



2018 NFV Report: State of the VNF Ecosystem

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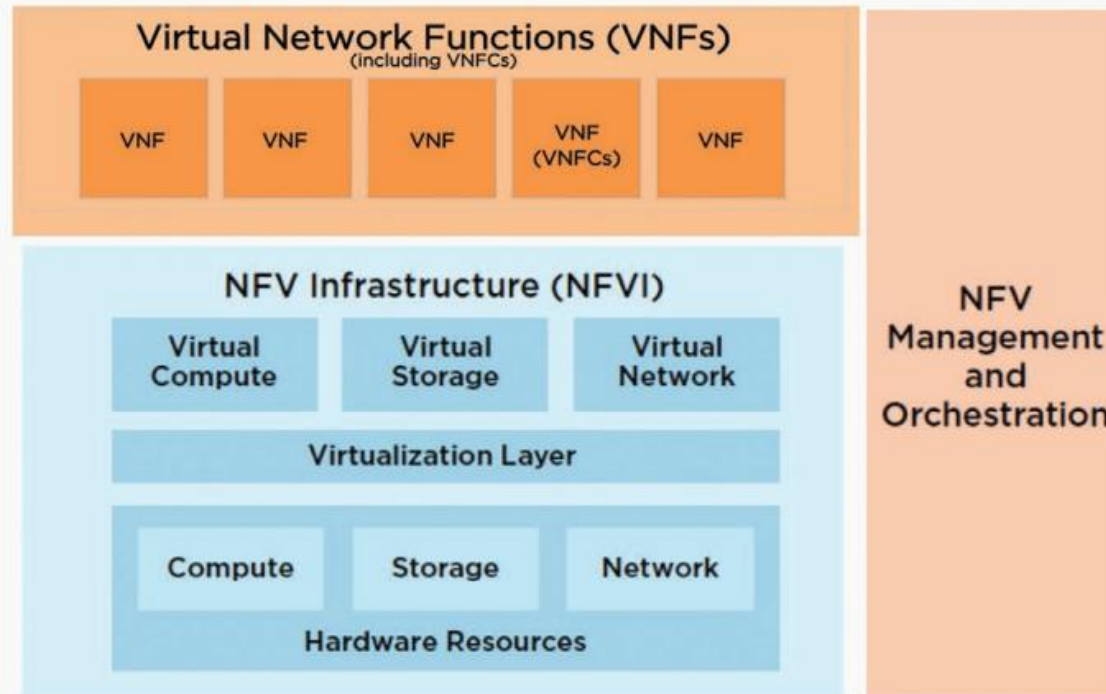


Content

- NFV Report Review
- Acknowledgement

The Virtualization Framework

NFV FRAMEWORK AND ROLE OF VNFs



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VNFs and NFV Advantages to Businesses

VNF's business promise has always been threefold:

- **Agility**

1. 'Recompiled' images of the hardware-based appliances from the incumbent appliance vendors.
2. The ability to stitch together VNFCs and VNFs into one cohesive service chain on-demand.

- **Cost**

1. With the advent of microservices, or **containers**, will further amplify the VNF density and lower capex for the CSP.
2. Interoperability challenges with VNFs and various VNFMs and difficulty in rolling out mature MANO stacks that can easily integrate with existing OSS/BSS systems at CSPs will continue to dog opex savings realization for the next 12-18 months, if not more.

- **Freedom from vendor lock-in**

VNFs Power Top NFV Use Cases

VNFs' original calling, and where they are most widely used today, is for providing a Layer 4 through 7 networking security service, including session border controllers, load balancers and application-delivery controllers, firewalls, intrusion detection devices, policy enforcement managers, DNS platforms, and WAN accelerators

- Virtualization of Home and Business Gateways (vCPE, SD-WAN)
Internet service providers (ISPs) rely heavily on residential gateways and set-top boxes based on embedded processors. The available bandwidth increase has given way to replacing these proprietary boxes with more industry standard CPU and VNFs.
SD-WAN continues to be one of the hottest market growth areas that is powered by replacing costly leased-line and MPLS connections with reliable Internet based broadband.
- Virtualization of Content Delivery Networks (CDNs)
- Virtual Network Platform as a Service
- Virtualization of RAN – vRAN
- Service Function Chaining (SFC)
Once VNFs are widely deployed, service providers should be able to offer additional higher valued services by providing point-to-point connections between VNFs that allow for composable paths through these VNFs.



VNF Major Challenges-VNF Onboarding

VNF onboarding consists of two stages. The first stage is the planning stage.

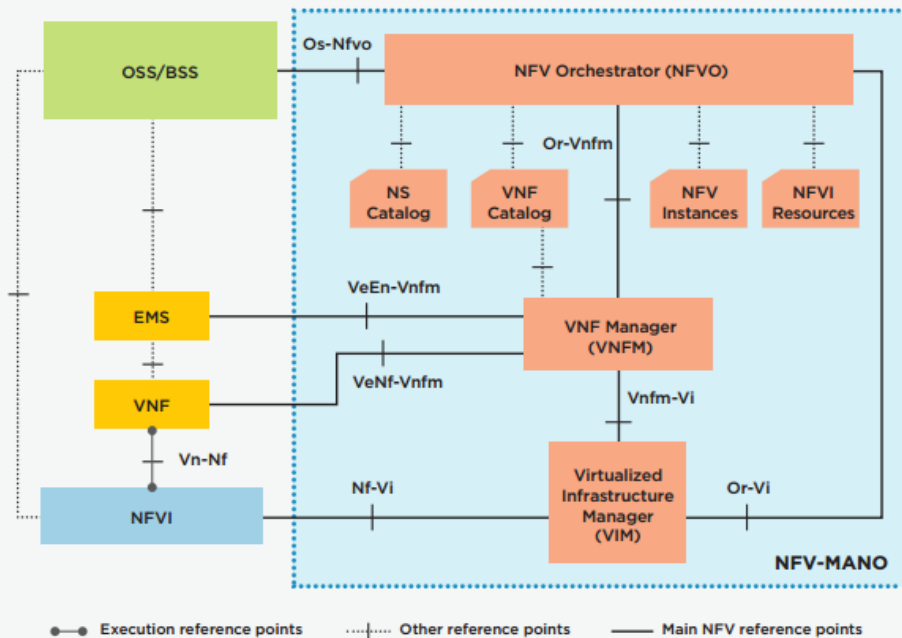
- Identification of the VNFs and VNF vendors
- Comprehending the licensing terms
- Procuring the VNFs from more than one vendor for testing
- Architecting the design-scale, heterogeneity, chaining, etc

The second stage is the operationalizing stage.

- Onboarding the VNFs from various vendors
- Orchestrating them with service function chaining (SFC), VNF Forwarding Graph (VNFFG) and Physical Network Functions (PNFs)
- Testing the capacity and performance before advertising the service capabilities

VNF Major Challenges-VNF Onboarding

NFV-MANO REFERENCE ARCHITECTURE



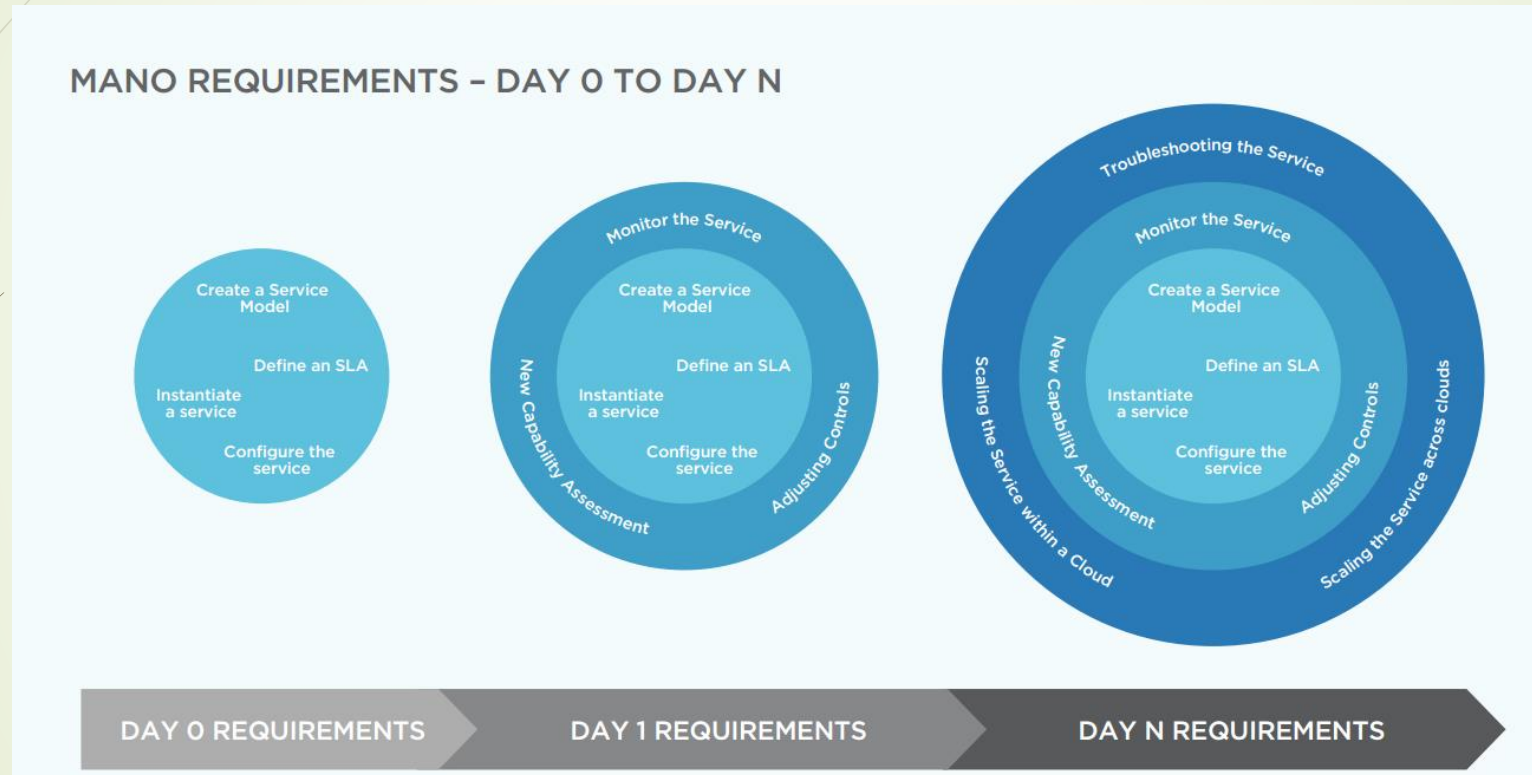
The onboarding process for any VNF involves:

- Support for the underlying NFVI
- Support for the VNFM that it brings along with it
- Integration, by extension, of the VNFM into the NFVO
- Optionally, direct integration into the existing EMS.

The biggest problem is that no standard way exists to instantiate, configure, and operationalize these multi-vendor VNFs.

VNF Major Challenges-VNF Monitoring

VNF monitoring is a key aspect of ensuring service availability and adjusting to changing conditions.



Often, VNF deployments focus on the Day 0 requirements, neglecting the Day 1 and beyond requirements. CSPs sometimes realize after initial deployment that they've neglected the remaining needs, resulting in much more expensive deployments after the fact.

VNF Major Challenges-Others

- Curse of the Fake VNFs
 - A VNF can be written in almost any programming language and come in any software package, with arbitrary interfaces (which may or may not fully conform to ETSI NFV standards)
- VNF Licensing—Still a Work in Progress
 - More granular approaches to licensing based on actual usage are required.
- VNF Performance—Value of HW acceleration
 - We're now seeing realization that using generic platforms might not make sense for all use cases (e.g. high-speed routing), and that HW acceleration in the form of Smart NICs and SSL/TLS assist might be necessary for some VNFs
- Generic VNFMs—Pipe-dream or Reality
- Performance Characterization—Whose Job is it?


Key VNF and NFV Market Trends in 2018

- Network-As-A-Service (NaaS) becomes Real
- Going Beyond Day 0 and Day 1 Operations to Day 'N' and Hyper-optimization
 - ❑ The distinct nature of 'carrier grade' requirements compared to a large enterprise IT application starts to really manifest itself more pronouncedly. These include: CPU pinning, DPDK (which was called out earlier), SR-IOV, cache sharing maximization, etc.
- Sophistication in VNF Workload Placement
 - ❑ Different infrastructure has different capabilities
- Mitigating NFV Islands Caused by VNFs
 - ❑ As CSPs roll-out NFV across different markets and use cases, they now find these disparate VNF islands, each of which might conform to the NFV framework, but which cannot interoperate much less mix and match VNFs.



During this one year...

- Survivable multicast provisioning
- NFV
- Machine Learning
- Others:
 - ✓ MEC
 - ✓ 5G
 - ✓ SDN controller placement
 - ✓ OTSS
 - ✓ Co-flow
 - ✓ RSA
 - ✓ ...



It's a precious memory...

- What I have learned from faculty members:
 - Academic attitude;
 - Pay more attention to what industry concerns;
 - Methods of doing research;
 - Be knowledgeable;
 - Be proactive;
 - English writing skills.
- What I have learned from lab-mates
 - Be interested in what you do;
 - Be hard-working;
 - Be energetic;
 - Be communicative.

It's a precious memory...





Thanks!