Perpetual Solutions
Delivering Knowledge

MEF Professional Certification Workshops
Fri, 12 Oct @ Layer123 SDN NFV World Congress 2018

> MEF SDN/NFV Professional
> MEF Network Foundations
+ Additional SD-WAN, SDN/NFV and related training

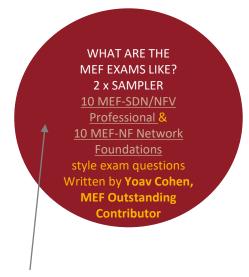# MEF Vendor Agnostic Professional Certifications

Validate your knowledge with vendor-neutral industry recognized certifications

MEF-SDN/NFV Certified Professional

- The MEF-SDN/NFV certification validates individuals' technical-level understanding of how to plan, build and operate modern networks. Knowledge and practice domains include SDN, NFV, and use cases in these domains. This new certification is geared toward the technical and engineering professional working in a technical role for an organization either providing or consuming modern network services (enterprise data centers, carrier managers, network operations center, etc.).

- Perpetual Solutions is a MEF Accredited Training Partner (MEF-ATP) helping to build and deliver MEF Professional Certifications.

MEF-NF MEF Network Foundations

- The Network Foundations (MEF-NF) certification validates individuals' concept-level understanding of key modern networking terms, processes, and elements. Knowledge and practice domains include SDN, NFV, Connectivity Services/CE, LSO/Orchestration, and use cases in these domains. This new certification is geared toward the marketing or technical sales professional working in a support role for an organization either providing or consuming modern network services (enterprise data centers, carrier managers, network operations center, etc.).

- Perpetual Solutions is an MEF Accredited Training Partner (MEF-ATP) helping to build and deliver MEF Professional Certifications.

WHAT ARE THE MEF EXAMS LIKE?
2 x SAMPLER
10 MEF-SDN/NFV Professional &
10 MEF-NF Network Foundations
style exam questions
Written by **Yoav Cohen, MEF Outstanding Contributor**

Follow links to test your knowledge.

Registration free - limited time offer

for Layer123 delegates!

SDN, NFV and Network Automation

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MEF Network Foundations

Course Code	PWL443
Duration	2 Day Workshop: 1 day live 12 Oct @ Layer123 SDN World Congress + 1 day virtual + virtual exam
Price	$795 USD. Includes MEF Exam Fee. +++ Use this link to register now +++

Course Description

This course prepares the student for the MEF Network Foundations (NF) certification exam. Passing the MEF-NF exam formally certifies that the successful candidate has vendor-neutral conceptual knowledge of the major domains of software-driven networking (SDN). The knowledge domains include SDN, NFV, Carrier Ethernet/Connectivity Services, Lifecycle Services Orchestration (LSO), and various combinations and use cases in these practice areas, collectively called 'The Software-Driven Network Vision'.

This course will educate the student and equip him with the required knowledge for the exam.

Objectives

- Discover the building blocks of Software Defined Networking (SDN)
- Examine the fundamentals of Network Functions Virtualization (NFV)
- Understand Lifecycle Services Orchestration
- Explore MEF Carrier Ethernet Concepts
- Gain understanding of the Software-Driven Network Vision

Target Audience

The major focus of this certification is the IT professional currently working in network operations e.g., server, network, storage andadministrators who is seeking greater responsibility in their current job, or seeking to validate new skills to gain a better job, or is interested in modern network technologies.

Additionally, the marketing, support, product management, and entry-level technical training needs of companies that make or utilize these technologies would also benefit by training and certification with This credential.

Some specific roles are listed below:

- Manager/Director for Network/IT Group
- Network Technician (Entry Level)
- IT Analyst (Entry Level)
- System Administrator (Entry Level)
- Consultant/Professional Services Engineer
- Sales Representatives
- IT Project Manager (assumes knowledge, skills, abilities in a project management domain)
- IT Project Manager (assumes knowledge, skills, abilities in a program management domain)
- Help Desk/NOC Engineer

Course Modules

Software Defined Networking (SDN) Concepts (7 topics)

- Key characteristics of an SDN solution
- Major benefits of an SDN solution
- Different definitions of SDN today
- Comparison of the major benefits of an SDN solution to those of its network predecessor
- Major challenges in moving to an SDN network
- How various SDN technologies relate to each other
- Example scenario: How SDN would be implemented to leverage its benefits

Understand Network Functions Virtualization (NFV) Concepts (7 topics)

- Key definitions of NFV today
- Key Characteristics of an NFV Solution
- The Major Benefits of an NFV Solution
- The Major Challenges Presented in Moving to an NFV Solution
- Comparison between the Different Characteristics of an NFV Solution to those of its Network Predecessor
- How Various NFV Technologies Relate to Each Other
- An Example Scenario: How NFV Would Be Applied to Leverage Its Benefits

Understand LSO Orchestration Concepts (6 topics)

- Key definitions of LSO
- Key characteristics of an orchestrated solution
- Major benefits of an orchestrated solution
- Major challenges presented in moving to an orchestrated solution
- How various LSO technologies relate to each other
- An example scenario: How LSO would be implemented to leverage its benefits

Understand Carrier Ethernet Concepts (6 topics)

- Major building blocks of carrier-based connectivity services
- The roles of the organizations and actors involved in buying and selling carrier-based connectivity services
- Major benefits of a carrier-based connectivity services solution
- Major challenges presented in deploying a carrier-based connectivity solution
- Comparison between the different characteristics of a carrier-based connectivity solution to those of its predecessor
- An example scenario: How a carrier-based connectivity solution would be implemented to leverage its benefits

Understand the Software-Driven Network Vision (5 topics)

- Key characteristics of MEF's Third Network
- The predecessors to MEF's Third Network
- Major benefits promised by a software-driven connectivity and functional service
- Major challenges in deploying a software-driven connectivity and functional service
- An example scenario: How combinations of SDN, NFV, and LSO are leveraged to form a Software-driven connectivity and functional solutions

Prerequisites

In order to pass the MEF Network Foundations certification exam, a foundational knowledge of Computer Networking is assumed. Also specific familiarity with various conceptual models of networking (OSI, Internet, etc.) and technologies also required. Resources that would be helpful Include publications on networking, as well as foundational certifications in networking from Cisco, Citrix, CompTIA, Juniper, or Microsoft, and materials freely available from MEF. Other materials and Resources may be referenced on the MEF Certification landing page.

MEF SDN/NFV Certification Workshop

Course Code	PWL444
Duration	3 Day Workshop: 1 day live 12 Oct @ Layer123 SDN World Congress + 2 day virtual + virtual exam
Price	$895 USD. Includes MEF Exam Fee. +++ Use this link to register now +++

Course Description

Software-defined Networking (SDN) is a new approach to designing, building and managing networks. It has evolved from original research work done at UC Berkeley and Stanford University. SDN allows network administrators to quickly and easily manage network services from a centralize location without having to manually configure each individual network element (switch/router). This is done through abstraction of lower layers functionality.

The basic concept of SDN is to make network control decisions from centralized location. This is done by decoupling and optimizing the system that makes switching/routing decisions and other control functions such as signalling (the control plane) from the underlying systems that forwards traffic to the selected destination (the data plane).

SDN requires some mechanisms for the centralized controller (such as Open Daylight or Open Network Operating System (ONOS) to communicate with the distributed data plane. This interface is also called Southbound interface. One such southbound interface is OpenFlow. The Open Networking Foundation was founded to promote SDN and OpenFlow by specifying the OpenFlow Application Programming Interfaces (API) for connecting between Software Defined Controllers and switches/routers.

SDN environment also utilizes open application programmatic interfaces to support the communication between applications and their controller (also called Northbound Interface). Northbound APIs enable efficient service activation, management and automation.

The goal of Network Virtualization (NV) is to simplify, optimize, and enhance the network by creating logical networks that are decoupled from the underlying physical hardware. Network Functions Virtualization (NFV) simulates hardware platforms, such as firewall or storage, using software components. This allows the usage of "off the self" computing platforms and therefore cost savings.

This technology will be applicable to the deployment of major carrier networks, engineered for the delivery of carrier services through performance-controlled interfaces such as those used in Carrier Ethernet networks. It will also be widely used in enterprise Cloud Computing systems.

This course describes the basic concepts of Software Defined Networks and the market drivers for these emerging technologies. The course looks at the different emerging flavours of Software Defined Networks. In addition, the course discusses the various flavors of north and southbound interfaces (their data models and protocols).

The course also discusses different approaches for virtualization, NFV definitions, NFV market drivers and management and the and few examples of NFV Deployment Use Cases

Finally, the course provides an overview of the SDOs (Standard Defining Organizations) that play a role in the specification of SDN and NFV technology as well as an overview of the Open Source players and activities.

Objectives

- Describe the key concepts in Software Defined Networks (SDN)
- Examine the SDN architecture and key functions
- Evaluate several SDN controller platforms Open Daylight and ONOS
- Examine Northbound Interfaces such as REST and Southbound Interfaces such as OpenFlow and Netconf
- Review the architecture and development of the OpenFlow standards

- Appreciate the problems of management and security in SDN
- Describe the key concepts of Network Virtualization and Network Functions Virtualization (NFV)
- Understand how Network Functions Virtualization (NFV) can be managed
- Identify the current status for development of SDN and NFV technologies

Target Audience

Strategic planners, network architects, network managers, systems engineers, service planners and carrier operation staff who are responsible for planning, implementing and deploying networks which may require SDN and/or NFV techniques in the future.

Additional Information

This class prepares students to take the MEF SDN/NFV Professional certification.

This class contains a number of Hands-On labs which offer the student the chance to build working technology which greatly helps to improve the understanding of key concepts. However the Labs are optional so those who do not wish to do Hands-On do not have to.

Course Modules

SDN Definitions (3 topics)

- SDN Definitions
- SDN Market Drivers
- Summary of SDN Principles

NFV (10 topics)

- Why Use Virtualization?
- Network Programming Models
- NFV Definitions
- Market Drivers for NFV
- ETSI NFV ISG Models
  - MANO Orchestration Framework
  - Example network virtualization functions use cases
    - SD-WAN
    - vCPE
    - SDN and NFV for Mobile Evolved Packet Core (EPC)

SDN Framework (20 topics)

- SDN Concepts
- SDN Architecture
  - Other approaches to SDN Controllers
- SDN Southbound Interfaces
  - NETCONF&YANG
    - NETCONF
    - YANG
    - RESTCONF
  - OpenFlow
    - OpenFlow Architecture

- OpenFlow Messages
    - HANDS-ON LAB: Running Mininet and OF without a controller
    - HANDS-ON LAB: Using POX controller running HUB environment
    - HANDS-ON LAB: Using POX controller running Bridge environment
- OF-Config
- OF Notifications Framework
- Hybrid OF Switches and Routers
- SDN Northbound Interfaces
    - REST APIs
    - Intent Model

SDN Controller Environment (12 topics)

- Event Driven Programming
- SDN Computing Platforms
    - Open Daylight (ODL)
    - Open Network Operating System (ONOS)
        - ONOS based CORD (Central Office Re-Architected as Datacenter) Models
            - HANDS-ON LAB: View OF node topology using ODL DLUX dashboard
            - HANDS-ON LAB: Using ONOS Controller and creating intent based requests
- Security Considerations
    - Northbound Interfaces
    - Southbound Interfaces
    - SDN Controller
- Controller Scalability and Redundancy

SDOs & Open Source Activities (6 topics)

- SDOs Defining NFV Environments
    - ETSI NFV ISG
    - OPNFV ISG
- Open Source Initiative examples
    - Open Source MANO (OSM)
    - Open Network Automation Platform (ONAP)

VNF Architecture (8 topics)

- NFV Overview
    - MANO Architecture
- MANO Components
- VNF Scalability
- VNF Load-Balancing
- MANO Descriptors
- OASIS - TOSCA
- Service Function Chaining

Evaluation and Review (1 topic)

- Synergies between SDN and NFV

Prerequisites

Delegates should be from an engineering background with a solid appreciation of carrier class or enterprise networks. Understanding of a programming language such as Python or Java is helpful but not essential.

Check if you have the required knowledge level by taking our pre-course skills assessment.

OpenSource Networking is here!

As OpenSource networking becomes mainstream there are many projects, use-cases and standards where knowledge is needed. The cost of making the wrong choice for your deployment can be heavy.

AM I READY?
SDN/NFV Skills
Pre-Test
Free
Pre-Program
Knowledge
Check

FREE Evaluation Tools for individuals and teams

SDN, NFV and Network Automation

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Sources of Industry SDN & NFV Knowledge

Vendor-Agnostic Knowledge Programs

Private Sector Providers (training companies)
University & Higher Education Providers

Vendor-Specific Classes

SDN & NFV Professional Certifications

Network Vendor #1 Certifications

SDO / Liaison organization(s) Certifications

Network Vendor #2 Certifications

SDN is an Opensource story – Professionals require both vendor and vendor-agnostic skills to be effective!

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Who are Perpetual Solutions?

Delivering Knowledge to professionals since 1999

Instructor-led Onsite

Public Schedules

Virtual Classes

Hands-On Learning

Telecoms	Broadcast	IT Vendor	Software Development	Professional Development

"

Excellent training with real use-case examples and hands-on classroom workshops. It has provided me with a foundation in troubleshooting.

"

Senior Solution Designer

orange™

MEF ATP
ACCREDITED TRAINING PROVIDER

THE LINUX FOUNDATION
AUTHORIZED TRAINING
PARTNER

DASH Industry Forum
MEMBER

ONF
Open Networking Foundation

SDN, NFV and Network Automation

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Linux Foundation Certifications and Workshops

Enhance and validate your knowledge in critical OpenSource topics

- OpenStack
- Kubernetes
- ONOS
- OpenDaylight
- ONAP
- OPNFV
- Cloud Native
- Cloud Foundry
- DevOps

- Linux Admin
- Linux Kernel
- Embedded Linux

- The Linux Foundation projects are playing an ever increasing role in the move to OpenSource networking.
- As an Authorized Linux Foundation Training Partner we deliver learning programs that incorporate these key technologies.
- Online, virtual and instructor-led formats available.
- Our longstanding history in telco brings added value to students from service providers, operators, vendors, systems integrators and enterprise network environments.

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SDN & NFV Knowledge Program – Meet key instructors

Yoav
Cohen

Daniel
King

- Yoav is a senior instructor with Perpetual Solutions, providing training and workshops on topics such as SDN & NFV, Cloud Computing and MEF-CECP, to operators, service providers and vendors. He also works within the CTO office of a major vendor on SDN, NFV and Cloud developments.

- During 35 years of professional endeavor, he has contributed technical work into several SDOs such as ITU, IETF, OIF, TMF, BBF and MEF.

- Yoav has been participating in the MEF Technical Committee continuously since 2002, and has been recognised as a key contributor to the MEF Technical Specifications.

- He currently contributes to the MEF LSO (Lifecycle Service Orchestration) development and the MEF UNITE program which brings together work of the TMF, MEF, ONF, Open Daylight and IETF.
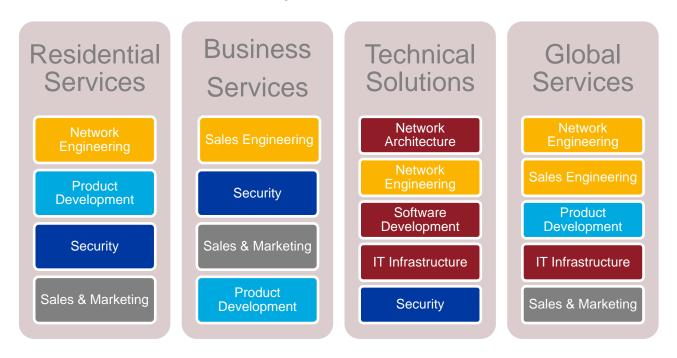
- Daniel is an expert instructor with Perpetual Solutions, a Senior Researcher at Lancaster University and embedded within the British Telecom & Intel Network Functions Virtualisation (NFV) lab. With over 18 years' experience within leading technology companies, he co-founded Aria Networks and held key roles at Bell Labs, Cisco Systems, Redback Networks and Movaz Networks.

- Daniel was the co-chair of the Software Defined Networks (SDN) Research Group (SDNRG) at the Internet Research Task Force (IRTF) and an Open Networking Foundation (ONF) Research Associate, and MEF Research Council Member)

- He is an editor and author on numerous Standards related to optical and packet networks, traffic engineering, network optimisation, packet forwarding, Software Defined Networks (SDN) & NFV, and Application-Based Network Operations (ABNO).

SDN, NFV and Network Automation

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Profession Based Learning & Certification

Learning Pathways for Professional Communities In Your Organization

- Professional Communities May Include:

  - Network Engineering, Architecture, Product Management, Security, Software Engineering, IT Infrastructure, Sales & Marketing, Management, Others..

- Professional Communities Are Currently Siloed Across Different Lines of Business.

Residential Services	Business Services	Technical Solutions	Global Services
Network Engineering	Sales Engineering	Network Architecture	Network Engineering
Product Development	Security	Network Engineering	Sales Engineering
Security	Sales & Marketing	Software Development	Product Development
Sales & Marketing	Product Development	IT Infrastructure	IT Infrastructure
		Security	Sales & Marketing

SDN, NFV and Network Automation

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Profession Based Learning & Certification

Learning Pathways for Professional Communities In Your Organization

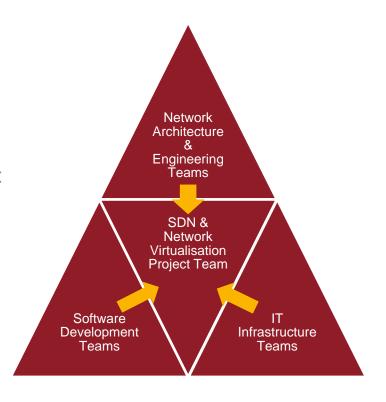- Digital Transformation requires current organization structure to become flatter, less siloed. By adopting profession based Learning Pathways organizations can standardize knowledge levels across different lines of business.

  - Benefits for the Individual
    - Defined career learning goals
    - Attainment of peer recognized certification
  - Benefits For the Organization
    - Define Learning Pathways for employees that mirror business objectives
    - Easy identification of talent across different Lines of Business
    - Project teams identified and assembled more rapidly
    - Respond to market opportunities and challenges

Network Architecture & Engineering Teams

SDN & Network Virtualisation Project Team

Software Development Teams

IT Infrastructure Teams

SDN, NFV and Network Automation

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SDN & NFV Knowledge Program: Individual / organization

SDN & NFV represents a convergence of different professions across multiple teams / BUs within your organization. We offer separate pathways to standardize skills across the professions.

Click Each Class Title For Full Online Description

IT Infrastructure Profession Pathway

PWL400 SDN & NFV
3 days

PWL402 SDN & NFV Engineering – 2 days

DEVOPSF Devops Foundation – 2 day

Python for SDN Fundamentals – 4 days

CL210 Redhat Openstack Administration – 5 days

AM I READY?
SDN/NFV Skills Test
Free Pre-Program Knowledge Check

Network Engineering Profession Pathway

PWL407 SDN & NFV Fundamentals and Engineering
5 days or 3 + 2 days

OR

PWL415 SD-WAN, SDN & NFV for Network Operators
5 day or 3 + 2 days

PWL409 SDN & NFV Orchestration, Infrastructure & Design
5 days or 2 + 3 days

PWL430 Operator-Driven Network Automation
5 days or 2 + 3 days

Software Development Profession Pathway

Telco Networks Architecture Primer
6 hrs e-learning

PWL400 SDN & NFV
3 days

PWL402 SDN & NFV Engineering – 2 days

DEVOPSF Devops Foundation – 2 day

Python for SDN Fast-track
2 days

Optional depending on technical depth required by this audience

Pre-Sales Engineering Profession Pathway

PWL400 SDN & NFV
3 days

DEVOPSF Devops Foundation - 2 day

Python for SDN Fundamentals – 4 days

Sales and Marketing Profession Pathway

Telco Networks Architecture Primer
6 hrs e-learning

PWL400 SDN & NFV
1 day version for Sales

Online & Virtual Delivery

High Level Overviews for teams and individuals requiring a basic understanding

- ✔ SDN Market Drivers – 30 min
- ✔ SDN Concepts – 30
- ✔ SDN Controllers – 30 min
- ✔ SDN Forwarding Infrastructure – 30 min
- ✔ SDN APIs and Protocols – 60 min
- ✔ Management and Orchestration – 30 min
- ✔ Service Provider SD-WAN Use Cases – 30 min
- ✔ NFV Concepts, Architectures & Products – 30 min
- ✔ ETSI NFV Use Cases – 30 min

Need Automation skills?
Add classes on Chef, Puppet, Nagios, GitHub, Python, Java, & OpenStack

Need Cloud Architecture knowledge?
Add classes on Cloud, AWS, Azure and more

SDN, NFV and Network Automation

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SDN & NFV Hands-On Workshops: Lab Menu

For onsite group training we offer customers the ability to pick and mix from our 'menu' of demo's and hands-on labs. This allows you to get practical real world skills in the topics and techniques you need.

Instructor led Demonstrations of NFV Infrastructure

Demo 1: Hypervisor and Virtual Machine (Demonstration USING Perpetual Blade running KVM)
- Creating Virtual machines
- Using Virtual Machines

Demo 2: OpenStack
- Running OpenStack via Horizon (dashboard)
- Creating Virtual Machines
- Creating provider and tenant networks via Neutron (networking)

Demo 3: Using an NFV MANO Solution
- TACKER
- Open Baton

OpenFlow SDN Student Labs

Lab 1: Running Mininet & OpenFlow Without a Controller
- Introduction to OpenFlow via DPCTL
- Introduction to Mininet

Lab 2: Running Mininet & OpenFlow with a Reference Controller
- Mininet with Reference Controller (PTCP)
- Using Wireshark to review OF protocol interactions

Lab 3: Using a POX controller running HUB environment
- Mininet with POX Controller
- Using POX to program Mininet OpenFlow Nodes and act as Hubs

Lab 4: Using a POX controller running Learning Bridge environment
- Mininet with POX Controller
- Using POX to program Mininet OpenFlow Nodes as a Learning Bridges

Advanced OpenFlow SDN Student Labs

Lab 5: Using Mininet and OVSDB Without a Controller
- Mininet with no controllers
- Introduction to OVSDB

Lab 6: Using MiniEdit to create custom topologies
- Creating custom controllers using MiniEdit a GUI-based tool
- Run a custom Mininet with multiple controllers

Lab 7: Using a RYU controller
- Creating OpenFlow 1.0 and 1.3 emulated switches

Lab 8: Using the ONOS controller and creating Intent requests
- Running ONOS with Mininet
- Creating Intent-based requests
- View OpenFlow node topology using the ONOS graphical interface

Advanced Controller SDN Student Labs

Lab 9: Using the OpenDaylight controller
- Running the OpenDaylight instance as the Open Flow Controller and analyze the behavior of ODL (OpenDaylight) during its interaction with a Network Infrastructure Topology created using Mininet
- View OpenFlow node topology using the DLUX dashboard

Lab 10: Using an NBI (REST-API) via the OpenDaylight controller
- Using REST tool Postman to generate a JSON output for the topology discovered and nodes resources available
- Show OF statistics and counters in ODL
- Installing OpenFlow entries via REST

Lab 11: Application development (Firewall and DDOS mitigation) on OpenDaylight controller
- OF matching and filter criteria to drop traffic for a FW Application
- Exporting and importing route info from ODL via RESTCONF for a DDOS Mitigation Application

Lab 12: OpenDaylight BGP-LS Lab
- Run local IGP instance on virtual router nodes on GNS3
- Configure BGP-LS on virtual nodes and advertise local connectivity to ODL via BGP-LS

Lab 13: Service Chaining using OpenDaylight

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Agile Networks Bootcamp

Customize your engineering profession Learning Pathway to reflect business objectives. Choose from our modular content & lab menus.
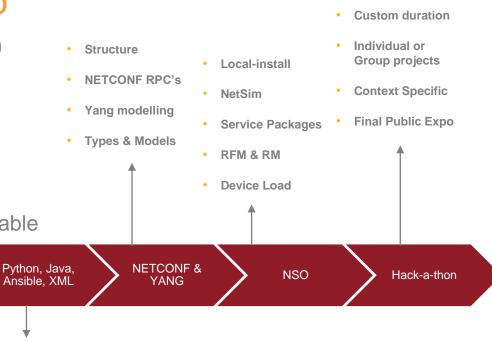
- Instructor-led hands-on training
- All labs done in networking context
- Industry and internal certifications available

- Structure
- NETCONF RPC's
- Yang modelling
- Types & Models

- Local-install
- NetSim
- Service Packages
- RFM & RM
- Device Load

- Custom duration
- Individual or Group projects
- Context Specific
- Final Public Expo

SDN & NFV Fundamentals & Engineering	Infrastructure Tools Swagger / GitHub	Agile Development	Python, Java, Ansible, XML	NETCONF & YANG	NSO	Hack-a-thon

SDN/NFV
SOFTWARE DEFINED NETWORKING AND FUNCTIONS VIRTUALIZATION

- **Building Blocks**
- **Architecture & Technology**
- **Standardization**
- **Use Cases**
- **Vendor Analysis**
- **Hands On Labs**

- **Install tools**
- **Prepare Environment**
- **Create Accounts**
- **Train students on uses**

- **Agile Practices**
- **Release Cycles**
- **Cloud Speed**

- **Scripting**
- **Playbooks**
- **Control Mechanisms**
- **Transformation**
- **Doc Generation**
- **XSLT**

Custom Hack-a-thons!

- Build from our menu
- Use cases are pre-approved by organization
- Senior Leadership to review projects
- Lead by our industry experts

SDN, NFV and Network Automation

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