# NSO Essentials for Programmers and Network Architects (NSO201) v4.0

## What you'll learn in this course

The Cisco **NSO Essentials for Programmers and Network Architects (NSO201)** v. 4.0 course introduces you to Cisco® Network Services Orchestrator (NSO). You will learn to install Cisco NSO and use it to manage devices and create services based on YANG templates with XPath. This course provides an overview of NSO as a network automation solution, as well as introductions to NETCONF, YANG, and XPath. You will learn about managing devices and creating device templates, service management and service package creation, network element drivers, interfacing with other systems using APIs, configuring and troubleshooting system settings, managing alarms and reporting, configuring NSO for scalability and performance, and capabilities that can be added to Cisco NSO.

## Course duration

- Instructor-led training: 4 days of classes with hands-on lab practice
- E-learning: Equivalent of 4 days of instruction with videos and hands-on lab practice

## How you'll benefit

This course will help you:

- Learn to install Cisco® Network Services Orchestrator (NSO)
- Practice configuring devices with NSO
- Practice designing and managing services with YANG models
- Gain confidence with NSO configuration

## Who should enroll

- Network administrators
- Solutions designers
- System installers
- System integrators
- System administrators

## How to enroll

### E-learning

- To buy a single e-learning license, visit the Cisco Learning Network Store.
- For more than one license, or a learning library subscription, contact us at learning-bdm@cisco.com.

### Instructor-led training

- Find a class at the Cisco Learning Locator.
- Arrange training at your location through Cisco Private Group Training.

## Technology areas

- Software Defined Networking
- Network Automation
- Service Provider

## Course details

### Objectives

After completing this course, you should be able to:

- Explain the transactional service activation and how it relates to business requirements
- Explain how Cisco NSO communicates with network devices
- Understand the NETCONF protocol and be able to read and write simple YANG models
- Understand the difference between devices that are fully NETCONF capable and those that are less or not NETCONF capable
- Understand the support for candidate configuration and confirmed commit support
- Use logs to troubleshoot the Cisco NSO deployment and check NSO communication with network devices
- Explain the YANG service model structure
- Design a real-world usable service
- Explain the mapping logic of service parameters to device models and consequently to device configurations
- Describe the use of different integration options and APIs
- Explain how to implement action with use of config-templates in NSO package
- Explain the use of Reactive FASTMAP in for manipulating and implementing advanced NFV components
- Describe the use of feature components and function packs
- Define and explain the ETSI MANO principles and solution
- Work with the alarm console, and understand the NSO alarm structure and how it conforms to modern network operations procedures
- Describe Cisco NSO 5.3 new features and changes in NSO

## Prerequisites

We require the following knowledge and skills before taking this course:

- Basic knowledge of the Cisco Command-Line Interface (CLI) or the CLI of UNIX-like operating systems
- Working knowledge of UNIX-based operating systems and basic tasks
- Basic knowledge of programming constructs and YANG data modeling
- Basic knowledge of Python programming
- Basic knowledge of the NETCONF communication protocol
- Knowledge of XML data structures and schemas
- Basic management of network components (routers, switches, etc.)

The following Cisco courses can help you gain the knowledge you need to prepare for this course

- **Network Programmability Basics (Cisco DevNet Course)**
- **Introducing Automation for Cisco Solutions (CSAU)**
- **Programming for Network Engineers (PRNE)**

## Course Outline

- Section 1: Introducing Service Orchestration with Cisco NSO
  - Challenges of Network Management
  - Network Management without Cisco NSO
  - Network Management with Cisco NSO
  - Challenges of Network Orchestration
  - Addressing Management Challenges with Service Orchestration
- Section 2: Exploring Cisco NSO Architecture
  - Cisco NSO Architecture
  - Cisco NSO Components
  - Cisco NSO and Ansible
- Section 3: Orchestrating Network Solutions
  - Orchestration Use Cases Overview
  - Orchestration Use Case Examples
- Section 4: Describing Cisco NSO Operation
  - NETCONF and YANG Overview
  - Cisco NSO Packages
  - Cisco NSO Mapping Logic
  - Network Element Drivers
- Section 5: Installing Cisco NSOSetup Overview
  - Cisco NSO Local Installation
  - Installing NEDs
  - Using Netsim

- Section 6: Exploring the Advantages of NETCONF
  - NETCONF Basics
  - NETCONF Operation
- Section 7: Managing Devices Using the Device Manager
  - Device Manager Overview
  - Device Configuration Management
  - Device Connection Management
  - Templates and Groups
  - Device Template Processing
  - Commit Queues
- Section 8: Creating YANG Models
  - YANG Basics
  - Other Representations of YANG
  - YANG Data Types
  - XPath Overview
  - Basic YANG Statements
  - Verify Yang Statements
- Section 9: Using Services
  - Package Architecture
  - Creating a Service Package
  - Sample Service Configuration
  - Service Template
  - YANG Service Model
  - Deploying a Service
- Section 10: Implementing Services with Model-to-Model Mapping
  - Mapping Service Parameters
  - FASTMAP
  - Template Processing
  - NSO Transaction Model
- Section 11: Designing Services in Cisco NSO
  - Service Design Overview
  - Top-Down Service Design
  - Bottom-Up Service Design
  - Device Configuration
  - Service Model
- Section 12: Managing the Service Lifecycle
  - Service Management Tasks
  - CDM Migration
  - Service Lifecycle Management Guidelines

- Section 13: Programming with Python in Cisco NSO
  - Cisco NSO Programmability Overview
  - Python Scripting
  - Python Service Skeleton
  - Creating a Service YANG Model
  - Creating a Service Template
  - Template Processing with Python
- Section 14: Configuring and Troubleshooting System Settings
  - System Configuration
  - Role-Based Access Control
  - System Troubleshooting
- Section 15: Discovering Cisco NSO Northbound APIs
  - NSO Integration Options
  - NETCONF Server
  - Web Integration
  - SNMP Agent
- Section 16: Managing Alarms and Reporting
  - Alarm Management
  - Reporting
- Section 17: Configuring Cisco NSO for Scalability and Performance
  - High Availability
  - High-Availability Cluster Communications
  - Addressing Performance Limitations
  - Layered Service Architecture
- Section 18: Describing Cisco NSO VNF Manager and Function Packs
  - Function Packs
  - Cisco SD-WAN Solution
  - NFV Orchestration
  - Reactive FastMap

## Lab outline

- Install Cisco NSO
- Use Device Manager
- Create a Device Template
- Create a Loopback Template Service
- Create a VLAN Template Service
- Create an L3VPN Template Service
- Migrate a CDM Device
- Set Up a Device Using Python Scripts
- Create an SVI Python Template Service
- Use NSO RESTCONF API with Postman

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