



**Network Function Virtualization**

**2 Hr. 36 Min.**



**LEARNING OBJECTIVE:**

- Describe Software Defined Networking and Open Flow concepts, motivation, benefits and applications
- Describe concepts behind Network Functions Virtualization (NFV)
- Compare and contrast SDN and NFV
- List principles behind cloud computing including IaaS, PaaS, SaaS
- Describe NFV and Open Flow building blocks, components, architectures and reference standards
- Discuss network functions virtualization
- Discuss NFV deployment models
- List NFV Device Implementations
- Discuss some applications for NFV

**TARGET AUDIENCE :**

Technical and Non-Technical professionals who want to learn key concepts in Network Function Virtualization (NFV) and Open Flow with examples, cases studies and demos.

**COURSE OUTLINE :**

**1. Service and Infrastructure Evolution**

**1.1 Concept for Network Transformation**

- 1.1 a) What's changing
- 1.1.b) The promised benefits of virtualization
- 1.1 c) OSS/BSS must change too
- 1.1 d) Progress is slow but steady
- 1.1 e) what is the holdup
- 1.1 f) What are the business inhibitors.

**1.2 The Changing Telecoms Industry scenario**

- 1.2 a) Technological developments
- 1.2 b) Declining tariff
- 1.2 c) Changing customer demand
- 1.2 d) Telecom equipment manufacturing
- 1.2 e) Competition

**1.3 Network Virtualization Basics**

- 1.3 a) Introduction
- 1.3 b) Virtualization types

- 1.3 c) Hypervisor
- 1.3 e) Network Virtualization
- 1.3 f) Conclusion

**1.4 Network Virtualization Survey**

- 1.4 a) Network Virtualization Environment
- 1.4 b) Reference Business Model
- 1.4 c) Infrastructure Provider
- 1.4 d) Service Provider

**1.5 Enablers for Network Functions Virtualization LTE/5G Networks**

- 1.5 a) Introduction
- 1.5 b) Generation Networks - Vision
- 1.5 c) Slicing Concept & Challenges
- 1.5 d) NFV & MANO System
- 1.5 e) ETSI MANO Framework

**1.6 Cloud Computing**

- 1.6 a) Infrastructure-as-a-Service (IaaS),
- 1.6 b) Platform-as-a-Service (PaaS)
- 1.6 c) Software-as-a-Service (SaaS)





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**2. Basics of Network Functions Virtualization (NFV)**

**2.1 Understand the transition towards virtual networks**

- 2.1 a) Needs of Migration from Traditional Network to LTE/5G Ready Network
- 2.1 b) Guiding Principles for Network Migration
- 2.1 c) Technical Foundations of Network Virtualization
- 2.1 d) Network Infrastructure Reconstruction
- 2.1 e) Challenges/Opportunities

**2.2 How is NFV different from SDN?**

- 2.2 a) Difference between NFV /SDN
- 2.2 b) SDN versus NFV
- 2.2 c) NFV and SDN – Working Together?
- 2.2 d) Summary

**2.3 Network Functions Virtualization (NFV) vs. Cloud technologies**

- 2.3 a) SDN and NFV Together
- 2.3 b) Cloud Computing
- 2.3 c) SDN without Cloud Computing
- 2.3 d) SDN and Cloud Computing

**2.4 Open Stack**

- 2.4 a) Introduction to OpenStack
- 2.4 b) How is OpenStack used in a cloud environment?
- 2.4 c) What are the components of OpenStack?

**2.5 Network Functions Virtualization vs. current network architectures**

**2.6 Network Functions Virtualization (NFV) Challenges**

- 2.6 a) Traffic Hidden for Monitoring
- 2.6 b) New Security Risk
- 2.6 c) Performance Bottlenecks

**2.7 Mobile Core Network virtualization**

- 2.7 a) How to virtualize the core network
- 2.7 b) Core network virtualization
- 2.7 c) What is a core network?
- 2.7 d) NFV/SDN
- 2.7 e) Network slicing

**2.8 Mobile Core Network beyond EPC**

- 2.8 a) Virtualization of mobile core network and IMS
- 2.8 b) Mobile core network functions
- 2.8 c) Mobile Network RAN Access
- 2.8 d) Services in EPS
- 2.8 e) LTE/5G core Network identity

**3. Network functions virtualization (NFV) Architecture**

**3.1 NFV requirements**

- 3.1 a) Portability
- 3.1 b) Performance
- 3.1 c) Elasticity
- 3.1 d) Resiliency
- 3.1 e) Security
- 3.1 f) Service Continuity

**3.2 Different approaches to network virtualization**

- 3.2 a) Virtualization of Cellular Base Station
- 3.2 b) Virtualization of Mobile Core Network
- 3.2 c) Virtualization of Home Network
- 3.2 d) Virtualization of CDNs (vCDN)
- 3.2 e) Impact of NFV on future telecom networks

**3.3 NFV architecture and building blocks**

- 3.3 a) Network Function Virtualization Infrastructure
- 3.3 b) NFV Infrastructure
- 3.3 c) NFV Infrastructure Building Blocks-
  - Compute
  - Storage
  - Networking
  - Virtualized Infrastructure
  - Management





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**3.4 SDN and NFV Open Standards Activities**

- 3.4 a) Open Networking Foundation (ONF)
- 3.4 b) Internet Engineering Task Force (IETF)
- 3.4 c) European Telecommunications Standards Institute (ETSI)
- 3.4 d) Internet Research Task Force (IRTF) Software Defined Networking Research Group (SDNRG)

**3.5 NFV challenges**

- 3.5 a) Interoperability and Compatibility
- 3.5 b) Performance
- 3.5 c) Migration from and co-existence of legacy while ensuring compatibility with Existing platforms
- 3.5 d) Management and Orchestration
- 3.5 e) Security & Resilience
- 3.5 f) Reliability and Stability

**3.6 VNF for NFV ETSI**

- 3.6 a) Types of VNF for Real Time Application
- 3.6 b) VNF as LTE Node/VRNC/VBSC
- 3.6 c) RCP/RCH Framework
- 3.6 d) RCH part-
  - Compute Server
  - Storage Server
  - Network Server
  - Controller Server

**4. Network Functions Virtualization (NFV) Approach**

- 4.1 a) Trends in cloud solutions
- 4.1 b) NFV to build dynamic, virtualized networks
- 4.1 c) NFV awareness: application and content
- 4.1 d) Virtualizing network applications
- 4.1 e) NFV applied to mobile networks
- 4.1 f) NFV Applied to LTE
- 4.1 g) NFV options for LTE
- 4.1 h) Network Virtualization case studies in 3GPP networks
- 4.1 i) Virtualized Open LTE/EPC case study

**Evaluation and feedback of the participants**

Maximum number of participants: 15

Duration: 2 Hr. 36 Min.

