Virtually speaking

Claude Robitaille, Chief Technology Officer at Accedian, argues that SDN and NFV even have benefits for transport networks

A rapidly changing usage and technology landscape is changing the way carriers construct and manage their networks. Not only are traffic volumes increasing, but there are also new and much more voluminous types of traffic involved, each with its own set of requirements (eg latency for video, or availability for Internet of Things safety-related services). There are more connected devices, and more ways to send, receive, and view data. All this creates challenges – but also opportunities – for operators.

As such, carrier networks are fertile ground for the benefits that software defined networking (SDN) bring to management, service definition, and optimal partner carrier and route selection. A programmable transport network – often deployed using existing control protocols like MPLS-TP to manage the data plane – can be easily automated to perform complex operations and drive real savings.

Least cost routing is a classic example: choosing partner carriers with the lowest transport cost in the moment, for a particular application, has long been relied on to save money while optimising service quality. SDN control offers the ability to do this over multi-carrier, multi-hop routes, which would previously have required sophisticated home-grown network management systems.

So the benefits of SDN are clear for operators making their living in the interconnect, peering, and transport domains. But what about network functions virtualisation (NFV)? What role can it play in a segment that is largely concerned with moving bits, instead of delivering services?

While most transport functions are not suited to immediate virtualisation – you would be hard pressed to virtualise a core or aggregation router on any form of white box – some of the important feedback mechanisms relied on to optimise transport, assure SLAs, and monitor performance and security, are very well suited to virtualisation. There are two reasons for this:

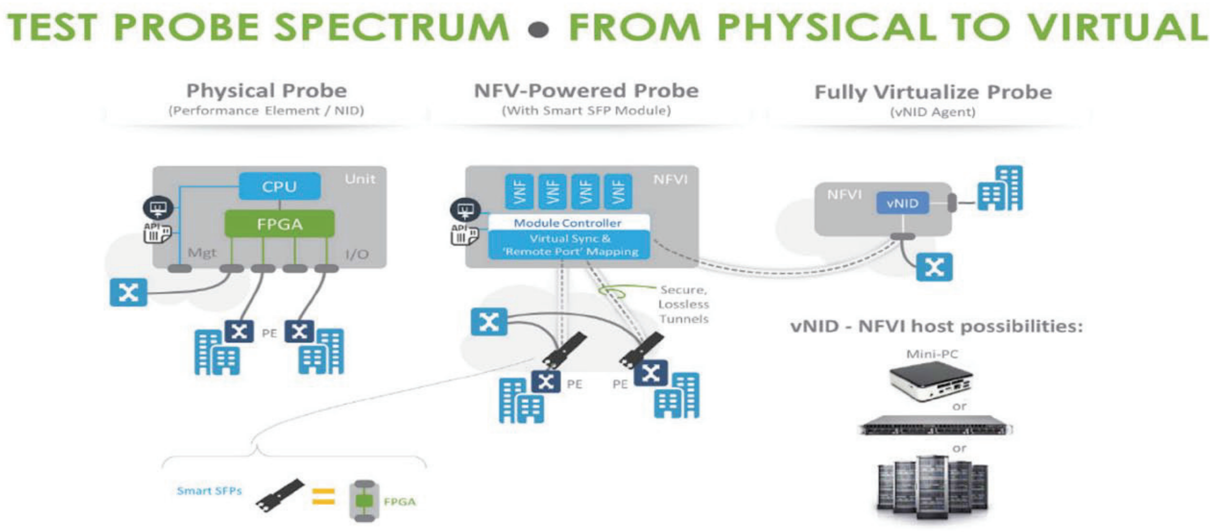
1. Performance assurance functions can be deployed more cost-efficiently with virtualised instrumentation, packet brokering, DPI, and intercept.
2. The coverage, granularity, and ubiquity of those deployments outstrip traditional probe-based monitoring methods and solutions.

Let's explore what virtualised instrumentation looks like, what it's capable of, and why it's transformative to carriers in terms of cost, deployment efficiency, and value.

Virtualised instrumentation techniques

Virtualising the sophisticated packet-level processing hardware that forms the basis of high-capacity monitoring probes needs to be handled carefully. Certain test and measurement functions – for example, latency – rely on very precise time-stamping for SLA reporting. Achieving microsecond precision is not currently possible in a virtual environment. Achieving sub-millisecond precision is.

The degree to which instrumentation can be virtualised, then, depends on the application at hand. If an operator is transporting general internet traffic, fully virtualised probes fit the bill. However, if the end-customer is a financial services provider delivering market feeds to customers globally, software-precision won't suffice. So carriers will need to employ different



The spectrum from traditional test probe architecture (standalone) vs. NFV-powered smart SFPs and virtual NIDs, along with options to host them

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levels of virtualisation, depending on the customers they are serving.

So how do you virtualise with software, while keeping hardware-level precision where required? The key comes from SDN. Software defined networking separates control from forwarding functions (control plane from data plane), simplifying the processing requirements at the data layer. This enables low cost – or even fully virtualised – network elements to move bits without the overhead associated with routing.

The same thing can be done to traditional probe-based monitoring systems, using a standards-based approach that is now becoming widely accepted and deployed across service provider’s business, mobile, and residential triple play networks.

Traditional monitoring equipment relied on purpose-built appliances with sophisticated CPUs, accompanied by line-rate FPGA processors to handle critical traffic conditioning, test, and measurement functions. A virtualised version of this, following the SDN architecture model, separates test session management, topology, SLA definitions, reporting, KPI crunching, and correlation (CPU functions) from the packet processing (data plane). Probes that used to take racks of equipment can be reduced to very minimal hardware that provides the required precision. Often this can be accomplished within the footprint of standard SFP optics—what’s known as a “smart SFP.”

In this setup, the instrumentation controller employs NFV principles to offload any local CPU processing functions from the smart SFP, so that no functionality or precision is lost, while footprint and cost has been optimised - often to 90% less than traditional probe-based systems.

Instrumenting co-location points, network-to-network interfaces (NNIs), and service endpoints is as simple as sending the smart SFPs to the appropriate location, then plugging them into a free switch or router port (out-of-line deployment method), or replacing an existing SFP (in-line method). The units ‘call home’ to their controllers, and self-register, eliminating the need to manage individual units – and thereby optimising operational simplicity.

These miniature probes can then test between each other (per link, or end-to-end, per service or for the complete ‘pipe’), as well as perform remote packet capturing (tapping), which the controller brokers back to existing DPI, optimisation systems, lawful intercept solutions, and so forth.

So what about the case where hardware precision isn’t required, or installing even a simple device isn’t practical? That’s where operators can benefit from fully virtualised probe solutions that use common Ethernet and IP layer performance measurement standards – like Y.1731 Ethernet OAM, and RFC-5357 Two Way Active Measurement Protocol (TWAMP) – for testing to existing network elements. As nearly all transport-grade network elements support reflectors for these protocols, tests can be conducted to any location in the operator’s network without installing any far-end equipment. In this case, a virtualised test probe can be loaded where desired (e.g. at a data centrE connected to a carrier hotel), and tests can then be conducted continuously to monitor any other handoff or service termination location, globally.

Combining and scaling virtualisation techniques

These techniques can be combined. A virtualised test probe can use the precise timing, traffic injection, and capture capabilities from smart SFPs located throughout the network to supplement probe points, and to increase test precision, where required. A smart SFP can also test to standards-based network elements, in addition to other smart SFPs and network interface devices (NIDs). The combinations are flexible, but a single virtualised controller means that session setup, reporting, and management are simple. APIs allow existing systems to not only to get data but also control monitoring functions.

Large scale deployments have proven the speed and completeness offered by this approach. Telefonica is instrumenting their global network, SK Telecom has done the same to monitor hundreds of thousands of flows to 40,000+ cell sites, and Colt has established global SLA monitoring with similar techniques. Most notably, deployment time and effort are minimal compared to any traditional technique. The result is total visibility, giving operators the intelligence needed to perform optimal control, ultimately delivering a better end-user experience.

SDN will change the way carriers manage and deploy their networks, and NFV can help as well – perhaps not in everyday function virtualisation, but to deploy end-to-end visibility that brings out the best of SDN, and the most cost efficiencies out of network operations. CSI

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