Drilling down to the core with NFV

Operators are finding it tough to adjust to the rise of mobile Internet, with over-the-top (OTT) content providers seeming to hammer the nail further into the coffin. The new rules of the game are disrupting existing value chains, with services increasing but revenues remaining stagnant. Operators are staring at the unpleasant view of a dumb pipe. But, a Better Connected World beckons that promises ubiquitous connectivity. For operators, the situation is something like Charles Dickens described in A Tale of Two Cities: "It was the best of times, it was the worst of times, it was the age of wisdom." They need to find the wisdom to step on the path to the best of times.

By Liu Hao

Rapid changes in the industry have been paralleled by a shifting landscape for users, networks, and services landscape. Operators have had no choice but to transform, or risk becoming shipwrecked on the shores of failure.

Network experience is pivotal to their success, which is why network transformation is a focal point of digital transformation. At the core of this sits network function virtualization (NFV) and software-defined networking (SDN), both of which promise immense value.

Restructuring with NFV

NFV is a key enabling technology for restructuring networks, architecture, operations, and services. It decouples software from hardware using standardized IT hardware platforms and virtualization tech to replace the private dedicated network elements of traditional telecom networks. NFV will help increase the flexibility of network operations, improve management and maintenance efficiency, and cut costs.

NFV's importance and huge commercial value in the network evolution process have made it a cornerstone of operators' future network development strategies. In October 2012, 13 operators – including AT&T, BT, Orange, and Deutsche Telekom – set up the Industry Specification Group for Network Function Virtualization (NFV-ISG) at ETSI (European Telecommunications Standards Institute). With the remit of developing NFV architecture and technology and promote network function virtualization, NFV-ISG released a series of white papers proposing goals and action plans for the new technology.

The world's leading operators have set out network transformation strategies based on NFV and SDN. For example, AT&T's Domain 2.0 plan outlines the carrier's goal to virtualize 75 percent of its networks by 2020, which includes shifting from hardware – to software-centric network infrastructure and restructuring its services on cloud-based open networks that open up network capabilities to third parties. Telefónica unveiled its UNICA

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project, which has multiple aims: build SDN-capable networks, deploy cloud-based telecom services, realize agile deployment for telecom services and universal cloud services, give users on-demand access to these services, and simplify network control.

At the 2015 Mobile World Congress in Shanghai, China Mobile announced NovoNet 2020, an ambitious vision for combining SDN and NFV tech to build a next-gen network that enables flexible architecture with open interfaces, scalable capacity, and global resource scheduling.

Expect a massive market

According to a July 2015 IHS Infonetics research report, the NFV market will skyrocket from a value of US$950 million in 2014 to US$11.6 billion in 2019, a compound annual growth rate of 65 percent. At present, standards organizations, open source communities, operators, and equipment vendors are collaborating to advance the NFV value chain. After more than three years of growth, NFV technology is maturing.

Sky high: The core reaches the cloud

While the NFV era is on the way, it's happening in the context of immense operator networks and extremely complex service scenarios. So, which scenario will be the first to embrace NFV? The consensus is core networks, in the following order of planes: control, signaling, data, and media. Core networks will be the first step on the way to full NFV adoption.

As for operators evolving their core networks with NFV, industry experts point out that the switching and control center network is the primary feature of a telecom plant. After the move to cloud networks, core networks must continue to offer carrier-grade services such as high reliability and performance, fault recovery, and open architecture. To do so, they need a cloud-based software design.

To start with, operators need to build agile networks. Compared to the rapid service innovation and responsiveness of OTT players, operators take much longer to introduce new services or capabilities due to their traditional network architecture. NFV and SDN enable operators to integrate the scalable resources of cloud-based infrastructure, including SDN and NFV service elasticity. The result is unified scheduling, network coordination, and VNFs (Virtualized Network Functions) based on service requests. Based on automated end-to-end resource deployment, schedule flexibility, and faster TTM, service instances increase during times of growth and decrease during periods of slow growth.

To achieve this, operators require advanced cloud-based software architecture that separates programs and data. With service state storage in an independent distributed database, service processing units can scale to meet service needs by flexibly adding or releasing virtual

machine resources without service downtime.

Next, operators need to build smarter, automated networks. Currently, the following trends are taking hold: network virtualization of data centers, decoupling software from hardware, network personalization, introduction of massive third-party services, and the auto-orchestration and auto-scaling of services and resources. Each of these features requires a maintainable, serviceable, and operable network alongside a unified smart orchestration system that can:

- Enable unified scheduling and dynamic updates of networks, resources, and network elements based on different services and policies.
- Automatically integrate and consolidate operations to automate service orchestration and maintenance, slashing workloads and reducing maintenance complexity.
- Monitor service KPIs in real time so that an alarm is triggered when KPIs hit the set threshold, and automatic recovery begins.
- Support end-to-end fault localization within an environment where hardware and software are decoupled. The system needs to consolidate and analyze security information like logs, alarms, and output exceptions from each component to ensure rapid fault localization and threat forecasts.

No matter how operators transform their networks, they must have a multi-layer strategy for reliability backed by innovative technology to deliver five-9 (99.999%) carrier-grade reliability after adopting NFV.

Finally, operators need to create more services and value through cloud-based networks. In their current state, they have little chance of beating OTT players when it comes to innovative service applications. However, they have accumulated vast digital assets over a long period of time that yield considerable value, which they must find a way to harness and unleash.

Operators can employ emerging NFV/SDN technologies to flexibly integrate their network capabilities, provide services (such as VNF as a Service) directly to third parties by opening up their network capabilities, create a new ecosystem, and increase revenues. To this end, they need

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support in offering third parties a one-stop platform that provides exposure to network capabilities, including a DevOps mode that supports the entire service lifecycle, from development to maintenance.

Moving forward, such a platform will need to encapsulate communication capabilities – including voice, video, conferencing, SMS, and access to location, bandwidth, and data – into APIs (application programming interfaces) and SDKs (software development kits). This will accelerate service innovation and release, and create an environment conducive to win-win outcomes between operators, their partners, and even OTT players.

It's worth noting that legacy telecom networks are unable to meet the varied requirements each vertical has for network capabilities. For example, the Internet of Vehicles requires ultra-low latency, video streaming sites need high bandwidth, and banks need the highest possible level of network reliability. NFV and SDN technologies enable VPN (virtual private network) slices that support the unique communication characteristics of each enterprise or industry. In other words, operators will be able to divide traditional telecom networks into thousands of network slices, with each slice meeting the custom needs of individual enterprises and industries. Such a model, which could be called Network Slice as a Service, would help operators better meet user needs in different personal, household, business, and specific industry scenarios.

Vodafone launches the world's first cloud-based VoLTE commercial network

For operators, the benefits of NFV go beyond reducing OPEX. The core value of agile, smart, and value-added cloud-based networks made possible by NFV is the extra revenue they can generate. Major operators are keen to begin extracting this value. Having accumulated useful experience in NFV deployment, they're now starting to walk the walk.

Despite being a leading global telecom operator, Vodafone's traditional telecom services like voice and SMS have been hit by OTT services. NFV has offered Vodafone an effective solution to this problem by providing the company a means to build smart pipes, optimize its networks, improve its management efficiency, and make its networks smarter and more controllable, all the while slashing maintenance costs. Moreover, NFV enables Vodafone to fully open up its underlying networks, and drive innovation and flexible deployment of Internet services.

Vodafone announced its One Cloud strategy to move everything to the cloud as far back as 2013. The goals of this transformation strategy are to challenge OTT services and, more importantly, adapt to the explosive growth of data traffic in the Internet era, deliver a better user experience, and change its role from a pipe provider to a service provider.

A key step in this strategy was to construct an NFV cloud-based VoLTE network – the world's first – in partnership with Huawei in 2014 in Italy. Vodafone teamed up with Huawei again to launch the network commercially for its Italian subsidiary in July 2015. Serving as the primary systems integrator, Huawei provided a cloud-based IP Multimedia Subsystem (IMS) network and delivered a vertically integrated, end-to-end system with a horizontal service layer, while guaranteeing carrier-grade capabilities over the cloud-based network.

Vodafone and Huawei worked together to develop the CloudHealth tool kit at Huawei's NFV/SDN open lab. When simulated errors were inputted into the system in a mirrored network environment, CloudHealth automatically detected sub-optimal performance and initiated automatic system recovery. This new system can issue a warning of potential system-level faults a full three hours in advance of system failure. Previously, simply detecting and localizing faults could take four hours after they had already occurred.

NFV live network pilots in China: Generating valuable experience

Chinese operators have also been hit by the sudden rise in OTT services. In response, they're transforming their networks, with NFV as a must-have technology. China Mobile, in partnership with Huawei, kicked off the pilot deployment of an NFV cloud-based core in September 2015. The operator's subsidiaries in Shaanxi and Anhui provinces ran test applications of NFV technology on their live networks and a small-scale field trial of the pilot network. These tests aimed to verify cloud-based networking, technical specifications, service capabilities, maintenance, and full-lifecycle management.

Then, on December 10, 2015, China Mobile, alongside Huawei, HP, and Inspur, completed the first cloud-based VoLTE call over its pilot NFV cloud-based network, demonstrating that the IMS system had successfully connected with a live network in a multi-vendor hardware environment.

Following this breakthrough, China Mobile completed another first, with a cross-province HD video call based on its pilot NFV networks in Shaanxi and Anhui.

Nevertheless, NFV-based networks can't be built overnight – the process is complex and requires operators to fully consider how NFV-based networks align with network transformation and comprehensive development strategies, meaning the large-scale commercial deployment of NFV-based networks will take place over the long term. Tier-1 operators such as Vodafone and China Mobile are currently piloting NFV technology, providing a useful reference point for other operators that are considering NFV deployment.

The foundation is in place for NFV to stake its claim as a key enabling technology in the network evolution process – a process that operators must follow.