
cisco
Cisco live!
June 25-29, 2017 • Las Vegas, NV

Using Cisco NSO With tail-f

Configuring, Managing, and Deploying Devices and Services

Syed Hassan, Saurabh Sharma,

Alexander Orel, Rajendra Chayapathi

LTRSPG-2515

Cisco live!

Agenda

- Introduction to Cisco NSO
- Installing Cisco NSO
- Lab exercise #1
- Introduction to Netconf /Yang
- Deploying Services using Cisco NSO
- Lab exercise #2
- Summary

Intro to Network Services Orchestrator (NSO) by tail-f

tail : displays the lines and then monitors the file. As new lines are added to the file by another process, tail updates the display

-f : In cases when the user is following a log file that rotates then it is advisable to use the -f option

eval (Tail-f NCS == Cisco NSO) ➔ true

Tail-f Network Control System (NCS) is now part of Cisco portfolio and is marketed under the name

"Cisco Network Services Orchestrator (enabled by Tail-f.)"

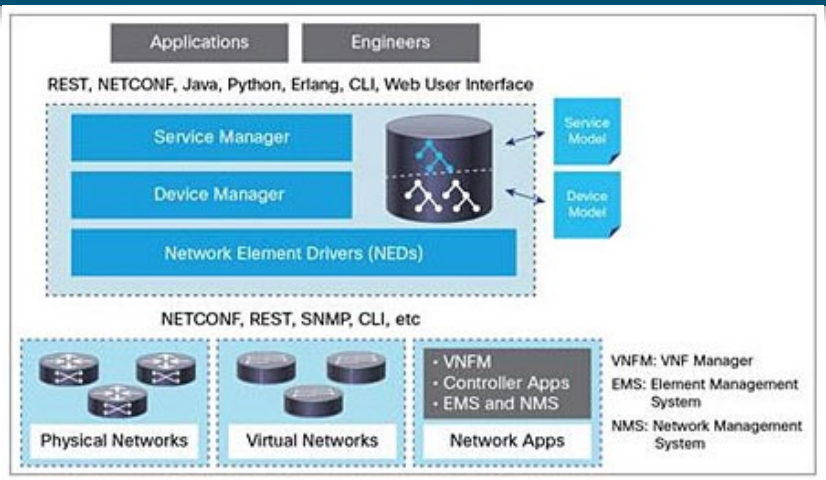
Tail-f components

Conf D

Device Configuration manager

- **Protocol:** NETCONF / SNMP
- **Interface:** CLI / Web UI / REST
- Embedded YANG database
- Cisco OEMs NCS6008, NCS5508, NCS5001, NCS5002

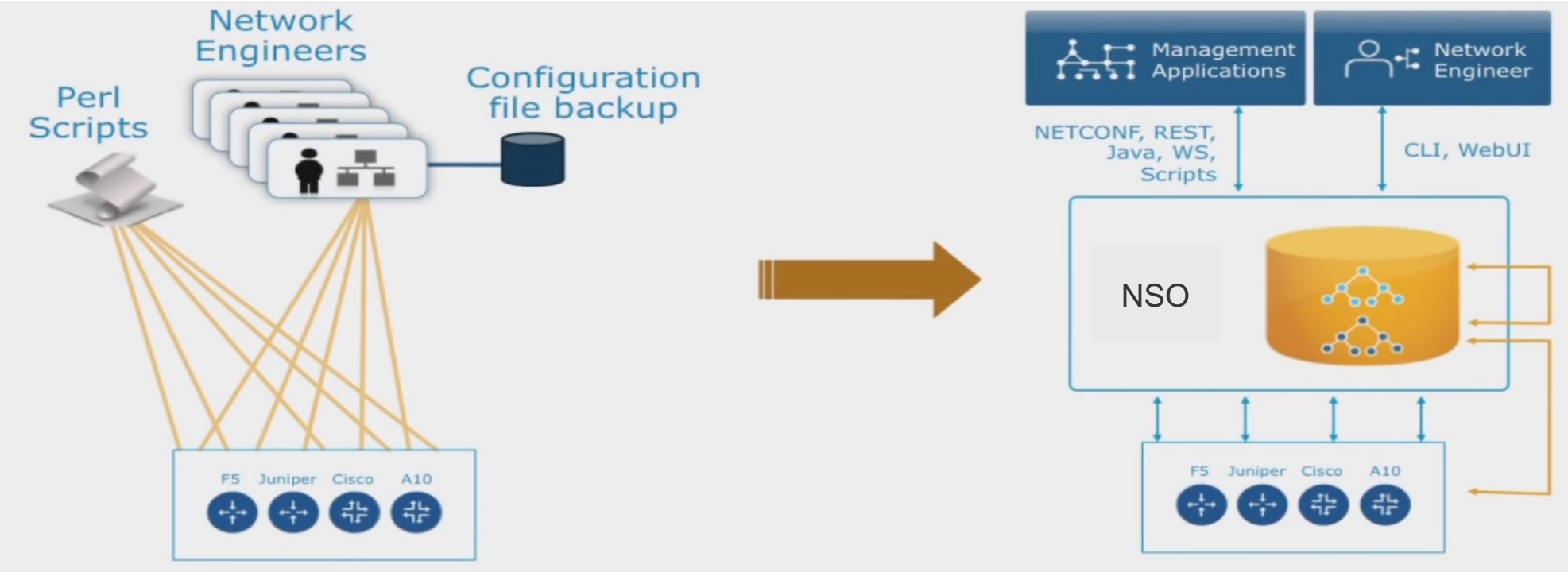
NCS == NSO



Network Orchestration / Configuration engine

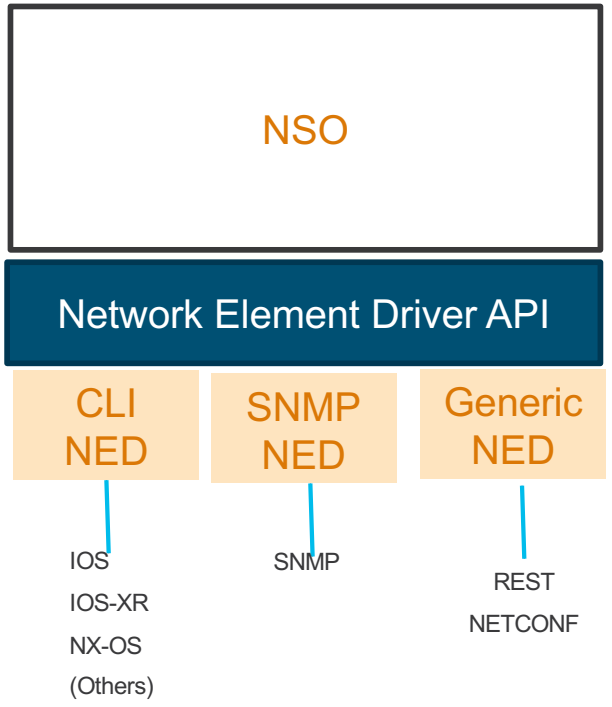
- Automatically translates YANG device models and templates
- pushes config down to individual machines

Deployment model: Existing vs NSO



NSO Network Element Driver (NED)

- Management support for devices - major bottleneck
- NSO uses Network Element Drivers (NED)
  - Communicate to any management interface
- Built in NED support for:
  - Cisco IOS
  - Cisco IOS XR
- NED packages
  - available for many other vendor products

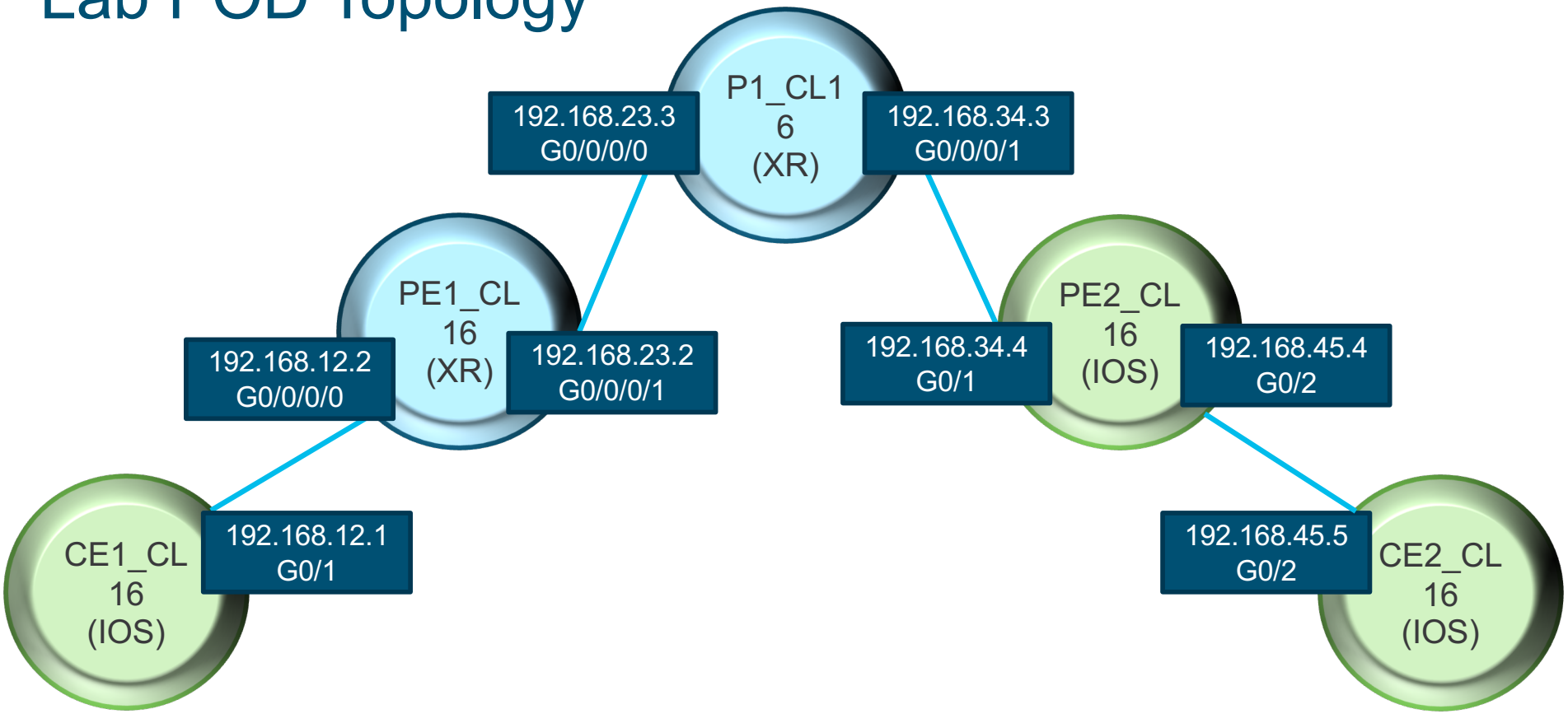


Introduction to the Tail-f NSO Lab

- Lab in two sections
- Section 1:
  - Installing the NSO system,
  - Adding NED packages,
  - Basic device configuration.
- Section 2:
  - Using Tail-f for creating and deploying services templates
- Lab manual available for download using Cisco Live site

https://cisco.box.com/v/LTRSPG2515

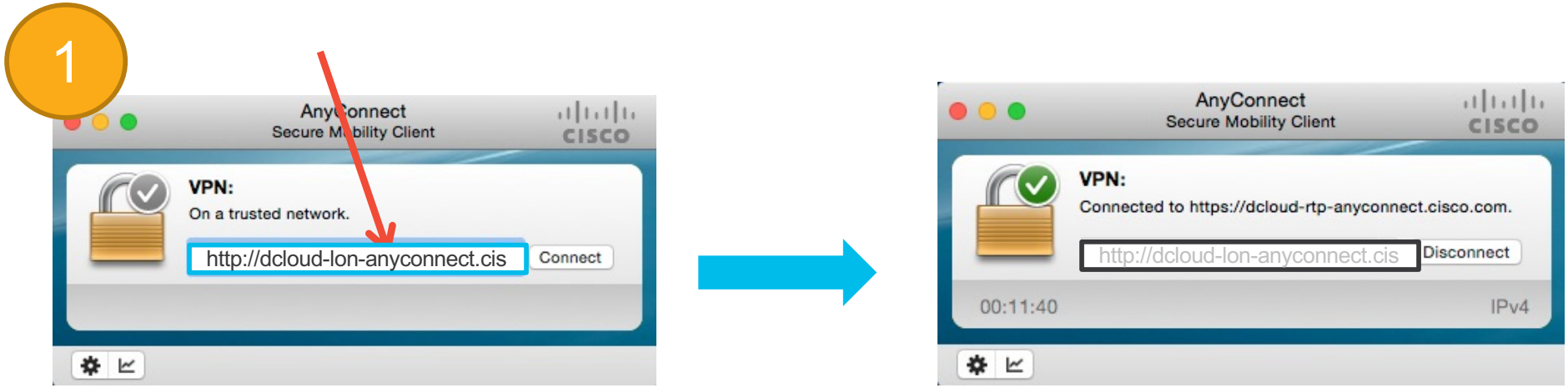
Lab POD Topology



Introduction to the Tail-f NSO Lab

- Sessions preconfigured on Cisco dCloud.
- To begin, use Cisco AnyConnect to login, use credentials provided

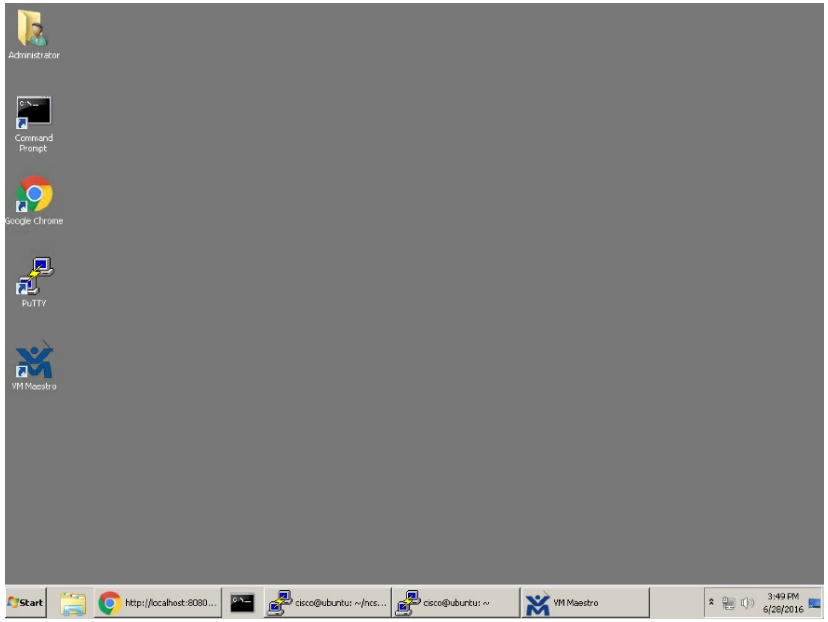
  http://dcloud-lon-anyconnect.cisco.com/



Introduction to the Tail-f NSO Lab

- Using RDP client provided on your laptop, connect to the jump server.

2



Lab Task #1:
Installing Cisco NSO by tail-f

Installing Cisco NSO by tail-f

Lab Tasks

Installing Cisco NSO

- Execute installation binary to a directory

Setup Working Environment

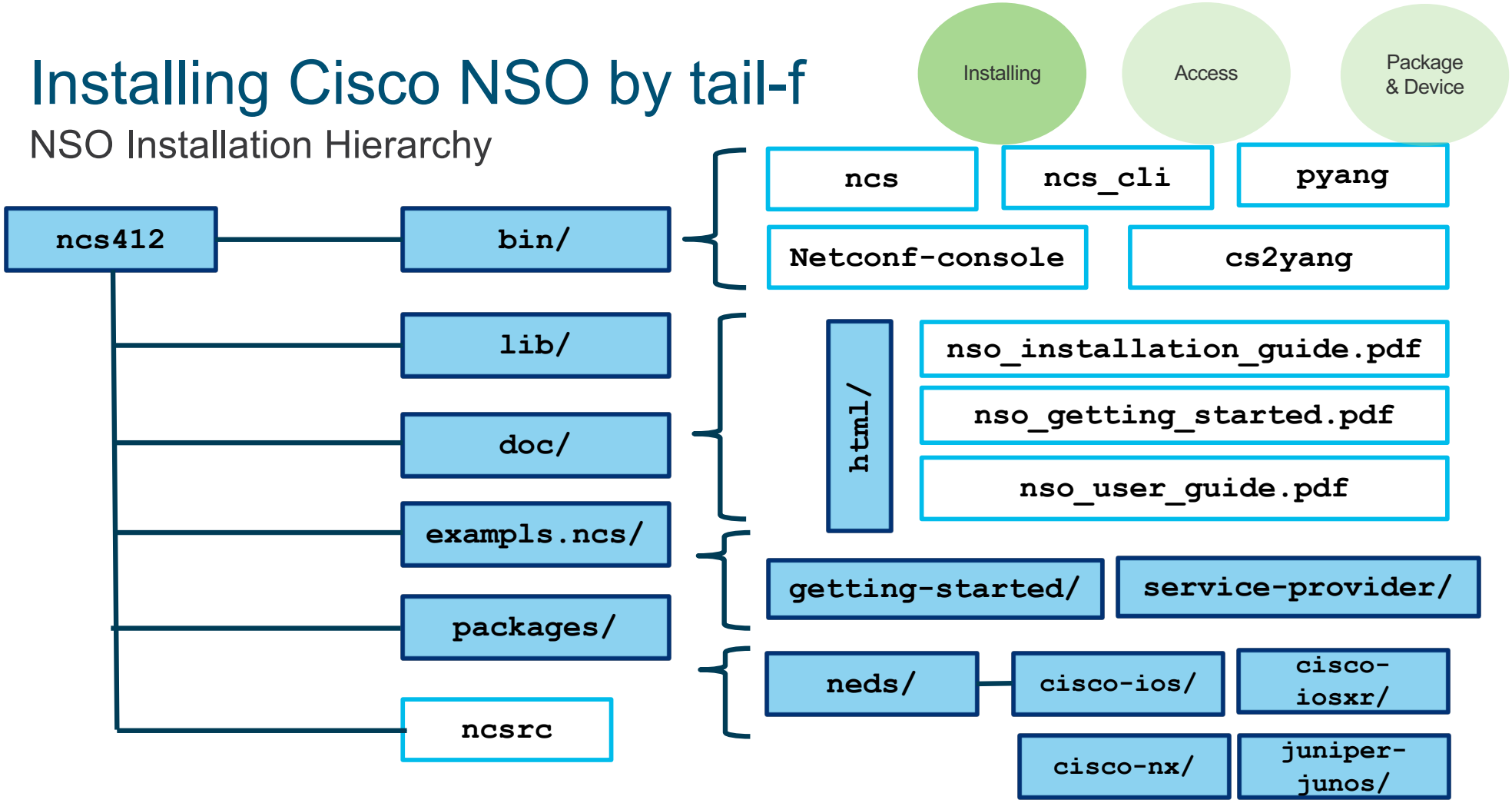
- Setup Environment using “ncsrc” file
- Use “ncs-setup” script
- No packages installed by default

Running NCS Daemon

- Daemon launched from run-time working directory
- Listens to ssh port 2024 by default (admin/admin)
- Listens to http port 8080 by default (admin/admin)

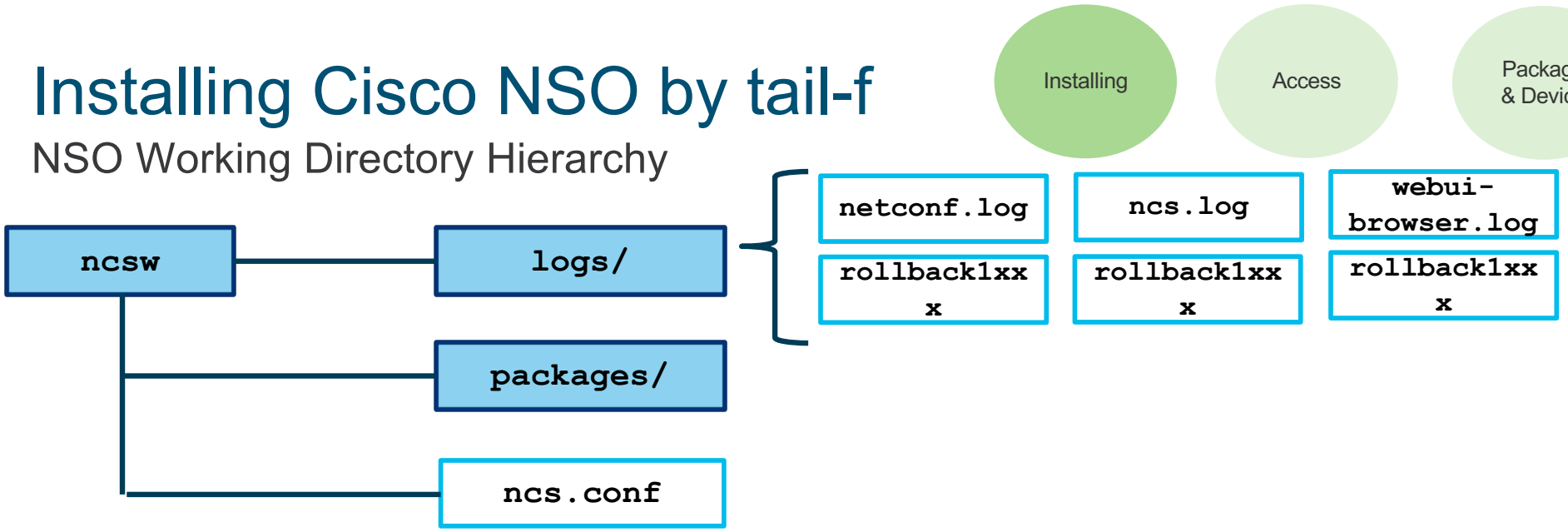
Installing Cisco NSO by tail-f

NSO Installation Hierarchy



Installing Cisco NSO by tail-f

NSO Working Directory Hierarchy



Accessing NSO

Installing Cisco NSO

Setup Working Environment

Running NCS Daemon

Accessing NSO

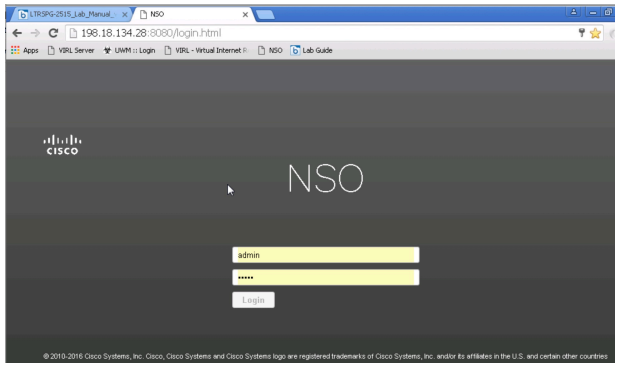
Built-in CLI

ncs_cli

SSH Session

ssh -l admin -p 2024 localhost
admin@localhost's password:

GUI



Adding Packages

Lab Tasks

Adding packages

- Packages needed to communicate with different device types
- Added by built-in Scripts

Starting NCS CLI

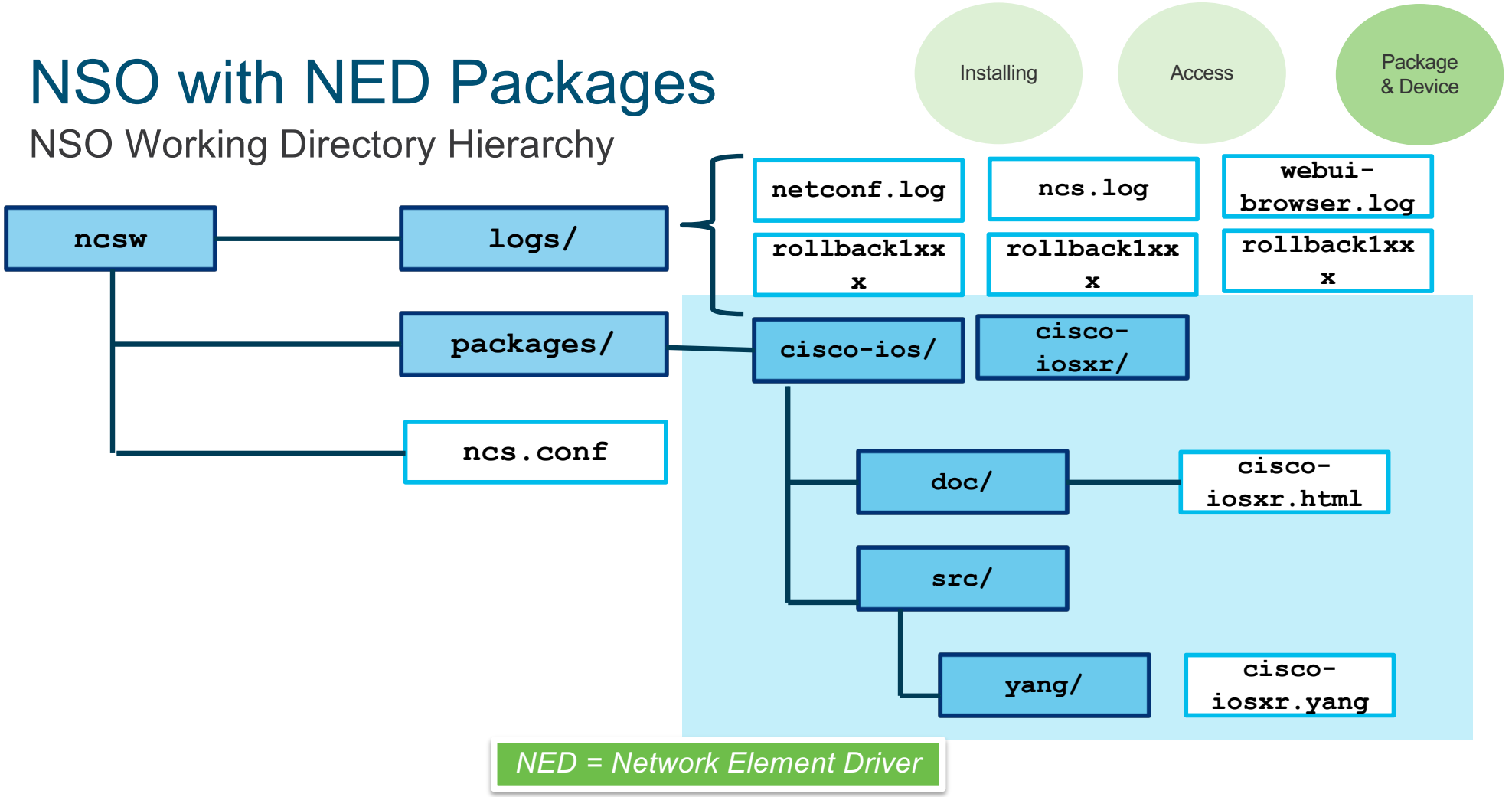
- Default CLI mode is JunOS like
- Can switch between cisco and junos like CLI
- All steps following can be done through GUI as well

Loading Newly Added Packages

- Any new packages after NCS daemon start will not automatically load
- Once loaded, daemon will also see these packages

NSO with NED Packages

NSO Working Directory Hierarchy



NED = Network Element Driver

Connecting to & Adding Devices

Lab Tasks

Define Auth Group

- Authgroup defines:
  - User name
  - User password
  - User secondary password (enable password)

Define Device

- Devices definition require:
  - A local name for the device
  - Management IP address to access the device, and authentication profile
  - Protocol of access (Telnet or SSH)
  - Type of Device (NETCONF or CLI with NED-ID)

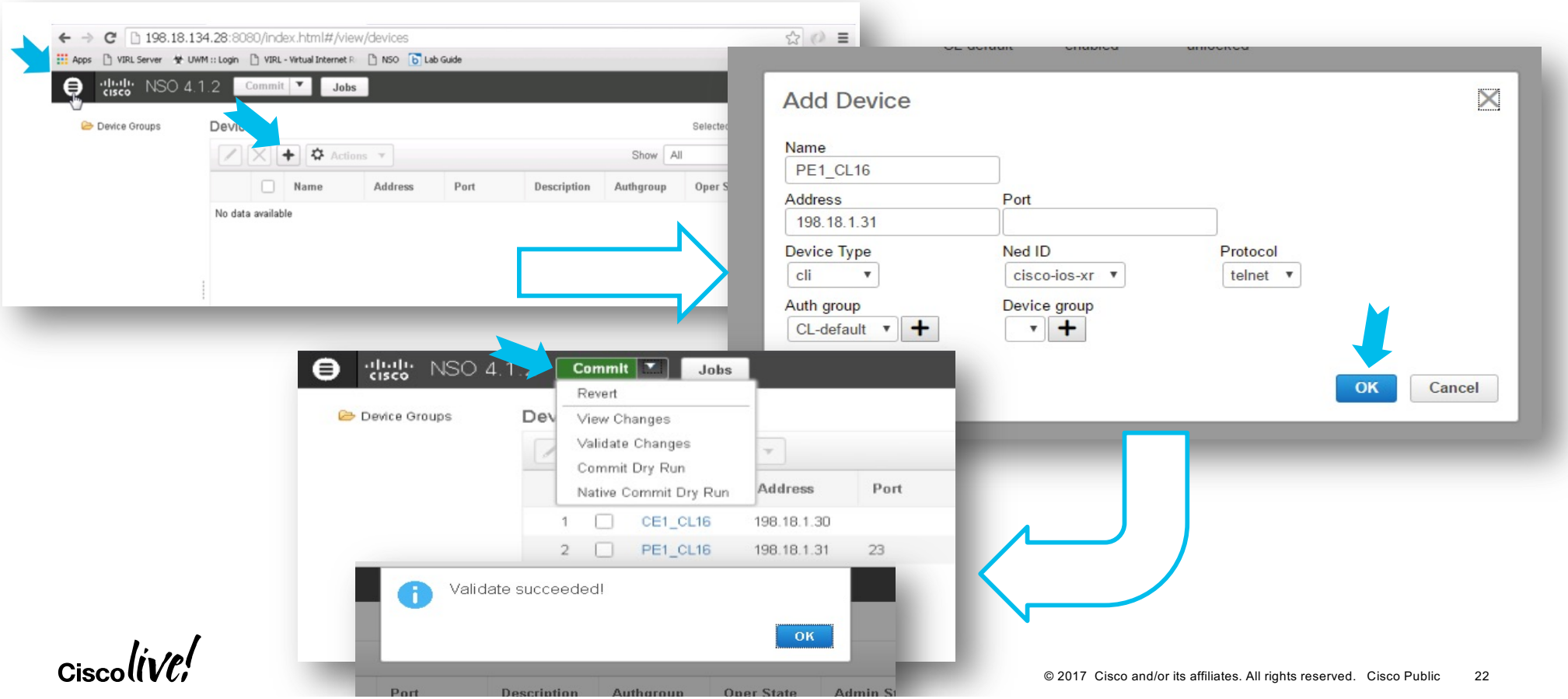
Adding & Connecting Devices

Lab Tasks

Installing

Access

Package & Device



Managing Device Configs

Lab Tasks

Load Current Config From Device

- Sync NSO Config from Current Config on Device:
  - Recommended before any configuration changes made in NSO
  - Use “sync-from” CLI command or GUI option

Unlock Device For Configuration

- NSO locks changes to Device Config
  - Safety latch to protect accidental changes
  - Needs to be Unlocked

Push NSO Changes to Device

- NSO communicates changes to the device
  - Commit configurations

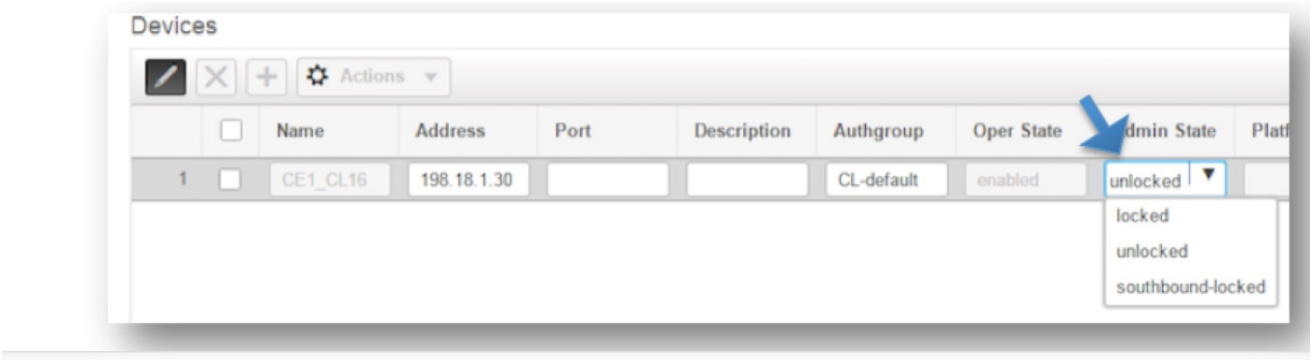
Cisco live!

Device Locks

Lab Tasks

Installing | Access | Package & Device

State	Description
Locked	Device's configuration changes are not allowed
South-bound Locked	Configuration changes can be made in the Tail-f, These changes can not be pushed out and committed to the device
Unlocked	Configuration changes can be made in Tail-f and can be pushed to the device



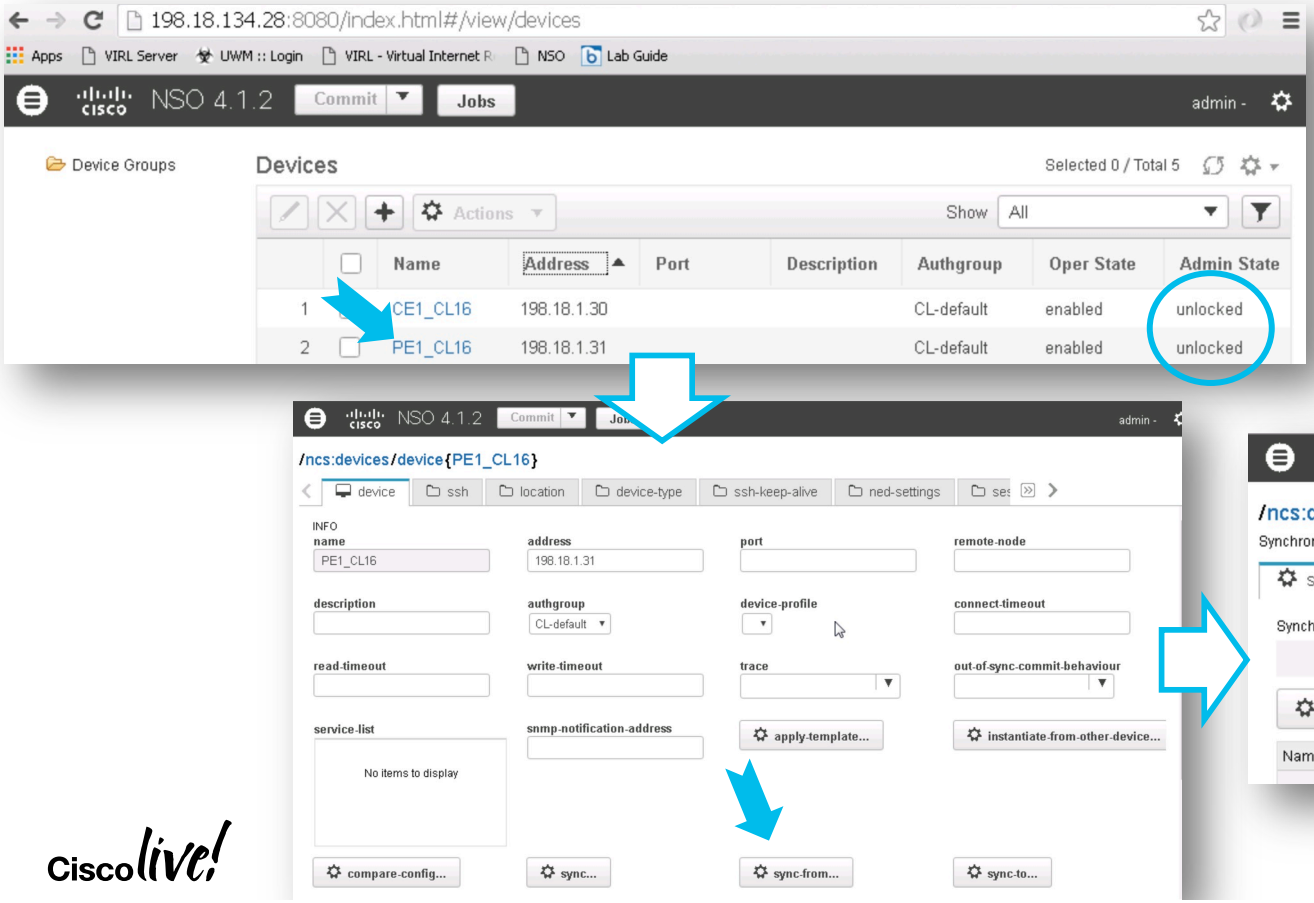
Syncing Device Configuration

Lab Tasks

Installing

Access

Package & Device



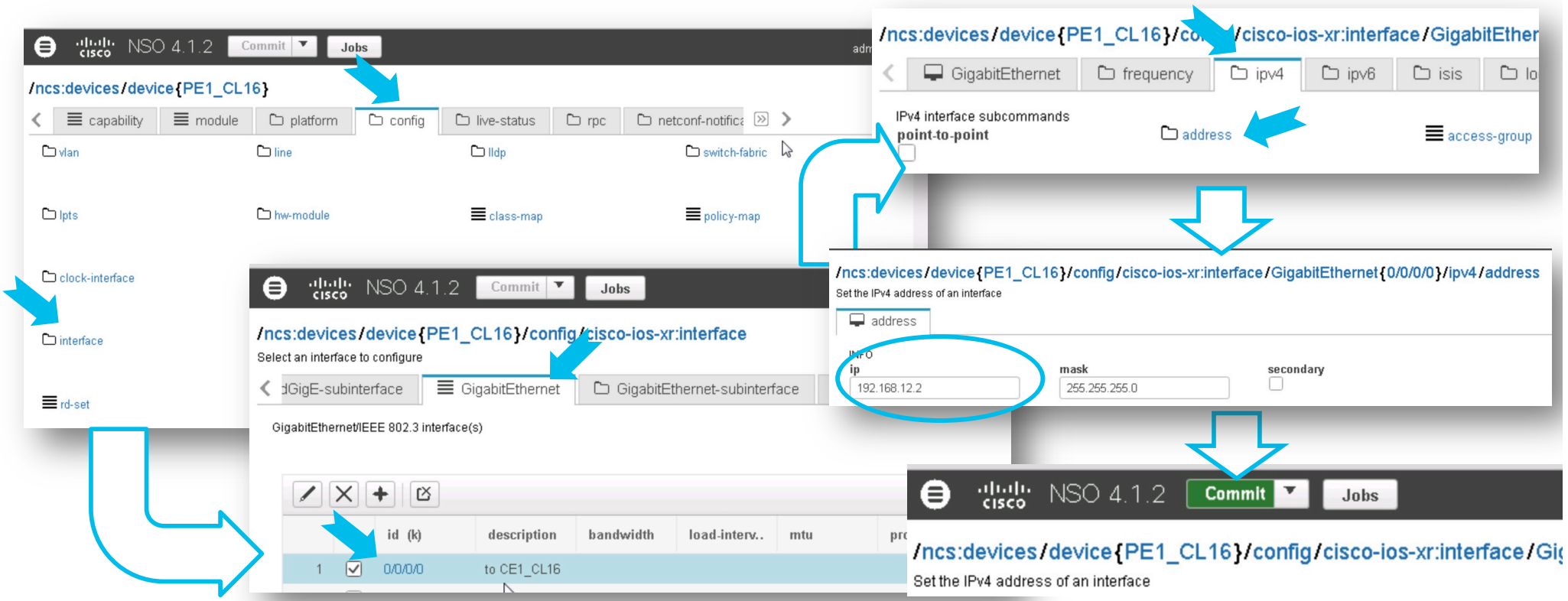
Syncing Device Configuration

Lab Tasks

Installing

Access

Package & Device



Execute Lab Task #1

http://go2.cisco.com/LTRSPG-2515

Introduction to Netconf /Yang

What is Netconf/Yang?

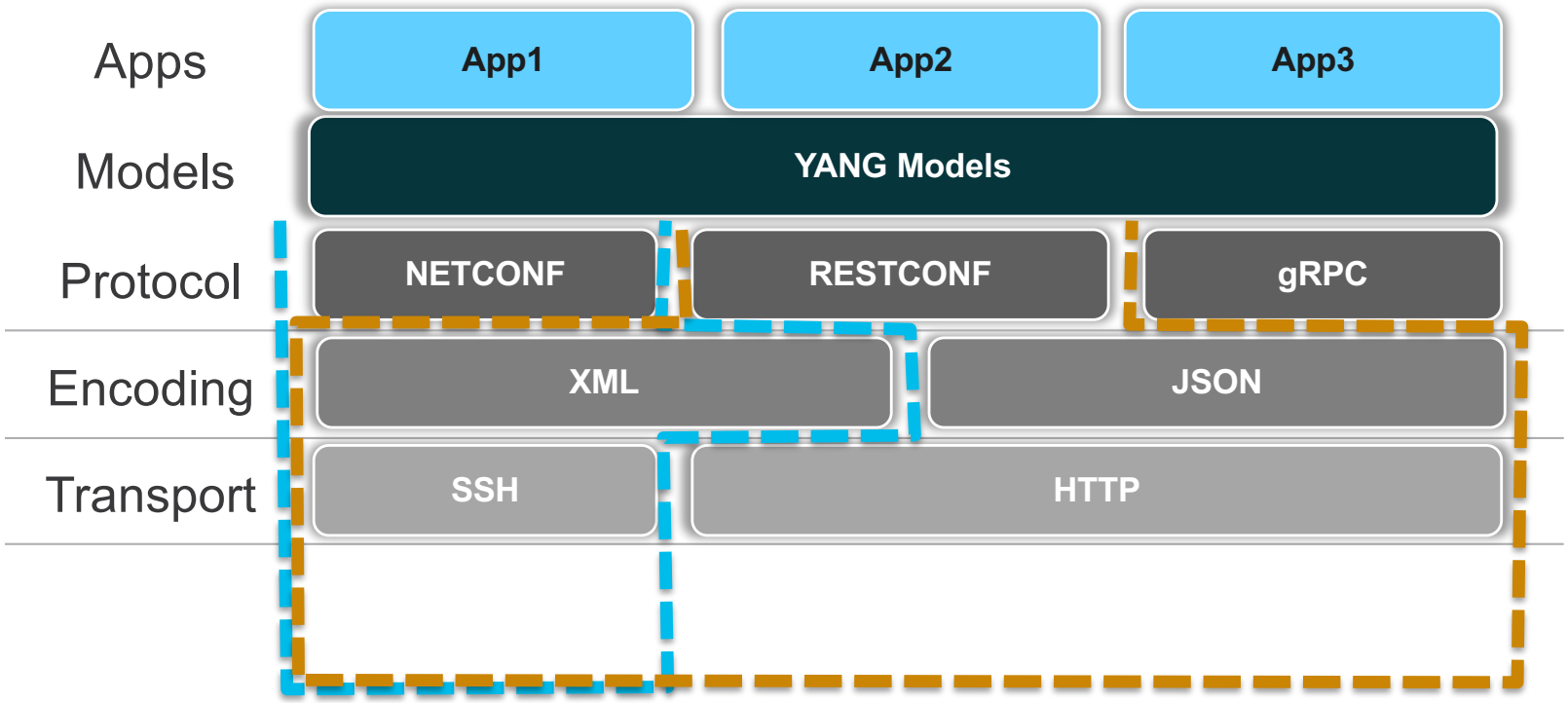
NETCONF – protocol By IETF to install, manipulate, delete the configuration of network devices.

- NETCONF (Network Configuration Protocol)
  - IETF config management protocol (RFC 6241)
  - Config access & Operational State Data
  - Uses XML to Encode

YANG - Data modeling language to model configuration and state data

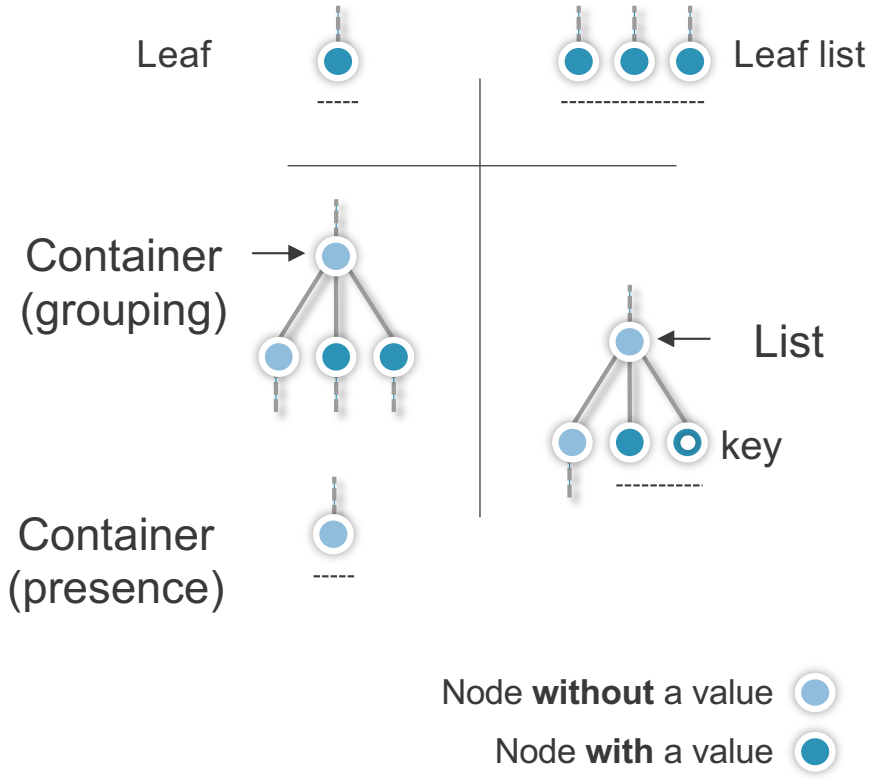
- YANG: Yet Another Next Generation Language
  - Data Modeling Language
  - Text based
  - Designed for use with NETCONF
  - Human readable
  - RFC 6020

What is Netconf/Yang?



YANG

- Nodes: Individual data items
- Main node types
  - **Leaf**:
    Holds a single value of a particular type
  - **Leaf list:**
    Sequence of leafs
    Holds multiple values of a particular type
  - **Container**:
    Groups nodes and has no value
  - **List**:
    Sequence of records with key leafs



Leaf & Leaf-List

Leaf:

```
leaf host-name {
  type string;
  mandatory true;
  config true;
  description "Hostname for this system";
}
```

Leaf-List:

```
leaf-list domain-search {
  type string;
  ordered-by user;
  description "List of domain names to
search";
}
```

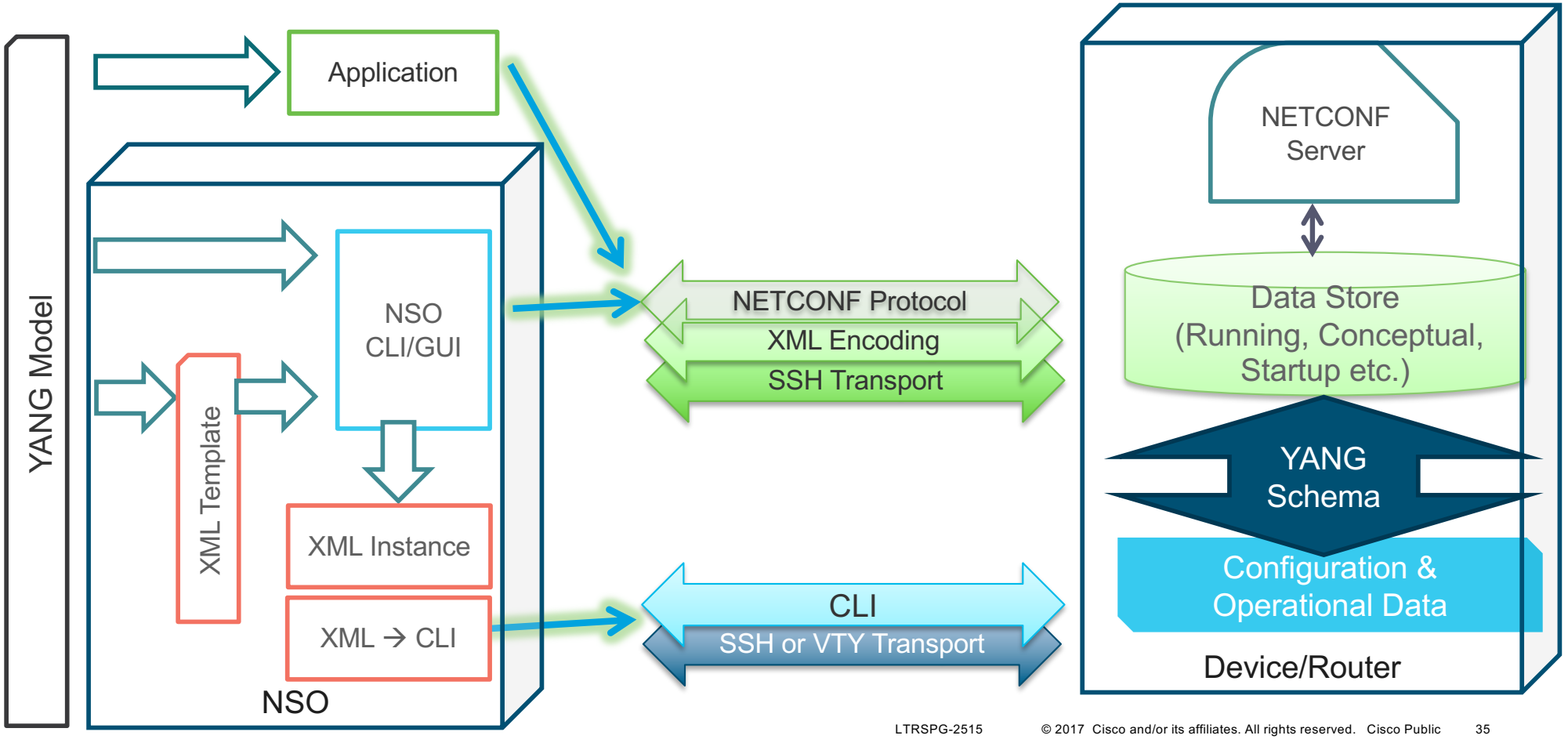
Container

```
container system {
  container services {
    container ssh {
      presence "Enables SSH";
      description "SSH service specific configuration";
       // more leafs, containers and other things
here...
    }
  }
}
```

List:

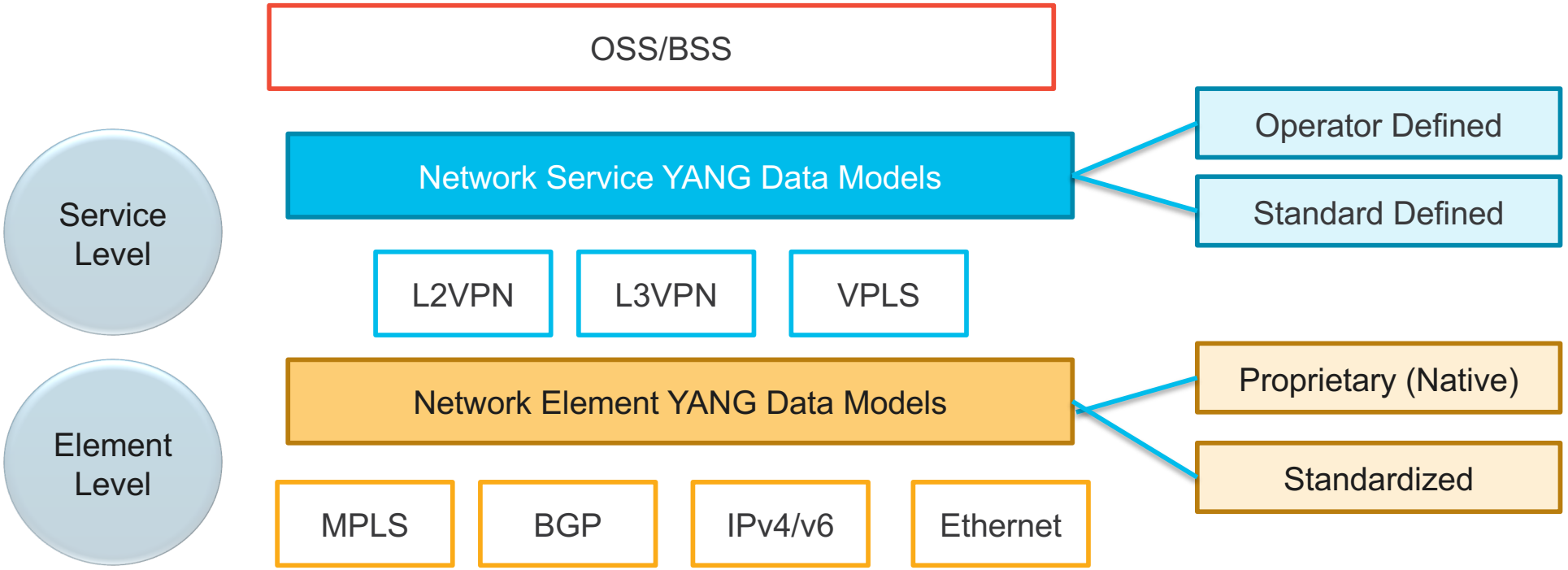
```
list user {
  key name;
  leaf name {
    type string;
  }
  leaf uid {
    type uint32;
  }
```

Netconf + YANG in Tail-f NSO context



Create and Deploy services using Cisco NSO by tail-f

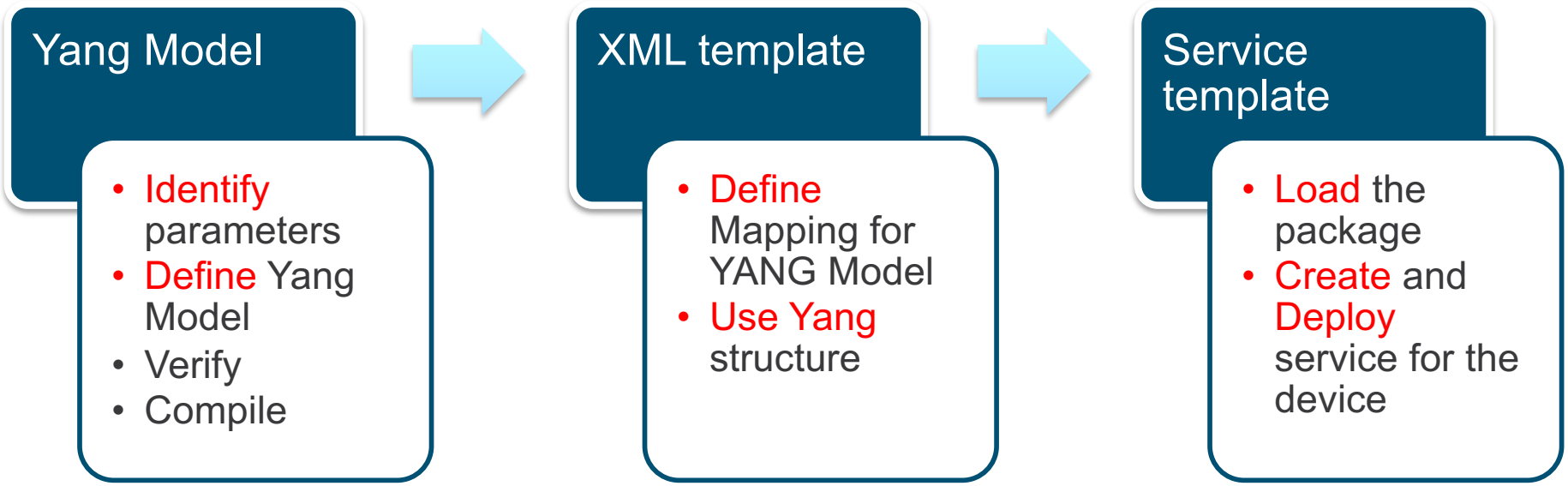
YANG Data Model Type



IETF draft-ietf-netmod-yang-model-classification

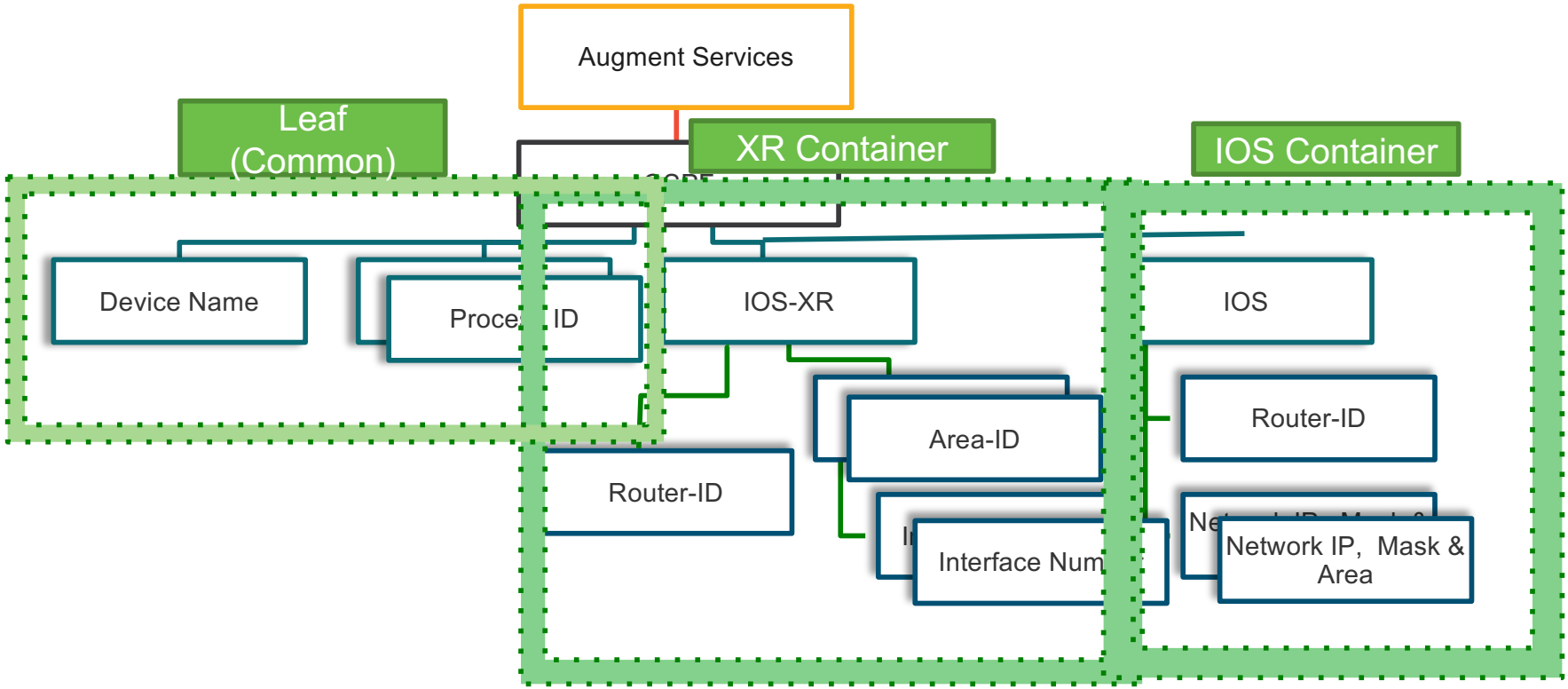
Defining Service Template

Lab Tasks



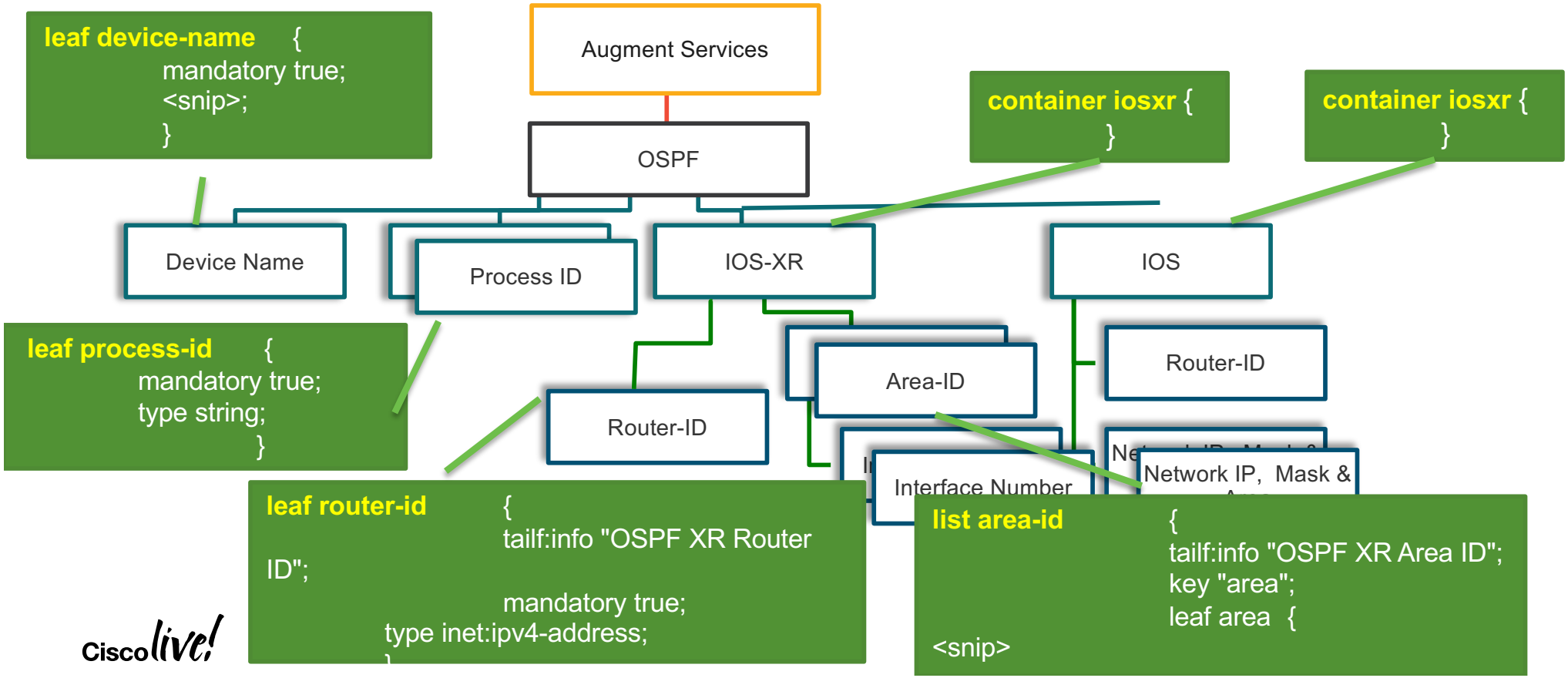
Defining Service Template

Lab Tasks



Defining Service Template

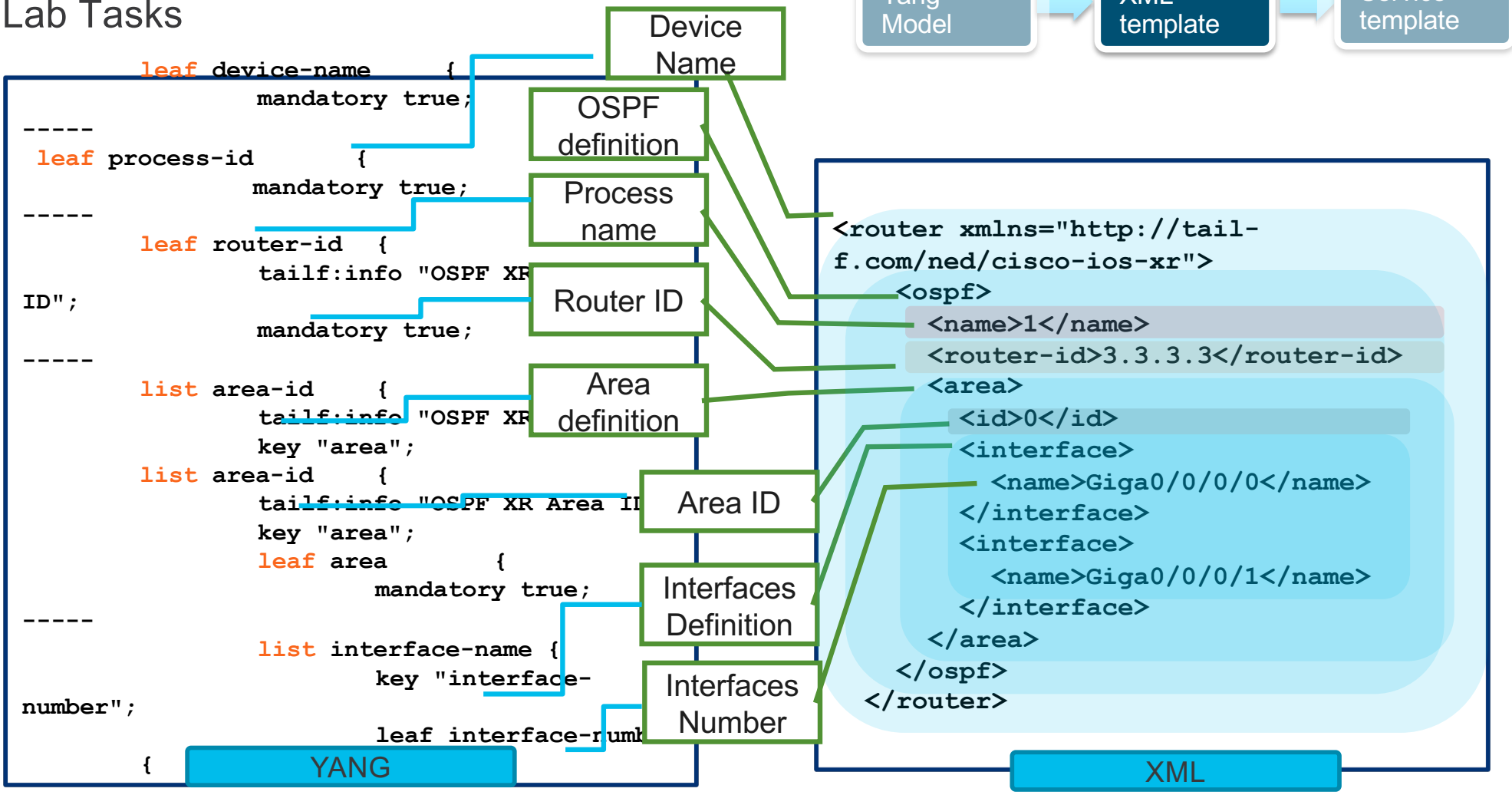
Lab Tasks



Cisco live!

Defining Service Template

Lab Tasks



Execute Lab Task #2

Bonus Lab Contents

- Using REST API for communicating to NSO
- Creating the OSPF yang model step by step
- Building XML for deploying OSPF on IOS and IOS-XR devices

Recap

- Introduction to Tail-f NCS
- Installing Tail-f NCS
- Lab exercise #1
- Introduction to Netconf /Yang
- Deploying Services using Tail-f NCS
- Lab exercise #2
- Summary

References

- XPath: http://zvon.org/comp/r/tut-XPath_1.html#Pages~List_of_XPaths
- Yang : http://www.tail-f.com/education/what-is-yang/
- Netconf Central: http://www.netconfcentral.org
- Standard Yang modules on GitHub: https://github.com/YangModels/yang
- Cisco DevNet : https://developer.cisco.com/site/nso/
- OpenDaylight Yang models and REST API: https://wiki.opendaylight.org/view/OpenDaylight_Controller:Model-Driven_Controller_Service_Abstraction_Layer
- NSO (ex Tail-f) http://www.tailf.com/education

NETCONF

- Officially published as a RFC 4741 NETCONF Configuration Protocol in late 2006. The IETF working group producing the standard also produced supporting RFCs for various transport mappings, including:
- RFC 4742 Using the NETCONF Configuration Protocol over Secure SHell (SSH)
- RFC 4743 Using NETCONF over the Simple Object Access Protocol
- RFC 5539 NETCONF over Transport Layer Security (TLS)
- The above versions was updated in 2011 to become the following:
- RFC 6241 obsoletes RFC 4741 with a small set of changes including a persist-id for confirmed commits
- RFC 6242 obsoletes RFC 4742 and introduces e.g. a new framing mechanism to address some potential security issues with the initial design
- Notable additions to the family of NETCONF RFCs produced by the working group are:
- RFC 5277 NETCONF Event Notifications that describes an asynchronous notification mechanism allowing clients to subscribe to named event streams
- RFC 6243 With-defaults Capability for NETCONF that describes an extension to the NETCONF protocol that allows clients to identify how defaults are processed by the server

Complete Your Online Session Evaluation

- Give us your feedback to be entered into a Daily Survey Drawing. A daily winner will receive a $750 gift card.
- Complete your session surveys through the Cisco Live mobile app or on www.CiscoLive.com/us.

Don't forget: Cisco Live sessions will be available for viewing on demand after the event at www.CiscoLive.com/Online.

Cisco live!

Continue Your Education

- Demos in the Cisco campus
- Walk-in Self-Paced Labs
- Lunch & Learn
- Meet the Engineer 1:1 meetings
- Related sessions

Thank you


cisco
You're
Cisco live!

R&S Related Cisco Education Offerings

Course	Description	Cisco Certification
CCIE R&S Advanced Workshops (CIERS-1 & CIERS-2) plus Self Assessments, Workbooks & Labs	Expert level trainings including: instructor led workshops, self assessments, practice labs and CCIE Lab Builder to prepare candidates for the CCIE R&S practical exam.	CCIE® Routing & Switching
• Implementing Cisco IP Routing v2.0 • Implementing Cisco IP Switched Networks V2.0 • Troubleshooting and Maintaining Cisco IP Networks v2.0	Professional level instructor led trainings to prepare candidates for the CCNP R&S exams (ROUTE, SWITCH and TSHOOT). Also available in self study eLearning formats with Cisco Learning Labs.	CCNP® Routing & Switching
Interconnecting Cisco Networking Devices: Part 2 (or combined)	Configure, implement and troubleshoot local and wide-area IPv4 and IPv6 networks. Also available in self study eLearning format with Cisco Learning Lab.	CCNA® Routing & Switching
Interconnecting Cisco Networking Devices: Part 1	Installation, configuration, and basic support of a branch network. Also available in self study eLearning format with Cisco Learning Lab.	CCENT® Routing & Switching

For more details, please visit: http://learningnetwork.cisco.com
Questions? Visit the Learning@Cisco Booth

Cisco live!

Design Cisco Education Offerings

Course	Description	Cisco Certification
Designing Cisco Network Service Architectures (ARCH) Version 3.0	Provides learner with the ability to perform conceptual, intermediate, and detailed design of a network infrastructure that supports desired capacity, performance, availability required for converged Enterprise network services and applications.	CCDP® (Design Professional) (Available Now)
Designing for Cisco Internetwork Solutions (DESGN) Version 3.0	Instructor led training focused on fundamental design methodologies used to determine requirements for network performance, security, voice, and wireless solutions. Prepares candidates for the CCDA certification exam.	CCDA® (Design Associate) (Available Now)

For more details, please visit: http://learningnetwork.cisco.com
Questions? Visit the Learning@Cisco Booth

Cisco live!

Wireless Cisco Education Offerings

Course	Description	Cisco Certification
• Designing Cisco Wireless Enterprise Networks • Deploying Cisco Wireless Enterprise Networks • Troubleshooting Cisco Wireless Enterprise Networks • Securing Cisco Wireless Enterprise Networks	Professional level instructor led trainings to prepare candidates to conduct site surveys, implement, configure and support APs and controllers in converged Enterprise networks. Focused on 802.11 and related technologies to design, deploy, troubleshoot as well as secure Wireless infrastructure. Course also provide details around Cisco mobility services Engine, Prime Infrastructure and wireless security.	CCNP® Wireless Version 3.0
Implementing Cisco Unified Wireless Network Essential	Prepares candidates to design, install, configure, monitor and conduct basic troubleshooting tasks of a Cisco WLAN in Enterprise installations.	CCNA® Wireless
Deploying Basic Cisco Wireless LANs (WDBWL)	Understanding of the Cisco Unified Wireless Networking for enterprise deployment scenarios. In this course, you will learn the basics of how to install, configure, operate, and maintain a wireless network, both as an add-on to an existing wireless LAN (WLAN) and as a new Cisco Unified Wireless Networking solution.	1.2
Deploying Advanced Cisco Wireless LANs (WDAWL)	The WDAWL advanced course is designed with the goal of providing learners with the knowledge and skills to successfully plan, install, configure, troubleshoot, monitor, and maintain advanced Cisco wireless LAN solutions such as QoS, “salt and pepper” mobility, high density deployments, and outdoor mesh deployments in an enterprise customer environment.	1.2
Deploying Cisco Connected Mobile Experiences (WCMX)	WCMX will prepare professionals to use the Cisco Unified Wireless Network to configure, administer, manage, troubleshoot, and optimize utilization of mobile content while gaining meaningful client analytics.	2.0

For more details, please visit: http://learningnetwork.cisco.com
Questions? Visit the Learning@Cisco Booth

Cisco live!

Cybersecurity Cisco Education Offerings

Course	Description	Cisco Certification
Understanding Cisco Cybersecurity Fundamentals (SFUND)	The SECFND course provides understanding of cybersecurity's basic principles, foundational knowledge, and core skills needed to build a foundation for understanding more advanced cybersecurity material & skills.	CCNA® Cyber Ops
Implementing Cisco Cybersecurity Operations (SECOPS)	This course prepares candidates to begin a career within a Security Operations Center (SOC), working with Cybersecurity Analysts at the associate level.	CCNA® Cyber Ops
Securing Cisco Networks with Threat Detection and Analysis (SCYBER)	Designed for security analysts who work in a Security Operations Center, the course covers essential areas of security operations competency, including SIEM, Event monitoring, security event/alarm/traffic analysis (detection), and incident response	Cisco Cybersecurity Specialist
Cisco Security Product Training Courses	Official deep-dive, hands-on product training on Cisco's latest security products, including NGFW, ASA, NGIPS, AMP, Identity Services Engine, Email and Web Security Appliances, and more.	

For more details, please visit: www.cisco.com/go/securitytraining or http://learningnetwork.cisco.com
Questions? Visit the Learning@Cisco Booth

Cybersecurity Cisco Education Offerings

Course	Description	Cisco Certification
New! CCIE Security 5.0		CCIE® Security
Implementing Cisco Edge Network Security Solutions (SENSS) Implementing Cisco Threat Control Solutions (SITCS) v1.5 Implementing Cisco Secure Access Solutions (SISAS) Implementing Cisco Secure Mobility Solutions (SIMOS)	Configure Cisco perimeter edge security solutions utilizing Cisco Switches, Cisco Routers, and Cisco Adaptive Security Appliance (ASA) Firewalls Implement Cisco's Next Generation Firewall (NGFW), FirePOWER NGIPS (Next Generation IPS), Cisco AMP (Advanced Malware Protection), as well as Web Security, Email Security and Cloud Web Security Deploy Cisco's Identity Services Engine and 802.1X secure network access Protect data traversing a public or shared infrastructure such as the Internet by implementing and maintaining Cisco VPN solutions	CCNP® Security
Implementing Cisco Network Security (IINS 3.0)	Focuses on the design, implementation, and monitoring of a comprehensive security policy, using Cisco IOS security features	CCNA® Security

For more details, please visit: www.cisco.com/go/securitytraining or http://learningnetwork.cisco.com
Questions? Visit the Learning@Cisco Booth

Cisco live!

Data Center / Virtualization Cisco Education Offerings

Course	Description	Cisco Certification
Introducing Cisco Data Center Networking (DCICN); Introducing Cisco Data Center Technologies (DCICT)	Get job-ready foundational-level certification and skills in installing, configuring, and maintaining next generation data centers.	CCNA® Data Center
Implementing Cisco Data Center Unified Computing v6.0 (DCUCI) Implementing Cisco Data Center Infrastructure v6.0 (DCII) Implementing Cisco Data Center Virtualization and Automation v6.0 Designing Cisco Data Center Infrastructure v6.0 (DCID) Troubleshooting Cisco Data Center Infrastructure v6.0 (DCIT)	Obtain professional level skills to design, configure, implement, troubleshoot next generation data center infrastructure.	CCNP® Data Center
Product Training Portfolio:DCAC9K, DCINX9K, DCMDS, DCUCS, DCNX1K, DCNX5K, DCNX7K, HFLEX200 UCSDF, UCSDACI, DCUCCEN	Gain hands-on skills using Cisco solutions to configure, deploy, manage and troubleshoot unified computing, policy-driven and virtualized data center infrastructure.	
Designing the FlexPod® Solution (FPDESIGN); Implementing and Administering the FlexPod® Solution (FPIMPADM)	Learn how to design, implement and administer FlexPod® solutions	Cisco and NetApp Certified FlexPod® Specialist
Designing the VersaStack Solution (VSDESIGN); Implementing and Administering the VersaStack Solution (VSIMP)	Learn how to design, implement and administer VersaStack solutions	

For more details, please visit: http://learningnetwork.cisco.com
Questions? Visit the Learning@Cisco Booth

Cisco live!

Network Programmability Cisco Education Offerings

Course	Description	Cisco Certification
Developing with Cisco Network Programmability (NPDEV)	Provides Application Developers with comprehensive curriculum to develop infrastructure programming skills; Addresses needs of software engineers who automate network infrastructure and/or utilize APIs and toolkits to interface with SDN controllers and individual devices	Cisco Network Programmability Developer (NPDEV) Specialist Certification
Designing and Implementing Cisco Network Programmability (NPDESI)	Provides network engineers with comprehensive soup-to-nuts curriculum to develop and validate automation and programming skills; Directly addresses the evolving role of network engineers towards more programmability, automation and orchestration	Cisco Network Programmability Design and Implementation (NPDESI) Specialist Certification
Programming for Network Engineers (PRNE)	Learn the fundamentals of Python programming – within the context of performing functions relevant to network engineers. Use Network Programming to simplify or automate tasks	Recommended pre-requisite for NPDESI and NPDEV Specialist Certifications
Cisco Digital Network Architecture Implementation Essentials (DNAIE)	This training provides students with the guiding principles and core elements of Cisco's Digital Network Architecture (DNA) architecture and its solution components including; APIC-EM, NFV, Analytics, Security and Fabric.	None

For more details, please visit: http://learningnetwork.cisco.com
Questions? Visit the Learning@Cisco Booth

Cisco live!

Cloud Cisco Education Offerings

Course	Description	Cisco Certification
Understanding Cloud Fundamentals (CLDFND) Introducing Cloud Administration (CLDADM)	Learn how to perform foundational tasks related to Cloud computing, and the essentials of Cloud infrastructure, administration and operations	CCNA Cloud
Implementing and Troubleshooting the Cisco Cloud Infrastructure (CLDINF); Designing the Cisco Cloud (CLDDES); Automating the Cisco Enterprise Cloud (CLDAUT); Building the Cisco Cloud with Application Centric Infrastructure (CLDACI)	Obtain professional level skills to design, automate, secure, provision and manage private and hybrid Clouds	CCNP Cloud
Product Training Portfolio: UCS Director: UCSDF, UCSDACI Prime Service Catalog: PSCF, PSCI, PSCD MetaPod: MPODF20	Gain in-depth hands-on skills using Cisco solutions to configure, deploy, manage and troubleshoot Cloud deployments	

For more details, please visit: http://learningnetwork.cisco.com
Questions? Visit the Learning@Cisco Booth

Cisco live!

Collaboration Cisco Education Offerings

Course	Description	Cisco Certification
CCIE Collaboration Advanced Workshop (CIEC)	Gain expert-level skills to integrate, configure, and troubleshoot complex collaboration networks	CCIE® Collaboration
Implementing Cisco Collaboration Applications (CAPPS)	Understand how to implement the full suite of Cisco collaboration applications including Jabber, Cisco Unified IM and Presence, and Cisco Unity Connection.	CCNP® Collaboration
Implementing Cisco IP Telephony and Video Part 1 (CIPTV1) Implementing Cisco IP Telephony and Video Part 2 (CIPTV2) Troubleshooting Cisco IP Telephony and Video (CTCOLLAB)	Learn how to implement Cisco Unified Communications Manager, CUBE, and audio and videoconferences in a single-site voice and video network. Obtain the skills to implement Cisco Unified Communications Manager in a modern, multisite collaboration environment. Troubleshoot complex integrated voice and video infrastructures	CCNP® Collaboration
Implementing Cisco Collaboration Devices (CICD) Implementing Cisco Video Network Devices (CIVND)	Acquire a basic understanding of collaboration technologies like Cisco Call Manager and Cisco Unified Communications Manager. Learn how to evaluate requirements for video deployments, and implement Cisco Collaboration endpoints in converged Cisco infrastructures.	CCNA® Collaboration

For more details, please visit: http://learningnetwork.cisco.com
Questions? Visit the Learning@Cisco Booth

Cisco live!

Service Provider Cisco Education Offerings

Course	Description	Cisco Certification
Deploying Cisco Service Provider Network Routing (SPROUTE) & Advanced (SPADVROUTE) Implementing Cisco Service Provider Next-Generation Core Network Services (SPCORE) Edge Network Services (SPEDGE)	SPROUTE covers the implementation of routing protocols (OSPF, IS-IS, BGP), route manipulations, and HA routing features; SPADVROUTE covers advanced routing topics in BGP, multicast services including PIM-SM, and IPv6; SPCORE covers network services, including MPLS-LDP, MPLS traffic engineering, QoS mechanisms, and transport technologies; SPEDGE covers network services, including MPLS Layer 3 VPNs, Layer 2 VPNs, and Carrier Ethernet services; all within SP IP NGN environments.	CCNP Service Provider®
Building Cisco Service Provider Next-Generation Networks, Part 1&2 (SPNGN1), (SPNGN2)	The two courses introduce networking technologies and solutions, including OSI and TCP/IP models, IPv4/v6, switching, routing, transport types, security, network management, and Cisco OS (IOS and IOS XR).	CCNA Service Provider®
Implementing Cisco Service Provider Mobility UMTS Networks (SPUMTS); Implementing Cisco Service Provider Mobility CDMA Networks (SPCDMA); Implementing Cisco Service Provider Mobility LTE Networks (SPLTE)	The three courses (SPUMTS, SPCDMA, SPLTE) cover knowledge and skills required to understand products, technologies, and architectures that are found in Universal Mobile Telecommunications Systems (UMTS) and Code Division Multiple Access (CDMA) packet core networks, plus their migration to Long-Term Evolution (LTE) Evolved Packet Systems (EPS), including Evolved Packet Core (EPC) and Radio Access Networks (RANs).	Cisco Service Provider Mobility CDMA to LTE Specialist; Cisco Service Provider Mobility UMTS to LTE Specialist
Implementing and Maintaining Cisco Technologies Using IOS XR (IMTXR)	Service Provider/Enterprise engineers to implement, verification-test, and optimize core/edge technologies in a Cisco IOS XR environment.	Cisco IOS XR Specialist

For more details, please visit: http://learningnetwork.cisco.com
Questions? Visit the Learning@Cisco Booth

Cisco live!

Internet of Things (IoT) Cisco Education Offerings

Course	Description	Cisco Certification
NEW! Managing Industrial Networks for Manufacturing (IMINS2 v1.3)	An associate level instructor led lab based training focuses on common industrial application protocols, security, wireless and troubleshooting designed to prepare you for the CCNA Industrial certification	CCNA® Industrial
Managing Industrial Networks with Cisco Networking Technologies (IMINS)	This instructor led lab based training addresses foundational skills needed to manage and administer networked industrial control systems for today's connected plants and enterprises. It helps prepare plant administrators, control system engineers and traditional network engineers for the Cisco Industrial Networking Specialist certification.	Cisco Industrial Networking Specialist
Control Systems Fundamentals for Industrial Networking (ICINS)	For IT and Network Engineers, provides an introduction to industry IoT verticals, automation environment and an overview of industrial control networks (E-Learning)	Pre-learning for IMINS, IMINS2 training & certifications
Networking Fundamentals for Industrial Control Systems (INICS)	For Industrial Engineers and Control System Technicians, covers basic IP and networking concepts, and introductory overview of Automation industry Protocols.	Pre-learning for IMINS, IMINS2 training & certifications

For more details, please visit: http://learningnetwork.cisco.com
Questions? Visit the Learning@Cisco Booth

Data and Analytics Cisco Education Offerings

Course	Description
ANDMB – Data Management, Architecture and Applications	Provides hands on training with a technical mix of application, compute, storage and networking topics concerning the deployment of Big Data clusters.
ANDMA – Advanced Data Management, Architecture and Applications	Covers major architecture design to cater to different needs of the application, data center or deployment requirements. It provides architectural designs and advanced hands-on training on topics covering Scaling of cluster to thousands of nodes and management, Data Life Cycle management with HDFS tiered storage, and different approaches for Multi-tenant Hadoop cluster deployments with Openstack
ANCISB – Basic Course in Data Virtualization based on Cisco Information Server	Hands-on accelerated training on installing and developing with Cisco Information Server Application Data Services. It provides technical guidance to engineers who will be performing complex integration activities.
ANCISV – Advanced Course in Data Virtualization based on Cisco Information Server	Recommended course for administrators who need to understand how Cisco Information Server fits into their environment and the types of administration tasks typically required by the product.
ANCISM – Administration Course in Data Virtualization based on Cisco Information Server	Course is for candidates who are familiar with Cisco Data Virtualization “basics” and want to focus on advanced Cisco Information Server features.

Data and Analytics training page: http://www.cisco.com/c/en/us/training-events/resources/learning-services/technology/data-analytics.html
For more details, please visit: http://learningnetwork.cisco.com
Questions? Visit the Learning@Cisco Booth

Cisco live!

Digital Business Transformation
Cisco Education Offerings

Course	Description	Cisco Certification
For IT and Network Professionals:		
Building Business Specialist Skills	• Builds non-technical skills key to ensure business impact and influence. Topics include: business analysis, finance, technology adoption and effective communications. • Bridges IT and business impacts of mature and emerging solutions including cloud plus Internet of Everything	Cisco Enterprise IT Business Specialist
For Technology Sellers:		
Applying Cisco Specialized Business Value Analysis Skills	Builds skills to discover and address technology needs using a business-focused, consultative sales approach	Cisco Business Value Specialist
Executing Advanced Cisco Business Value Analysis and Design Techniques	Enables customer transformation through business architecture and solution selling expertise	Cisco Certified Business Value Practitioner
Performing Cisco Business-Focused Transformative Architecture Engagements	Provides skills and an approach to build a strategic roadmap of IT initiatives, aligned to business priorities	Cisco Transformative Architecture Specialist
Cisco Customer Success Manager Specialist	Prepares for the crucial role that drives adoption and enablement, ensuring that customers achieve their expected business outcomes, and reduces churn/increases renewal for services and subscription based products.	Cisco Certified Customer Success Manager

For more details, please visit: http://learningnetwork.cisco.com
Questions? Visit the Learning@Cisco Booth

Cisco live!