

Software-defined networking (SDN) and its complementary technology network functions virtualisation (NFV) are helping enterprises globally in improving the agility, automation capability, flexibility and interoperability of their network designs. SDN helps create a virtualised network overlay, which allows the underlying network to quickly respond to network changes and forward traffic efficiently. Meanwhile, NFV allows the transition of traditional network functions such as load balancers, firewalls, subscriber policy management and mobile radio access network from a physical hardware set-up to a virtual network.

SDN and NFV deployments have started altering operational and service dynamics for telecom operators across the world. Operators are increasingly using SDN and NFV to manage and provision network services from a centralised location, thereby enabling faster and cost efficient delivery of on-demand applications with minimal disruption. Besides, the bandwidth flexibility, programmability and automation capabilities of SDN and NFV are helping service providers monetise their range of services linked to internet of things (IoT) and cloud infrastructure.

### Global market size and growth

The global SDN market is expected to grow from \$8.8 billion in 2018 to \$28.9 billion by 2023, at a compound annual growth rate (CAGR) of 26.8 per cent. This will be driven by the burgeoning demand for data centre services in enterprises. Data centres are the major end users of the SDN framework. SDN helps in addressing congestion-related issues in data centres as it provides visibility and control of the traffic in a network. The SDN market is expected to witness the maximum growth in North America as the region is leading in terms of adoption of next-generation technologies such as cloud computing, network functions virtualisation (NFV), mobility services and bring-your-own-device.

As per industry estimates, the size of the NFV market will reach \$70 billion by 2024 driven by the growing adoption of mobility services in enterprise IT infrastructures, low telecom carrier costs, and commercialisation of 5G technology. Moreover, enterprises are expected to deploy cloud-based NFV solutions to scale their networking infrastructure in order to meet the increased workloads and reduce the cost incurred in procuring additional hardware appliances for supporting new network services. The adoption of NFV will also enhance enterprises' ability to deliver better network function performance with smaller data centre rack spaces, and limited power and cooling requirements.

So far, the hardware segment has held the majority share in the global NFV market due to the

large-scale adoption of NFV servers for virtualising diverse network functions such as firewalls, network address translation, routing and internet protocol (IP) security. However, going forward, the software segment is expected to lead the NFV market growth due to the extensive deployment of NFV management and network orchestration (MANO) platforms as well as virtual network function software applications for virtualising a diverse set of network functions. The manufacturing sector is expected to be the largest adopter of NFV owing to the large-scale implementation of industrial IoT technology. In the manufacturing sector, NFV uptake is expected to register a CAGR of 50 per cent between 2018 and 2024.

### **Indian operators to ramp up investments**

The Indian SDN and NFV market has witnessed subdued growth owing to the lack of well-developed standards for these solutions. However, the upsurge in data consumption is compelling telecom operators to adopt SDN and NFV in a big way. Operators are turning towards SDN and NFV to provide the highest level of customer experience and, at the same time, keep operational costs in check.

At present, Bharti Airtel is using SDN/NFV to offer music and on-demand video services. It had earlier signed a contract with software major Google to use the latter's SDN-based platform for running network services in a virtualised environment. The platform will allow Airtel to adapt to new services and traffic patterns effectively and efficiently. Meanwhile, Reliance Jio Infocomm Limited has joined the open network automation platform as a platinum member to work with open source communities to build Jio MANO, its own management and network orchestration software, which is in pre-production, and develop its own SDN controller. Vodafone Idea Limited is also running trials of SDN and NFV, and plans to soon deploy these technologies commercially. The operator is also working towards simplifying and upgrading its data centre architecture in order to host cloud-native apps related to network and the IT domain.

### **Enabling role of SDN and NFV in 5G roll-outs**

SDN and NFV are expected to accelerate 5G deployment by addressing the major functional needs of 5G networks. The high flexibility and adaptability of SDN and NFV solutions will help meet the throughput and processing requirements of different 5G services. SDN and NFV will also help operators scale easily to support 5G expansion and configure their networks to allow a seamless interaction among different services inside the core network.

NFV will play a critical role in the deployment of 5G services on third-party hosting infrastructures. Besides, it will allow a 5G physical network to be divided into various virtual networks capable of supporting multiple radio access networks across different customer segments and environments. Meanwhile, SDN can be used to provide an overall framework to enable 5G to function across a normalised control plane. This will help manage network behaviour through application program interfaces and provide services through the network. In addition, SDN can provide better data traffic management on the 5G network by determining optimal data flows in real time, minimising network bandwidth and boosting latency. SDN will also assist in efficient performance monitoring of 5G networks.

Therefore, it is imperative for telecom operators to work with global co-location and interconnection providers offering carrier-grade infrastructure and a wide range of easy-to-deploy SDN and NFV solutions in order to realise the full potential of 5G services.

### **Growing popularity of SD-WAN**

Over the past two to three years, wide area network (SD-WAN) has emerged as the most popular application of SDN technology. SD-WAN is a virtual WAN architecture that allows enterprises to leverage any combination of transport services including multiprotocol label switching, long-term evolution and broadband internet services to securely connect users to applications.

The traditional WANs based on conventional routers are not cloud friendly and typically require backhauling of all traffic including the traffic that is routed over the cloud from branch offices to a hub or a headquarter data centre. The delay caused by backhaul impairs the application performance resulting in the poor user experience and productivity loss. SD-WAN technology uses a centralised control function to securely and intelligently direct traffic across WAN, thereby increasing application performance, enhancing user experience and reducing IT-related costs.

The two key SD-WAN capabilities for enterprises are centralised orchestration and zero-touch provisioning (ZTP). Centralised orchestration helps enterprises centralise the configuration, application performance and security policies of WAN. Meanwhile, with ZTP, configurations and policies are programmed once and pushed to all branch locations without having to manually

program each device. It therefore eliminates the need to send specialised IT resources to branch locations whenever a new application is added or a policy change is introduced. ZTP also reduces human errors, resulting in more consistent policies across a firm.

For enterprises globally, SD-WAN will usher in a new era of flexibility. SD-WAN handles traffic based on priority, quality of service and security requirements. It continuously monitors applications and WAN transport resources, and can quickly adapt to the changing network conditions to maintain the highest application performance and availability. Advanced SD-WAN delivers the highest levels of experience, even if a transport service experiences an outage. This improves business productivity and end-user satisfaction. Owing to its flexible nature, SD-WAN helps reduce the need for over-provisioning, thus bringing down overall WAN expenses. According to research firm Gartner, up to 25 per cent of WAN users will manage their network with the help of SDN solutions within the next two years. Meanwhile, revenue from SD-WAN solutions is growing at 59 per cent annually and SD-WAN is expected to become a \$1.3 billion market by 2020.

### Key challenges

While the shift towards SDN and NFV is expected to help enterprises and service operators create a more agile, virtualised and automated network infrastructure, it is likely to bring in a new set of challenges for them. For one, until the migration to all-virtual networks is completed, enterprises and service providers will have to deal with a combination of legacy networks and new virtualised networks to manage a multivendor environment. Operators will have to look for orchestration vendors that can function as service integrators, and ensure end-to-end integration and management of the ecosystem.

Further, an enterprise cannot fully leverage SDN and NFV unless its operations support systems and business support systems are aligned with the new technologies. On the technology front, the lack of a mature technology, consensus on multiple open source standardisation initiatives and proven business cases also pose significant challenges.

In order to migrate to SDN- and NFV-driven networks, operators and enterprises will have to modify their network architectures, overhaul their business models and make organisational changes. These technologies require a fundamental change in the way networks are controlled, and a completely different approach to network and employee management.

### The way forward

SDN and NFV encompass various solutions aimed at making networks agile and flexible. These technologies provide myriad benefits to telecom operators, enterprises and data centres. Besides addressing the explosive increase in mobile data traffic, SDN and NFV can help service providers limit their capex and opex requirements by reducing their dependence on expensive proprietary hardware platforms. Globally, the major service providers are scaling up investments in SDN and NFV, and it is about time that Indian operators step up their SDN and NFV deployment as well. This will facilitate the roll-out of 5G services, which require a dynamic, flexible, programmable and virtual network architecture in order to ensure a steady flow of revenue and sustainability for service providers.

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