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The Benefits and Challenges of Virtual Networks

SDN (Software Defined Networks) and NFV (Network Function Virtualization) are about to change the way operators and service providers offer network services. Moving away from a hardware-centric, proprietary network infrastructure towards an open, standards-based, software model will revolutionize the way networks will be designed, implemented and operated.

Of course, the road to this future state is not without obstacles. As service providers deploy virtual services, they face an entirely new set of challenges testing, assuring, monitoring, and managing those services. Kevin Oliver, VP and GM at Viavi Solutions is seeing this play out today, "Network technology is well down the path of virtualization, and all members of the ecosystem need to adapt accordingly. However, there are two market requirements that must also drive development: interoperability, and streamlined ability to address hybrid configurations of physical and virtual networks."

It's becoming very clear that in addition to virtualizing the core networking functions – the vital support functions must be virtualized as well (service activation, performance monitoring, etc.). Those traditional assurance processes must transition from a static, slow, and reactive model to a much more dynamic approach with proactive monitoring, real-time intelligence, and analytics. Further, those functions must be tightly coupled with orchestration and policy systems. Lastly, multiple services and applications including Ethernet/IP, video, and mobile must also be addressed.

White Paper

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Key Benefits of NFV for Network Testing & Monitoring

1. Faster reaction time

NFV dictates a migration from rather static service offerings and deployment models to a dynamic environment in which services can be provisioned by a mouse click and immediately activated.

Applying the same NFV techniques to network test and service assurance enables network operators to test on-demand or as an integrated part of the service roll-out. Instead of dispatching a technician carrying specialized equipment to perform a test on site (which could take days), things like service activation and performance tests can be run automatically when required – remotely.

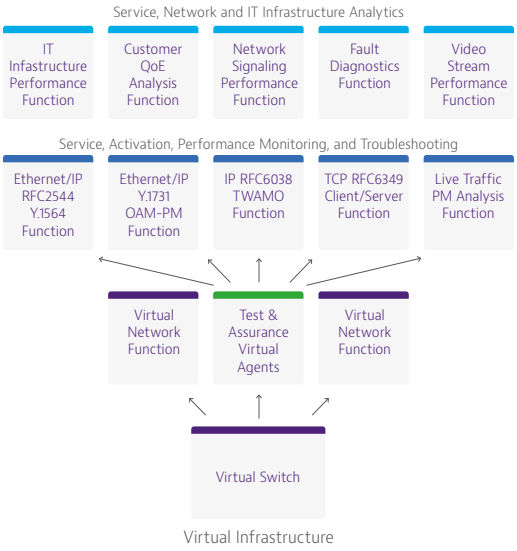

Figure 1: Potential setup for virtual test and performance monitoring functions

2. Migration to Software-Based Agents

Migration to software-based agents is critical to achieving the goals of speed and scale in NFV networks. However, as physical network functions get virtualized as software; test and performance monitoring functions cannot be left behind in the hard-wired world. It's not sustainable. Therefore, software agents must run on the same compute platform as the core network functions to provide visibility. They must also be deployable on-demand or as part of complex service chains.

Interoperability of software-based agents with field instruments, microprobes, and other physical network elements is essential for operators to integrate a virtual network into their legacy physical networks. Because of the sizable capital operators have invested in their legacy networks and the massive expense to forklift it out, legacy technology will not disappear for many years. Therefore, service assurance solutions and processes must support both virtualized and non-virtualized environments, enabling a smooth transition from today's networks to the future state: software-defined, multi-vendor, orchestrated virtual networks. Such hybrid networks will be the norm for nearly all network operators for the foreseeable future.

3. Cost Efficiencies

Historically, network monitoring and test systems required their own proprietary hardware platform. Those platforms were custom built and did not scale quickly with growing network traffic.

Current software-based agents combined with new data collection methodologies enable operators to leverage the non-proprietary compute platforms they're already deploying (for virtual network functions). No additional hardware is needed and testing scales rapidly with network and traffic growth. The result is operators can exponentially increase the number of test points deployed in their networks – providing dramatically increased visibility and performance data at a fraction of the historical cost.

4. Open Architecture

Network operators have hundreds of vendors represented up and down the layers of the Open System Interconnection (OSI) stack in their complex networks. Therefore, easy, standards-based interoperability across all of these layers is central to the widespread adoption of NFV and SDN. Because real-world networks are never based on a single vendor, the success of network vendors nowadays hinges upon the ability to leverage and build upon the innovation of others as much as it is the ability to deliver value in isolation.

It follows that an open architecture and multi-interface support is critical to the testing and monitoring of NFV networks. The IETF is standardizing virtual test and PM in broadband networks as part of the LMAP-Standard (RFC 7594). Open interfaces at multiple levels allow network operators to integrate assurance-solution components into various systems, and open APIs are required at the collection, mediation and reporting layers, among others.

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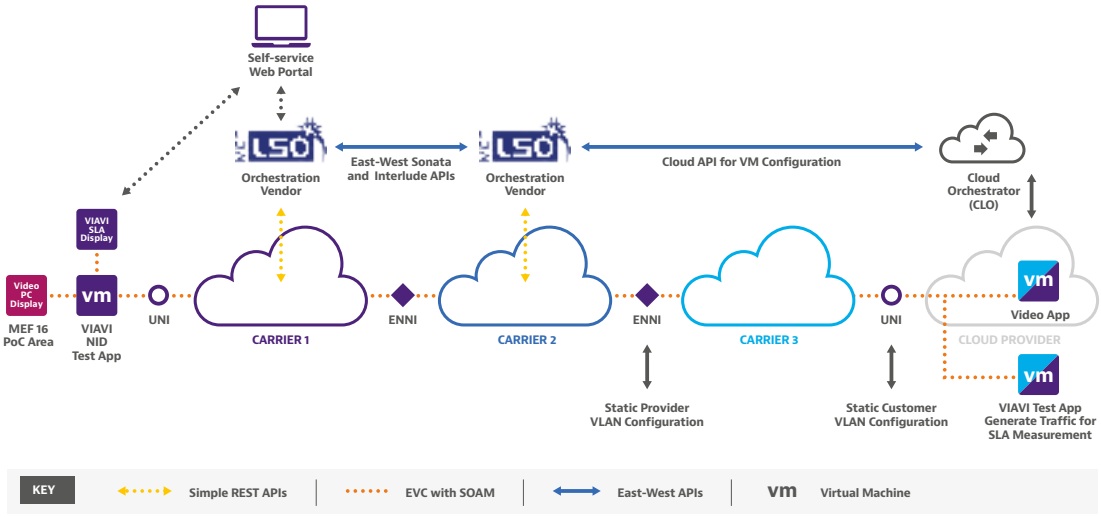
Virtual Test in Action

Sometimes a ping is not enough

At a recent event sponsored by the Metro Ethernet Forum (MEF), several companies were asked to illustrate the concept of the Third Network. One demonstration was a proof of concept collaboration between five companies: Comcast Business, Tata Communications, Telecom Italia/ Sparkle, ECI Telecom and Viavi Solutions. This international team displayed how an end-user could visit a web portal, select a cloud service from a drop-down menu, then gain access to it via a private network connection within minutes—all provisioned without human intervention.

The bandwidth-on-demand requirement of the demonstration was provisioned between Baltimore, Maryland and Frankfurt, Germany on live production networks and orchestrated across multiple service providers across 6,000 km. Comcast Business, Tata Communications and Sparkle provided the originating network, the intermediate network and the direct connection into the cloud, respectively. ECI's EPIC platform (with fulfillment functionality developed as part of MEF's OpenLSO fulfillment project) provided the intelligence to seamlessly connect these disparate domains. Viavi's Virtual Test & Activation administered service activation testing and provided real-time verification data on whether the newly created service met defined SLA requirements.

Orchestrated Multi-Carrier Multi-Platform POC at MEF16



Viavi's software-based test agents, deployed in virtual machines (VMs) at both ends of the connection, enabled the service activation testing and performance monitoring. The demonstration showed that by coupling the core virtualized network functions with the virtual test functions that support them, service providers can build automated network testing into activation workflows.

When NNIs (connections) between Comcast Business, Tata, and Sparkle had been established, a simple ping test was run between Frankfurt and Baltimore. At first glance it appeared that the network was up. A more sophisticated Y.1564 throughput test on Layer 3 (IP layer) using Viavi's virtual test agents confirmed the network connectivity, but also revealed that the link was experiencing a 15% packet loss. For the purposes of the demonstration, 15% packet loss was acceptable, but if that circuit had belonged to a paying customer, 15% could have resulted in an unsatisfied user. The loss was determined to be caused by buffer settings on one of the carrier's routers, which was easily corrected. This use case is a valuable example of the simple ping test leading to false conclusions—or at least inadequate conclusions—whether in a legacy or virtual network.

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Three Advantages of Virtual Test

Applying SDN/NFV to the area of test, monitoring and service assurance will provide several benefits:

1 Integration of test and service assurance methods into the service definition allows for automated testing when a new service is deployed.

2 Dynamic or static deployment of software-based virtual test and PM agents/virtual taps enable:

- Elimination of costly service technician dispatches
- Immediate and fast troubleshooting from a central location
- Reduction of costly test and monitoring tools
- Measurement of network and application performance
- Transition from re-active to pro-active network assurance
- Creation of a self-healing network infrastructure

3 Comprehensive data analytics tools leveraging the virtual test and monitoring data enable sophisticated new service and revenue models.

Bridging the 'Virtual' Evolution

There is no question that SDN and NFV will radically transform how telecom networks are built and operated, and how communications services are delivered and consumed. By leveraging high-volume standard servers and IT virtualization, NFV enables use of a single physical platform for different applications. As NFV moves from the lab to real world trials, the spotlight will increasingly be focused on how to monitor and test new virtual services and applications.

Virtual test, diagnostic, and service assurance functions will be as necessary as the core network functions they support, and must be virtualized along with them. Once deployed, these capabilities enable dynamic assurance and troubleshooting functions bridging the virtualized networks of tomorrow and legacy networks of today.

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