Software-defined access networks

Applying SDN/NFV to fixed access networks

SDN and NFV have finally arrived at the edge. As access networks become more complex due to growing pressures for speed and coverage, fixed network operators will need virtualization to help them manage.

But while many think virtualization is a cure for everything, Nokia focuses on where it provides concrete benefits to operators. Creating a software-defined access network that can be programmed and controlled centrally from the cloud allows operators to deal with increased network complexity through remote configuration and intelligent automation. This leads to increased operational agility, better network performance and even new business opportunities.

This white paper explores the application of virtualization in the fixed access network and the real-world benefits it can bring.
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The operator challenge: network complexity

New services and innovation are driving exponential growth in data: more subscribers with more devices are generating more traffic and demanding more bandwidth. To cope with demand, fixed access networks have become more diverse and multi-technology environments, with growing numbers of small remote and widely distributed access nodes. This results in increased service and network complexity.

Nokia’s response is Intelligent Access, a smarter approach to fixed access that combines the intelligent application of technology with the intelligence of the network to help operators make their broadband operations faster, better and smarter. Intelligent Access helps operators to simplify their networks and processes in ways that allow them to continue increasing capacity but also improve agility and keep costs under control.

Figure 1: Data growth and network complexity
Simplifying and streamlining the access network

Operators are seeking to support the changing demands of businesses and win new business for themselves. Using software-defined networking (SDN) and network function virtualization (NFV) to create a software-defined access network (SDAN) simplifies and streamlines the network. It makes operators agile again and renews their ability to scale.

• NFV centralizes functions in the cloud, creating an always on-line experience and the ability to dynamically add capacity and processing.

• SDN provides automated and intelligent control over nodes and other assets in the network making it quick and easy to roll out new apps, capabilities and services.

SDN and NFV arrived with high hopes and expectations (a.k.a. hype), but Nokia is making SDAN a reality. Through the pragmatic application of SDN/NFV where it makes business sense, an approach known as network function optimization (NFO), we are helping operators transition to the new virtualized world and uncover the benefits of SDAN.

Creating software-defined access networks

Today’s access networks are monolithic, with vendor-proprietary network elements and a closed implementation running on specialized hardware. This makes the introduction of new features and services cumbersome, as it implies a software upgrade and a costly integration cycle with OSS/BSS across different platforms.

SDAN expands the value of operator assets by decoupling the hardware and software design cycles. From the software, all the way down to the hardware, SDAN decomposes applications to bring forward new open, data-centric architectures.

It can allow operators to:

• **Build a collaborative ecosystem.** Integrate easily across multi-vendor systems, partners, and third-party components. Leverage open interfaces, open data models and open-source components to accelerate adoption.

• **Automate the network.** Program networks from the cloud, and make smarter decisions that simplify operations and improve network performance.

• **Introduce agility.** Use cloud-native access and scalable data center practices to transcend CPU/RAM limitations of nodes and roll out new capabilities faster.
SDAN allows operators to run network functions in the cloud, on general-purpose hardware. The open nature provides a new approach to adapt switching and compute capacity as demand evolves. Functions can run anywhere and be distributed to the edge of the network (i.e. the edge cloud). This allows operators to make an optimal trade-off between real-time performance and data center consolidation.

By adopting data center principles in their local real estate, operators turn their central offices (COs) into cloud COs. Hardware and software disaggregation in independent modules gives operators more engineering options to evolve the access network. It allows them to react to changing demands or usage trends, increase network performance, and minimize service impact during software upgrades or equipment replacements.

SDAN introduces standard protocols and programmable APIs to create well-defined modular components with open and standardized interfaces (based on NETCONF/YANG). Operators benefit from programmable solutions that can be easily integrated in their existing operations and cloud infrastructure. This programmability creates the foundation for a high degree of automation, upgradability, and service creation in true DevOps style.
Nokia offers comprehensive SDAN portfolio

The Nokia SDAN portfolio enables operators to create an open, unified cloud access platform. This platform applies Nokia’s expertise in building scalable networks and drives new deployment practices for COs, data centers, and the outside plant.

The portfolio includes Nokia Altiplano, a cloud-native access platform that helps operators transition from traditional access networks to an open telco environment. Nokia Altiplano transforms fixed access management systems. The Altiplano software uses intuitive business logic to auto-align the network and cut across FCAPS silos.

Nokia also offers powerful hardware specifically designed for SDAN use cases. The Nokia Lightspan family of access nodes enables operators to bring data center practices to the CO and introduce cloud agility and automated operations to the outside plant equipment.

SDAN use cases

With SDAN, SDN and NFV have arrived at the edge of the network. But while many think SDN and NFV are the cure for everything, Nokia focuses on where virtualization provides concrete benefits, delivering use cases that address the most important needs of operators. Examples include:

• **Data center economies.** Introduce cloudified network functions and scalable data center practices and support edge cloud architectures in the central office.

• **Simplified operations.** The network in the cloud is always-on and scalable. Pre-provision regardless of whether nodes are online or offline. Embrace zero-touch and error-free operations.

• **Network slicing.** Virtual access networks enable service partitioning and open access, increasing cooperation and network monetization.

• **5G fronthaul over NG-PON.** Optimized PON latency meets 5G fronthaul delay needs, with cloud-based control and integration.

• **Flexible software upgrades.** Update, customize and deploy new access functions and services without touching the access node.

• **ONT self-activation.** Reduce ONT activation cost through automated activation of ONTs by field technicians.
Advancing SDAN through collaboration

Software defined networks, through their openness and advanced programmability, depend on collaboration. Nokia is working closely with network operators around the world, defining and providing the industry with the most compelling use cases for SDAN while leveraging free and open-source initiatives like BAA, ON.LAB and CORD. This collaboration extends to helping operators bridge the virtualization gap, i.e. transition from a traditional network, through a hybrid stage and to finally realize a software defined telco environment on modern cloud platforms. Nokia is also working with industry bodies like the BBF to drive standardization of the protocols that underpin SDAN as well as with application developers making best use of the open APIs to drive innovation.

Delivering a new way of working

The access network plays a key role in the delivery of services to end users. With the rapid growth of the Internet of Things (IoT) and cloud-based services, operators are evolving their networks to address the need for continuous, affordable and reliable access. Nokia's answer to this challenge is software-defined access networks (SDAN), which enable operators to use the principles of SDN and NFV to become more agile and renew their ability to scale.

Software and cloud-based infrastructures are at the heart of this evolution. SDAN helps operators transition to the new virtualized world and helps operators to get more value from their fixed access network, by virtualizing where it matters and by addressing concrete use cases. SDAN enables the on-demand flexibility and online availability that operators require to speed up new product development, increase network performance and better serve subscribers.
Acronyms

API       Application program interface
BBF       Broadband Forum
BSS       Business support system
CORD      Central Office Re-architected as a Datacenter
DevOps    Development operations
IoT       Internet of Things
IP        Internet Protocol
NETCONF   Network Configuration Protocol
NFO       Network function optimization
NFV       Network function virtualization
ONT       Optical network terminal
OSS       Operation support system
PON       Passive optical network
SDAN      Software-defined access network
SDN       Software-defined networking
YANG      Yet another next generation