Software-defined networking (SDN) and its complementary technology network functions virtualisation (NFV) are playing a pivotal role in the digital transformation of network infrastructure. These technologies are aimed at decoupling software from hardware. As a result, service providers will no longer have to rely on expensive proprietary hardware platforms. Besides, both the technologies can significantly bring down the operational expenditure of operators by reducing their physical space, manpower and power requirements. SDN and NFV also provide increased flexibility and agility to networks by making them more programmable, dynamic and architecturally simple.

SDN and NFV are transforming telecom networking globally by helping operators significantly reduce their hardware and software requirements, and achieve higher value through cloud-based networks. These technologies also have an important role to play in the Indian market, where operators have struggled to get a return on their investments in spectrum owing to pricing pressures and low average revenue per user. Using SDN and NFV, Indian operators can reduce costs, accelerate service deployment, maximise resource utilisation, reduce network complexity, enhance scalability and offer on-demand and differentiated services.

Market uptake

Currently, the adoption of SDN and NFV is largely driven by enterprises. Enterprises across verticals are using SDN and NFV to deploy a centralised management framework for automating network devices. NFV is helping enterprises automate network services such as firewalls and load balancers. Further, NFV is being increasingly used to automate hybrid cloud networking, which is typically dependent on manual configuration. Going forward, businesses are expected to move towards bring-your-own-licence and pay-as-you-go cloud SDN and NFV models to further derive value from network virtualisation.

Telecom operators have started virtualising their internal networks as well. For instance, as part of its efforts to transform into a digital operator, Bharti Airtel is leveraging SDN and NFV to optimise its networks and launch new services. It is working with South Korea-based operator SK Telecom to leverage the latter’s expertise in building advanced telecom networks through SDN and NFV. It has also partnered with Google to use its SDN framework-based platform for running network services in a virtualised environment and adapting to new services and traffic patterns effectively and efficiently. Other operators, too, have begun discussions with technology providers for the virtualisation of their networks, which, in turn, will help them in the faster roll-out of new products and services. Reliance Jio Infocomm Limited (RJIL) has joined the Open Network Automation Platform (ONAP) project as a platinum member to work with open source communities and global telecom players to bring about a fundamental shift in the

telecom framework using cloud-centric digital models. SDN and NFV technologies will be at the core of this shift, which will help RJIL evolve its networks beyond all-IP. Meanwhile, SDN and NFV are helping operators explore new markets, particularly in rural areas, which they were unable to serve earlier owing to the high cost of network deployment.

Emerging trends

• Enabling role in 5G roll-out: SDN and NFV are expected to address some of the major architectural challenges in 5G networks. NFV will enable 5G network slicing, allowing various virtual networks to run on the top of a single physical infrastructure. Currently, domain-specific standards bodies and open source communities are using slicing in contextually different ways, which has increased the complexity of implementing network slicing in a converged core 5G infrastructure. Besides, NFV will allow a 5G physical network to be divided into various virtual networks capable of supporting multiple radio access networks. Moreover, 5G will help develop a virtualised infrastructure and systems that are scalable as well as flexible enough to cater to future unknown 5G applications.

SDN, on the other hand, can be used to provide an overall framework to enable 5G to function across a normalised control plane, thereby helping manage network behaviour through application program interfaces and providing services through the network. It can also provide better data traffic management on the 5G network by determining optimal data flows in real time, minimising network bandwidth and boosting latency.

• Increasing adoption of SD-WAN: Software-defined wide area network (SD-WAN) is fast emerging as a popular application of SDN technology for WAN connections, which are used to connect enterprise networks such as branch offices and data centres over large distances. SD-WAN adopts a software-based approach to migrate a large part of the network control to cloud, thereby helping the enterprises save costs on the installation of expensive fixed-circuits, or proprietary hardware for WAN connections. Besides, SD-WAN has the ability to manage multiple types of network connections ranging from multiprotocol label switching (MPLS) to long term evolution. SD-WAN is managed through a centralised controller, which enables the companies to remotely programme edge devices and reduce provisioning time, thus minimising the need to manually configure traditional routers in branch locations. Further, SD-WAN architecture enables administrators to reduce the dependence on expensive leased MPLS circuits by sending lower priority, less-sensitive data over cheaper public internet connections, reserving private links for latency-sensitive traffic. The flexible nature of SD-WAN also reduces the need for over-provisioning, reducing overall WAN expenses. SD-WAN enhances the network by identifying network traffic by source/destination, application and users, and routing

the traffic in accordance with the centrally defined security policies. The adoption of SD-WAN is expected to significantly pick up pace in the coming years. According to Gartner, up to 25 per cent of WAN users will manage their network through SDN solutions within the next two years. 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.

• Data centre optimisation: SDN and NFV are helping enterprises optimise their data centre operations. Enterprises that have a complex and fragmented network ecosystem spanning multiple data centres are abstracting the control layer through SDN. This enables them to control network functionality, traffic distribution and network automation. Using NFV, enterprises can deploy a virtual appliance, which acts as a powerful load balancer that monitors workloads in the data centre and on the cloud.

Key challenges and the way forward

While SDN and NFV promise significant improvements with regard to network performance and cost optimisation, the shift towards these technologies is likely to bring in new challenges. 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, and thus manage a multi-vendor environment. Operators would have to look for orchestration vendors that can function as service integrators, as well as enable end-to-end integration and management of the ecosystem. Further, the optimal value of SDN and NFV will not be realised until the operations support systems and business support systems are aligned with the new technologies. On the technology front, the lack of mature technology, consensus on multiple open-source standardisation initiatives and proven business cases also pose significant challenges.

Operators will also have to develop new testing and measurement (T&M) solutions for SDN and NFV. They will have to adopt a new T&M approach that allows them to know the current state of the network and its elements, provides confirmation of the successful implantation of SDN and NFV-related network changes, and predicts network trouble spots.

With regard to the adoption of SD-WAN technologies, the principal concern of enterprises is return on investment. The capex and opex of a SD-WAN solution needs to be compared with the overall cost of WAN. Another problem is vendor lock-in. There are several SD-WAN products, and they are all different and incompatible. While some get incorporated into the

existing WAN, others replace the WAN hardware completely. The evaluation process should consider the long-term commitment to the vendor.

These challenges notwithstanding, the uptake of SDN and NFV is poised to grow considerably in the Indian market, where the operators continue to face challenges in providing the highest level of customer experience, and at the same time keeping the operational costs in check. SDN and NFV solutions will help operators cater to the service agility demands, improve customer experience and reduce expenses.

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