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ETSI NFV ISG – REGULATORY IMPLICATIONS

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Disclaimer

- This presentation reflects the positions of the ETSI NFV ISG work program. It does not necessarily reflect the positions of individual ETSI members. Although I work for AT&T, I am here today solely in my capacity as an ETSI Committee Chair and the views expressed here do not necessarily reflect the views of AT&T.
- As Committee Chair, the presenter has consulted other members of his Industry Specification Group leadership team, and the ETSI Staff, to ensure this presentation reflects the positions of the ETSI NFV ISG work program.
- As a standards organization, ETSI focuses on technical standards for a diverse group of industry participants. ETSI is pleased to present technical information, to help inform policy considerations. However, ETSI is not advocating any particular policy position with these answers. With these caveats, we offer the following thoughts.

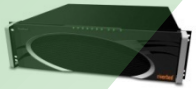
NFV Vision: An open ecosystem for NFV enables rapid service innovation for Network Operators and Service Providers. Innovation in end-to-end services is enabled by software-based deployment and operationalization of virtualized network functions on independently deployed and operated NFV infrastructure platforms.

Classical Network Appliance Approach


Message Router


CDN


Session Border Controller


WAN Acceleration


DPI


Firewall


Carrier Grade NAT


Tester/QoE monitor


SGSN/GGSN


PE Router


BRAS


Radio Network Controller

- Fragmented non-commodity hardware.
- Physical install per appliance per site.
- Hardware development large barrier to entry for new vendors, constraining innovation & competition.

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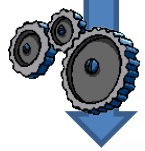
Network Virtualisation Approach


Cloud automation & SDN programmability


Standard High Volume Servers


Standard High Volume Storage


Standard High Volume Whitebox HW (e.g Ethernet Switches)

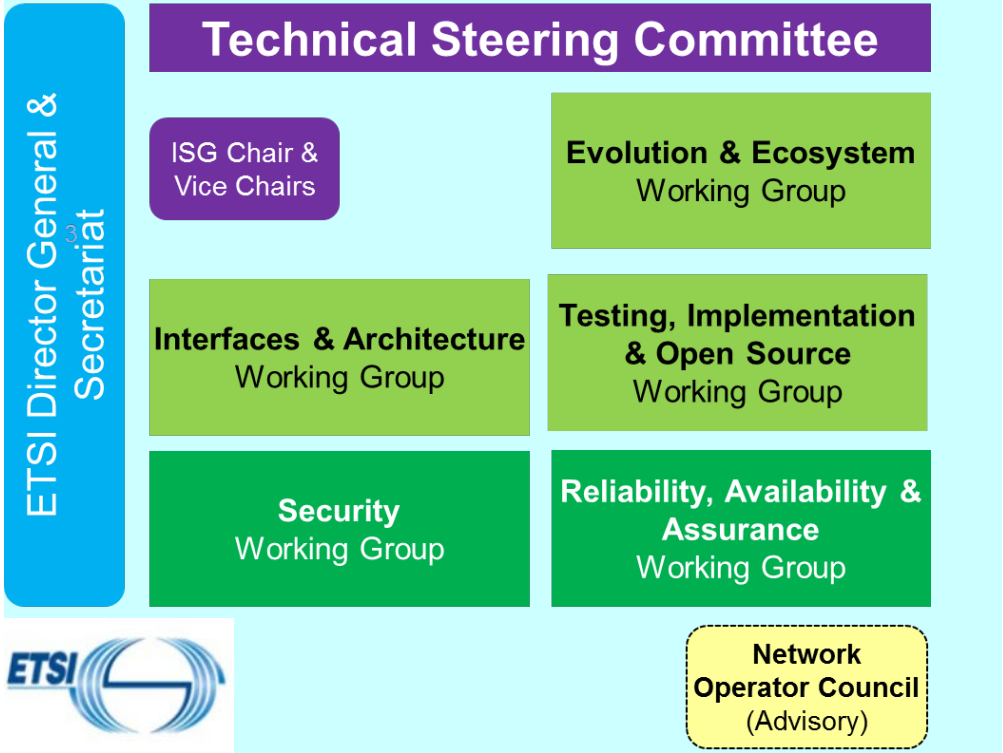
Independent Software Vendors

First articulated in the network operator white paper published in October 2012

ETSI NFV ISG

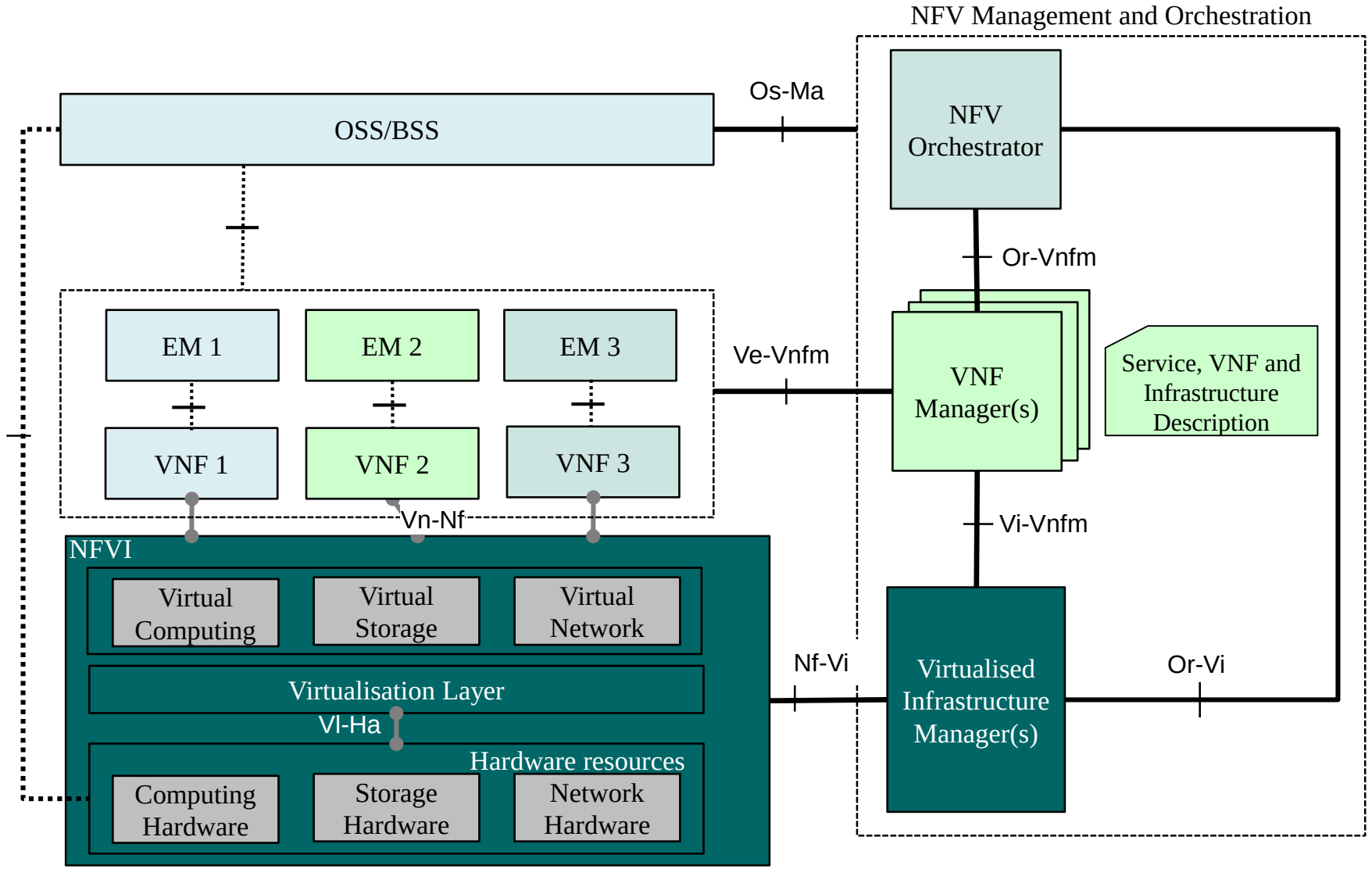
- *NFV Vision:* An open ecosystem for NFV enables rapid service innovation for Network Operators and Service Providers. Innovation in end-to-end services is enabled by software-based deployment and operationalization of *virtualized network functions* (and network services) on independently deployed and operated NFV infrastructure platforms.
- Pro-active coordination with other industry bodies (SDOs and Open Source) to map their domain specific technologies into NFV Framework (e.g. as VNFs)

ETSI NFV ISG Organization Structure



NFV Architectural Framework

Published October 2013: **GS NFV 002**



NFV Infrastructure (NFVI)

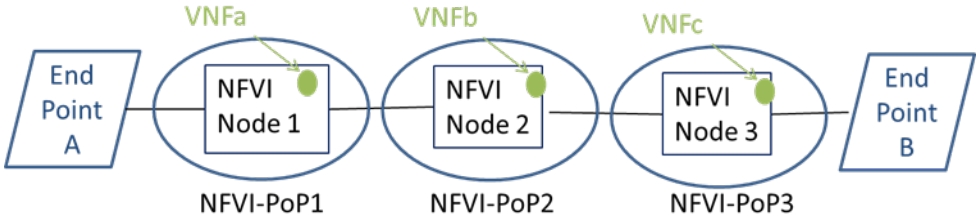


Figure 14 of GS NFV INF 001 published January 2015

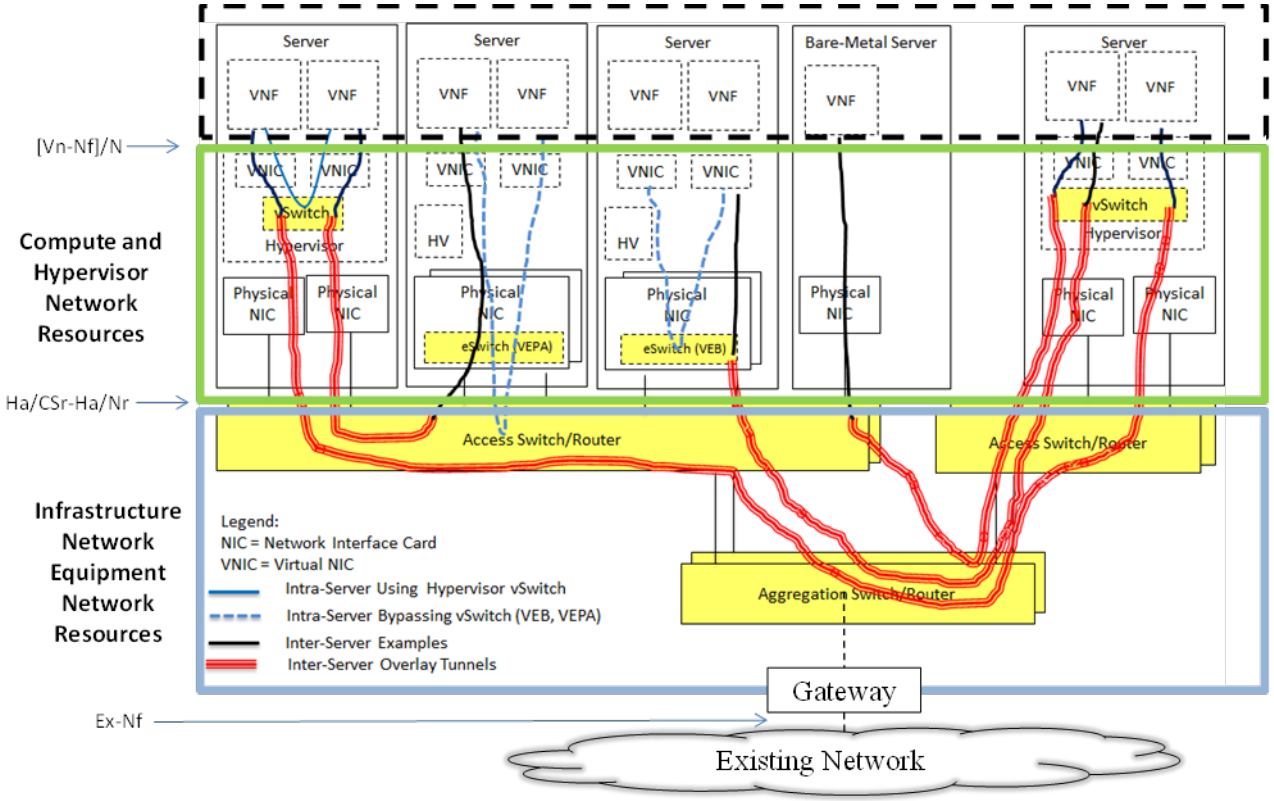


Figure 23 of GS NFV INF 005 published December 2014

(1) Do SDN and NFV enable fixed network access which gives alternative network operators more control over the network of the incumbent compared to current layer 2 wholesale access products (also known as Ethernet bitstream or virtual unbundled local access (VULA))?

The high-level objectives identified in our NFV specifications include: *Rapid service innovation* through software-based deployment and operationalization of network functions and end-to-end services; *Improved operational efficiencies* resulting from common automation and operating procedures; *Reduced power usage* achieved by migrating workloads and powering down unused hardware; *Standardized and open interfaces between network functions* and their management entities so that such decoupled network elements can be provided by different players; *Greater flexibility in assigning VNFs to hardware*; *Improved capital efficiencies* compared with dedicated hardware implementations.

NFV is concerned with the virtualization of a variety of network functions (including layer 2 functions). Service Providers are considering the virtualization and administration of many different types of functions to execute in the same programmable, “cloud like”, environment. These may include IT functions and network management functions as well as other functions typically associated with network equipment. Some functions may be only partially virtualized using technologies like SDN to separate them into control and data planes. We may envisage a future network deployment scenario where an operator delivers a variety of end-to-end services via deployments of NFV Infrastructure. In such a case, the service providers offering layer 2 services may support the delivery of such services through the NFVI and may utilize the NFV Infrastructure to access wholesale layer 2 services in order to interconnect NFVI Nodes and customer premises as a component of other services.

(1) (a) Is this possible in principle?

Putting aside the many operational and practical issues that go beyond the scope of ETSI's standards work, as a purely technical matter, improvements in control (e.g., automated deployment) achieved by the service provider could potentially be exposed to other operators with reasonably comparable performance. There may be some small differences depending on additional functionality (e.g., authentication processes) and the resource allocation configurations of the different operators, to support the security, service isolation and other operational controls required. While NFVI Nodes could be deployed in a variety of locations – core, edge, customer premises etc, virtualizing network functions does not, however, in itself create new physical infrastructure or access connectivity beyond that already deployed. SDN and NFV can be combined in a variety of ways see e.g. GS NFV EVE 005.

(1) (b) Will SDN and NFV also be standardized in a way (including multi-tenant support) which will make such forms of network access possible based on SDN/NFV?

It is premature to answer definitively whether standardization will make such access possible as a technical matter or what would be the technical and economic implications for an operator of such SDN/NFV services. The GS NFV 001 specification does include use cases referring to different network operators sharing resources. These use cases were not intended to be exhaustive and were documented as being sufficiently representative of the technical span of the fields of application to be addressed by NFV ISG. However, to simplify the effort, most of the detailed work to date has proceeded under the assumption of a single service provider. The NFV Architectural Framework in GS NFV 002 does not explicitly identify an inter-provider interface or reference point. The specifications related to NFV also use the term multi-tenancy to refer to different types of tenants – both different Service Providers, as well as different Virtual Machines in the same cloud. Virtualization brings with it a number of new challenges that we are currently studying. Multi-tenancy adds significant complexity – particularly in terms of security. Traditional standardization approaches may also be superseded by developments in Open Source Communities. The developments of SDN and NFV are symptomatic of a network technology trend towards open source and cloud software implementation to which the communications industry is responding. Open source communities may be considered by some to provide a more open environment for innovation than traditional standards bodies. It is important to note that open source communities are not controlled by any single entity or group of entities and it is not yet clear the extent to which markets (for VNFs as an example) will follow Open Source Communities vs traditional Specifications. SDN and NFV can be combined in a variety of ways see e.g. GS NFV EVE 005.

(1) (c) Will SDN and NFV also be offered by vendors (and/or open source) which will make such forms of network access possible based on SDN/NFV?

It is not yet clear the extent to which vendors will make such forms of access possible. To provides VNFaaS, as an example, requires at least the commercial availability of VNFs suitable for such a service. The ETSI NFV ISG has encouraged the formation of commercial teams to demonstrate capabilities in Proof of Concept activities. Commercial components are emerging in the marketplace, and it seems reasonable to expect that such forms of access could evolve from market forces. Many of these have also leveraged open source community efforts.

Vendors may adopt various implementation strategies, for example basing their products on open source but they may add more and more proprietary extensions; or by offering an integrated hardware + software system with the objective of offering of proprietary virtual appliances and adding SDN capabilities. It is not yet clear, what forms of network access will become possible with such vendor approaches. Network operators are limited in their ability to influence vendor roadmaps and have even less influence in open Source communities that are driven largely by the IT industry.

Despite that uncertainty, in this rapidly evolving and highly competitive landscape that requires massive private investment capital, regulatory authorities should refrain from picking a particular standard for access obligations, in particular at such an early development stage to avoid predetermining a technology development path while the industry is largely in an experimental phase with respect to adoption of NFV and SDN.

(2) Will SDN and NFV enable other new forms of network access or network sharing?
(a) If this is the case, please present them?

Enabling service innovation is one of the objectives of NFV. The definition of new services, however, is not within the scope of the ETSI NFV ISG. One way to consider NFV is as an effort to create a market in VNFs. VNFs can be designed to operate at a certain scale and be associated with specific resources through various metadata abstractions associated with the VNF and Network Service. Most of those VNFs are expected to provide additional functionality beyond layer 2. NFV is service agnostic in that sense.

The ETSI NFV ISG has an informative work item in progress being developed in conjunction with the MEF regarding the delivery of MEF services over NFVI. This has not yet addressed network access or network sharing. D/GS NFV EVE 002.

(2) (b) Will SDN and NFV facilitate new services which enables end users to set-up data (Ethernet) connections dynamically on-demand similar to phone calls?

Rapid deployment of new services is an objective of NFV. This is expected to include the ability to automate the ingestion of new types of VNFs, the development of new types of network services as well as the deployment of new instances of end-to-end network services - including individual VNFs and the connectivity between them. On-demand connectivity of layer 2 services between endpoints within the control of the NFVI would be a viable use case within scope for NFV. New service use cases, as proposed above, would require further definition of the parties involved, the dynamics, mobility, service availability, security, signaling protocols, and other operational implications.

It should be noted that the ETSI NFV ISG is not targeting our work towards any specific field of application or VNF. The ISG objective is to create a set of common technical specifications that enable service providers to acquire, (or develop) and instantiate all the different types of VNFs needed for their business. This includes virtualized versions of the various IT, network management and more traditional network connectivity functions required to support the range of services identified above.

(2) (c) Will SDN and NFV enable network operators to offer Virtual Network Functions (VNF) as a service to other operators? Do you expect that this will happen? Which VNFs?

As an analogy to the cloud computing SaaS service model, The ETSI NFV Use Cases document GS NFV001 envisages a use case of VNF as a Service (VNFaaS). This use case is described in terms of the service provider delivering a VNF as a service for an enterprise customer – it does not identify specific inter-provider uses. Some Mobile Virtual Network Operator business models already use a similar use case – e.g. a virtualized HSS.

More detailed technical specifications on VNFaaS have not yet been developed. NFV is still at an early stage, though some deployments of VNFs in support of existing network services are reportedly scheduled to start this year and next. It may take some time for NFVI deployments to reach the critical mass necessary to make such VNFaaS commercially viable.

(3) Will SDN and NFV have an (further) impact on the current value chain? If this is the case, please present how SDN and NFV will alter the current value chain.

The software based, dynamic nature of SDN and NFV enables the value chain to become much more dynamic and subject to open innovation driven by market forces. The emergence of Open Source Communities supporting code bases are an important factor to be considered in a value chain analysis. Such Open Source Communities may support much larger user bases than just telecommunications, enabling open innovation on a broader scale. A key aspect impacting the value chain from the open source software communities is the freedom to innovate that such broader communities provide. However, the use of open source in the telecommunications environment is not yet proven to deliver the operational requirements needed to support (for example) the requirements of critical national infrastructures, including security and resilience. When VNFs may be OSS, BSS, other IT functions as well as network functions, the boundaries between links in the value chain may become blurred.

SDN and NFV are not inherently restricted to communications service providers – indeed the basic technology is largely adopted from the IT industry. New business models might additionally have an impact on the future value chain by establishing a new class of role, potentially combined with innovative business models which in turn might influence the competitive landscape e.g. the impact on the value chain of partnering between internet service providers (e.g. Amazon, Google, Netflix, et al) and large enterprises is adoption of such distributed technologies is not understood yet.

(4) Will SDN and NFV have an impact on the relation between OTT and telecommunications service providers? If this is the case, please present how SDN and NFV will alter the role and possibilities of OTT and telecommunications service providers.

SDN and NFV are the industry reaction to the trend towards software – particularly cloud and other open source software - impacting telecommunications as it has other industries. This disruption impacts both Service Providers and the providers of technology innovation upon which they rely. OTT and new entrant service providers are more easily able to adopt SDN and NFV technologies than incumbents due to the absence of large legacy infrastructures. Enterprises are also adopting various virtualization and SDN techniques. Both groups are looking to these technologies for increased operational flexibility, speed to market and lower cost structures. Both groups are also better positioned to take advantage of the growing open source communities in these technologies due to the skill mix and process changes involved in engagement with open source communities. The NFV Architectural Framework does not distinguish whether the beneficiary of the transformation impacting the industry is an incumbent or a new entrant.

(5) Do SDN and NFV have other regulatory implications?

When telecommunications Service Providers deploy SDN and NFV in support of critical infrastructure this increases the importance of software in that infrastructure. There is also some relationship between NFV and cloud computing where layer 2 services may be delivered through cloud-like infrastructures. As communications services come to rely more on IT infrastructures, this drives further convergence as a technical matter. Policymakers may need to take a fresh look at policies, to the extent that both technical infrastructure and consumer services converge, even if participants come from different traditional sectors.

NFV enables service providers to deploy VNFs on NFVI Nodes providing an appropriate execution environment at NFVI Points of Presence (NFVI PoPs) that may be located in a data center, at the edge of the network or customer premises. The SDN separation of control and data plane enables the control of network elements in other locations. The NFVI Nodes are essentially IT infrastructure that may also support execution of other workloads. In consequence, this SDN and NFV have the potential to further blur market boundaries in the Information Technology and Communications Technology industries.