

# Exploring Network Functions Virtualization (NFV)

Instructor Led | Duration: 2 Days | Course Number: NWW\_203



Network Functions Virtualization (NFV) standards are still evolving as the industry grapples with this potentially significant technology transformation. NFV proposes to leverage standard IT virtualization technology to consolidate network equipment types onto industry standard high volume servers, switches and storage. NFV is expected to reduce cost, improve network flexibility, manageability and allow the network administrator to customize the operations of the network on a large scale. The course starts with a discussion of the motivation behind deploying NFV. The course also provides an overview of the NFV architecture, NFV requirements and challenges, VNF operations and management, hypervisor technologies, and how NFV can be applied LTE and IMS network functions. The course also discusses the how NFV and Software Defined Networking (SDN) technologies are used together.

## Intended Audience

This is a technical course, primarily intended for a technical audience requiring a technical introduction to the application of NFV network.

## Learning Objectives

After completing this course, the student will be able to:

- Describe virtualization, cloud computing and its service models
- Discuss the NFV reference architecture and building blocks
- Identify the key NFV requirements and benefit
- Discuss the role and performance aspects of the virtualization layer
- Define the NFV building blocks: Virtualization of Compute, Network and Storage
- Describe the integration of NFV and SDN and how to complement each other
- Understand how can OpenStack be an NFV VIM
- Contrast Current LTE and IMS architecture with LTE and IMS using NFV
- Discuss networking performance enhancements that can be used in an NFV system.
- Define NFV in the context of LTE and IMS network functions
- Apply NFV as a use case in LTE and IMS

## Suggested Prerequisites

- Working knowledge of LTE and IMS
- Working knowledge of SDN and Cloud Computing (IaaS)

## Course Outline

### 0. Prologue

#### 1. NFV Overview

- 1.1. NFV and SDN
- 1.2. NFV High-Level Framework?
- 1.3. NFV Requirements and Benefits
- 1.4. Main NFV Challenges

#### 2. Virtualization Concepts-I

- 2.1. Virtualization Overview
- 2.2. PNFs to VNFs
- 2.3. Virtual Functions Software Options

#### 3. Virtualization Concepts-II

- 3.1. Virtualization Layer
- 3.2. Hypervisor Types (0,1, 2)
- 3.3. The Container Hypervisor
- 3.4. NFVI Domains
- 3.5. Hypervisor Domain in NFV
- 3.6. VM Live Migration

#### 4. NFV Architecture and Orchestration

- 4.1. NFV Architectural Framework
- 4.2. NFV MANO Components
- 4.3. VNF Life Cycle
- 4.4. Role of EMS-OSS-BSS
- 4.5. VNF Forwarding Graphs
- 4.6. NFV Challenges
- 4.7. OpenStack as a VIM in NFV
- 4.8. Orchestration Layers

#### 5. NFV Deployment Scenarios

- 5.1. Cloud computing service models
- 5.2. NFVI as a Service (NFVaaS)
- 5.3. VNF as a Service (VNFaaS)

#### 5.4. VNF as a Service (VNFaaS)

#### 5.5. NFV Service Models Benefits and Challenges

### 6. NFV Infrastructure and Service Deployment Options

- 6.1. NFV Infrastructure Deployment
- 6.2. NFV Descriptors
- 6.3. NFV On-Boarding Process
- 6.4. Network Service Creation
- 6.5. Elasticity and Scaling in NFV
- 6.6. Placement of SDN in NFV

### 7. Network and Performance Enhancements

- 7.1. Introduction
- 7.2. Traditional Network Interface Virtualization
- 7.3. Overview of DPDK
- 7.4. Overview of SR-IOV
- 7.5. DPDK & SR-IOV Together
- 7.6. Overview of VxLAN, NFVGRE
- 7.7. Overview of NUMA Memory

### 8. VNF Architecture

- 8.1. VNF Functional Architecture
- 8.2. VNF Logical Interface Points
- 8.3. VNF Composition
- 8.4. VNF States
- 8.5. VNF Load Balancing
- 8.6. VNF Auto Scaling and Elasticity
- 8.7. NFV design exercise

### Appendix A: NFV Applications

- A.1. LTE and IMS overview
- A.2. NFV options for LTE and IMS