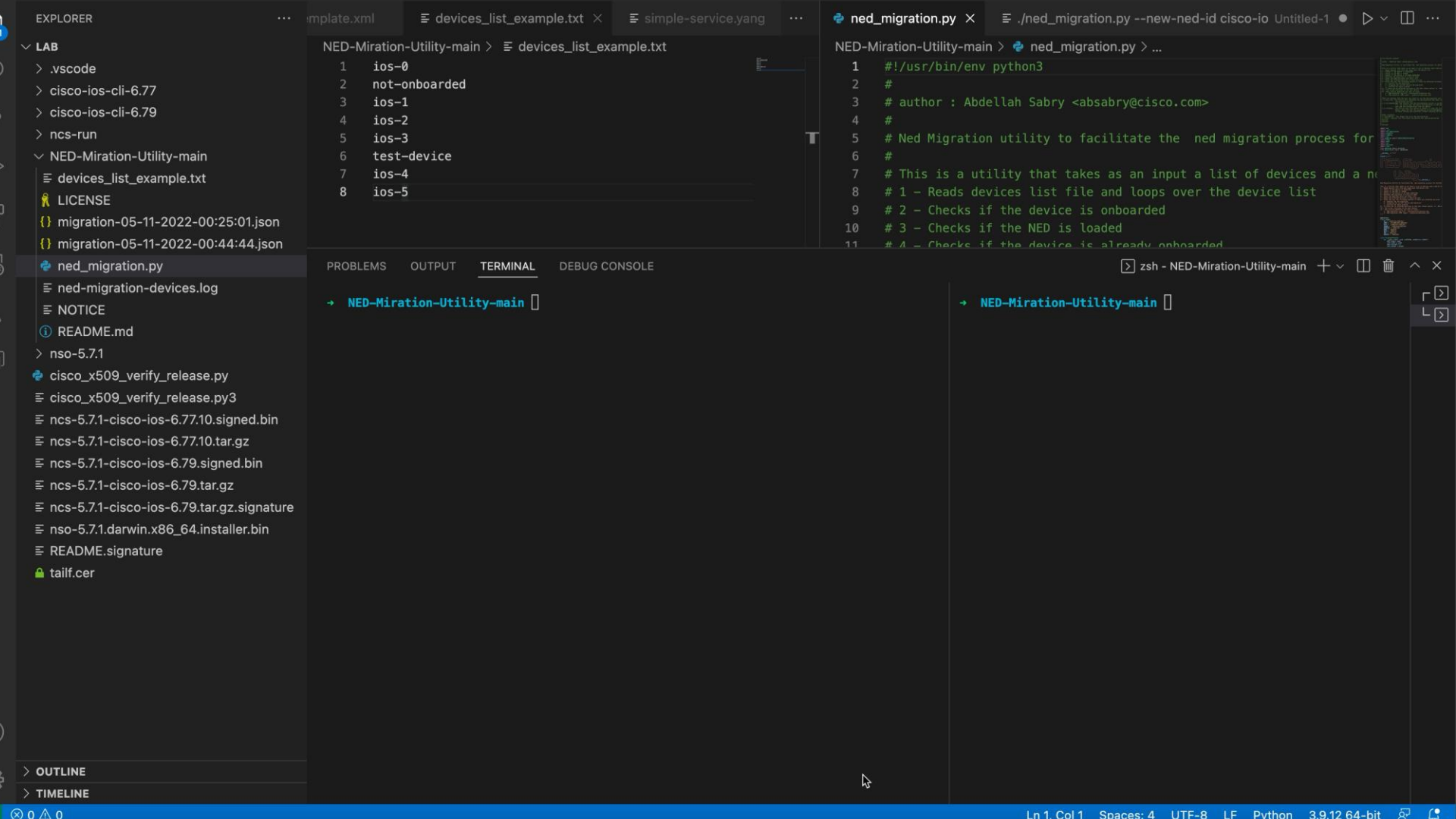
- Checks if :
  - Devices are onboarded
  - NED package is loaded
  - Device is already migrated
  - Device is locked

# Capability

- Executes ned migration of a group of devices in a dry-run verbose mode
- Shows the modified paths and their info
- Gives the possibility to handle the devices with affected services separately
- Loops over the list of the provided devices
- Records & logs every step of every migration

# Demo

https://github.com/cybot16/NED-Miration-Utility


EXPLORER
LAB
.vscode
cisco-ios-cli-6.77
cisco-ios-cli-6.79
ncs-run
NED-Miration-Utility-main
devices_list_example.txt
LICENSE
migration-05-11-2022-00:25:01.json
migration-05-11-2022-00:44:44.json
ned_migration.py
ned-migration-devices.log
NOTICE
README.md
nso-5.7.1
cisco_x509_verify_release.py
cisco_x509_verify_release.py3
ncs-5.7.1-cisco-ios-6.77.10.signed.bin
ncs-5.7.1-cisco-ios-6.77.10.tar.gz
ncs-5.7.1-cisco-ios-6.79.signed.bin
ncs-5.7.1-cisco-ios-6.79.tar.gz
ncs-5.7.1-cisco-ios-6.79.tar.gz.signature
nso-5.7.1.darwin.x86_64.installer.bin
README.signature
tailf.cer
OUTLINE
TIMELINE
devices_list_example.txt
simple-service.yang
NED-Miration-Utility-main > devices_list_example.txt
1 ios-0
2 not-onboarded
3 ios-1
4 ios-2
5 ios-3
6 test-device
7 ios-4
8 ios-5
ned_migration.py
./ned_migration.py --new-ned-id cisco-io
Untitled-1
NED-Miration-Utility-main > ned_migration.py > ...
1 #!/usr/bin/env python3
2 #
3 # author : Abdellah Sabry <absabry@cisco.com>
4 #
5 # Ned Migration utility to facilitate the ned migration process for
6 #
7 # This is a utility that takes as an input a list of devices and a n
8 # 1 - Reads devices list file and loops over the device list
9 # 2 - Checks if the device is onboarded
10 # 3 - Checks if the NED is loaded
11 # 4 - Checks if the device is already onboarded
PROBLEMS
OUTPUT
TERMINAL
DEBUG CONSOLE
zsh - NED-Miration-Utility-main
→ NED-Miration-Utility-main
→ NED-Miration-Utility-main
Ln 1, Col 1
Spaces: 4
UTF-8
LF
Python
3.9.12 64-bit

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