SDN NFV Course

Course Duration: 2 days

Course Objectives:

- Create conceptual-level designs for SDN and/or NFV solutions (independent of technology)
- Explain the various SDN frameworks
- Explain how SDN and NFV complement and reinforce each other
- Identify the various components in a SDN/NFV system
- Explain the interfaces and functionality of SDN and NFV components
- Explain the concept of a service chain
- Determine required controller functionality against specific service requirements
- Select products for networking services based on the business requirements using SDN/NFV
- Lab Hands-on to create basic and complex topologies with help of Mininet and OpenDaylight Controller
- Knowledge of latest Networking Technologies like SD-WAN,SD-LAN, universal CPE(uCPE) and Segment Routing which are prime use cases of SDN/NFV

Goals:

Upon completion of this course, you will be able to:

- Select an SDN and NFV ecosystem based on the functional requirements of the services each will carry
- Implement an SDN/NFV solution, including controller selection and installation service a service chain
- Integrate a new network element/network function into a SDN/NFV domain
- Troubleshoot SDN/NFV technologies when they break or are misconfigured
- Capacity planning/dimensioning/scale in and scale out of network functions and SDN controllers

Prerequisites:

- Basic Networking Terminologies
- Basic Knowledge of Transport/ IP / MPLS / Ethernet Technologies
- OSI Layer & Network Architecture and Design

Target audience:

- Network Strategy Professionals / Network Architects and Engineers
- Product Managers / Engineering Managers
- Technical Sales and Pre-sales Engineers
- Product and Service Support Technicians / Technical Project Managers
- Standards Specialists / Network/ System Consultants and Integrators
- Network Operations and Support Staff / Technical Trainers

Course content:

- Issues/Pain points in current transport Networks
- Why SDN?
- Operating System Model vs SDN Model
- Open Network Forum (ONF) original Proposal
- SDN Network Evolution
- Basic Terminologies
    - Abstraction vs decoupling: complementary developments in networking
    - Virtualization overview
    - Programmable networking overview
    - Network slicing overview
- Industry and market drivers
- Benefits and limitations
- Standardization and guidance bodies
- ONF, ONAP, ETSI, OASIS, TOSCA, etc
- Discussion: Implications of advances of SDN and NFV to network engineering jobs/roles

- **SDN**
- SDN elements: Controllers, Switches
- SDN General Architecture:
    - Data, Forwarding &Application planes,
    - APIs
        - Programmability (Netconf, Yang, REST)
        - Northbound
        - Southbound
        - East/Westbound
- OpenVSwitch, FlowVisor
- SDN in the industry (ONOS, Juniper Contrail, Nuage, etc.)

- **OpenFlow**
- OpenFlow operation
    - Pipeline processing
    - Flow tables
    - Action Lists, Sets and Buckets
    - Instructions vs actions
    - Reactive and proactive flows
- Statistics, counters, timers and metering
- OpenFlow message types
- Group tables
- Port groups
- Protocols (OF-Config, OAM, OFDPA, OVSDB, etc)
- ONF OpenFlow vs Cisco OpenFlow
- OpenFlow controllers (NOX, Beacon, Helios, RYU, Brocade SDN Controller, Floodlight, etc)

- **SDN Planning and Implementation**
- SDN Orchestration
- SDN Controller scaling and resilience
    - Controller placement
    - Hierarchical design
    - SDN provider design scenarios

- Administrative domains
- High Availability
- Controller federations
- Controller clustering

- SDN Migration
  - Migration strategies
  - Direct vs Phased
  - Greenfield, Hybrid and Mixed
  - Planning
- Scaling case studies

- **SDN Lab**
- Download and install Mininet on VirtualBox or (VMware)
- Set up virtual network on Mininet
- Work with simple and complex topologies and default controller
- Work with external controller eg POX
- Download and install OpenDaylight
- Network visualizations with OpenDaylight

- **NFV**
- Virtualisation and NFV
- What can you virtualize?
- ETSI NFV Components
  - Hardware Resources (Compute, Storage, Network)
  - Virtualization software
  - Virtual Resources
  - Software Instances & Logical Abstraction (VNF forwarding graph/service chain)
- MANO Functional Blocks
  - NFV Orchestrator
    - Resource orchestration
    - Service orchestration
  - VNF Manager
  - VIM
- NFV Management and Orchestration Architecture
  - NFVI, VNF, EMS, OSS/BSS
  - NFV reference points (VeEn-Vnfm, VeNf-Vnfm, Nf-Vi, Ve-Vnfmi, etc)
  - Repositories :
    - VNF Catalog
    - Network Services Catalog
    - NFV Instances
    - NFVI Resources
- Positioning of SDN controller in ETSI NFV architectural framework
  - SDN controller as a VIM, Virtualized Infrastructure Manager
  - SDN controller as a VNF
  - SDN controller in the NFVI
  - SDN controller in the OSS/BSS
  - SDN controller as a PNF
- NFV Use Cases
  - Network Functions Virtualisation Infrastructure as a Service
  - Virtual Network Platform as a Service (VNPaaS)
  - Virtual Network Function as a Service (VNFaaS)
  - Virtualisation of Mobile Core Network and IMS
  - Virtualisation of Mobile base station

  - Virtualisation of the Home Environment
  - Service Chains (VNF Forwarding Graphs)
  - Virtualisation of CDNs (vCDN)
  - Fixed Access Network Functions Virtualisation
- NFV Lab: Create a virtual DataCenter using OpenNebula

- **5G** (OPTIONAL)
- How SDN and NFV are paving the way for 5G
- Issues/Pain points of current network
- SDN and NFV in 5G Architecture
- Use cases emerging out of SDN and NFV across Fixed, Mobile, Enterprise, Data Centers and Traditional Service Provider Networks.
- Is SD-WAN the Super-Glue That Will Bring 5G core and all the Edges Together?
- How LTE & 5G Fit into your SD-WAN Strategy