Virtualization for Networks

(Related to "Network Slicing", "Network Function Virtualization" and "Software Defined Networks").

Virtualization for a server is the ability to support multiple independent virtual machines on one server (including their operating systems).

Virtualization for a network is the ability to support multiple independent virtual (logical) networks on one physical network infrastructure.

Basic Concepts are:

(1) Virtualization

(2) Orcherstration: Coordinate and manage distinct server or network processes such as resource allocation to make virtualization possible.

(3) Isolation: Isolating virtual entities in terms of performance, security, privacy and management.

SDN developed originally to allow programmable networks.

NFV developed originally to virtualize expensive hardware "middle boxes" onto commodity servers for such telecommunications functions as firewalls, deep inspection, encryption/decryption etc...

SDN and NFV complement each other and are mutually beneficial. SDN and NFV enable 5G network slicing.

Virtualization for 5G can apply to mobile core networks, mobile base stations, home environments and content delivery networks (which use cache nodes to deliver multimedia services).

Terms:

(1) Hypervisor: a virtual machine monitor consisting of software, firmware or hardware that creates and manages virtual machines (see Wikipedia).

(2) NFV-MANO: Network Function Virtualization – Management and Orcherstration.

Virtualization is an old idea, an antecedent is Virtual Private Networks (VPNs). Thomas Edison invented a 4 to 1 telegraph multiplexer allowing four telegraph signals to be sent over one wire.

[1] J.G. Herrara and J.F. Botero, "Resource Allocation in NFV: A Comprehensive Survey", IEEE Transactions on Network and Service Management, vol. 13, no. 3, Sept. 2016, pp. 518-532.

[2] J. Ordonez-Lucena, P. Ameigeiras et. al., "Network Slicing for 5G and SDN/NFV: Concepts, Architectures and Challenges, IEEE Communications Magazine, May 2017, pp. 80-87 (special issue section on network slicing).