Reconstruct to re-energize

Unleashing the power of networks

Network transformation into a cloud-based business model lets operators provide more than just connectivity as simple network infrastructure service providers – it lets them make the move into the cloud service arena.

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Four main drivers

The decades and trillions of dollars poured into communications networks are proving to be no match for today's needs. Revenue and ARPU growth are slowing, efficiency is poor, TTM for new services is slow, and changes to user demands outpace operators' ability to meet them. OTT vendors are a new competitive force, and digital services are eroding revenues from voice and SMS.

There are four main drivers forcing operators to carry out ICT network transformation and combat these issues:

Services

Operators' main services in the future will include virtual, augmented, and mixed reality; cloud services; 5G and IoT; and HD video. Networks will need to carry these services and meet a slew of demands, for example, ultra-low latency, high bandwidth, high reliability, huge numbers of concurrent connections, seamless connectivity, security, rapid service provisioning, and quick and easy online customization.

User experience

Operators' digital services must deliver a ROADS experience: Real-time, On-demand, All-online, DIY, and Social. Traditional network architecture is unable to do so.

Operations and maintenance

Operators need intelligent and flexible future networks that automate distribution and deployment for agile O&M without the need for manual intervention. The real-time, automated adjustment of network resources would provide elastic scalability, automated fault isolation, and self-healing.

To compete with the service innovation capabilities of OTT players, operators hope to attract third-party (3P) partners – including OTTs – to deliver ROADS services to enterprises and users on next-gen platforms and digital markets. To make this possible, they need to integrate and open up network capabilities because 3Ps cannot easily develop services on traditional networks. But, reconfiguring network elements (NE) in a unified and dynamic way to expose network capabilities is far from easy.

TCO and total value of ownership (TVO)

Sluggish revenue growth for telcos is compounded by the need to invest increasing amounts into infrastructure due to the surge in data traffic, causing TCO to jump. The alternative – low resource utilization coupled with the increasing costs of capacity expansion – is unsustainable. Network transformation can cut TCO, boost TVO and resource utilization, and maximize ROI.

Network transformation can unleash the massive value of network infrastructure by creating an agile, open, and automated network that's cloudified and software-based with SDN and NFV. In a trend that will transform the telecom industry, networks will function as seamless service-enabling platforms on which telcos can provide IaaS, PaaS, and SaaS on a pay-per-use basis.

Unleashing the power

An immense undertaking, transformation involves services, architecture, networks, and operations.

Architecture

Operators need to cloudify their entire ICT network infrastructure with data centers (DC) at the

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core. Information storage, processing, and exchange; service processing; and transactions will occur in DCs, which will also be the telephone exchanges of the future.

Future DCs will be distributed, and transformed from traditional DC infrastructure through cloud computing and SDN technologies based on the core concepts of physical distribution and logical integration.

Physical resources in the DC will be virtualized to form logical pools spanning multiple DCs. Virtual DCs (vDC) can then be provisioned from these logical resource pools for use by users or tenants, thereby linking multiple discrete, stratified, and heterogeneous distributed cloud DCs to form new distributed cloud DCs.

The distributed cloud DC model will support open and flexible architecture that enables integrated resource scheduling across multiple DCs through SDN cloud-and-network synergy. Resource utilization will be boosted, management simplified, and user experience improved. The cloud DC will not only carry telecom clouds, it will also support operators' private and public cloud services and provide integrated, unified ICT architecture.

Network transformation

Network transformation uses SDN and NFV to construct an agile, open, and automated operator network on top of cloud DC infrastructure.

SDN separates the forwarding and control planes, so entire networks can be centrally managed and controlled, vastly improving network resource allocation and efficiency. Using the SDN controller, northbound coordinator, and SDN applications, E2E services can be rapidly deployed and the following features can be automated: inter- and intra-DC networks, access networks, and WANs. SDN helps build a software-defined, programmable, application-oriented, and open intelligent network.

NFV is used to make NEs software based by decoupling software and hardware. Virtual network functions (VNF) run on a unified cloud DC-based NFV infrastructure (NFVI). NFV management systems and coordinators (MANO) allow the unified orchestration and lifecycle management of physical and virtual resources on the cloud architecture.

Combining SDN and NFV enables the network and NE functions to be software-based, accelerating new service development and deployment. It enables automated network deployment and elastic scaling based on current network traffic, and automates system management, including isolating faults and self-healing. SDN and NFV promotes new business models by utilizing network resources more efficiently, improving deployment and O&M efficiency, shortening service TTM, and opening up key network capabilities to third-party partners and developers.

Transforming operations

Transforming operations is more than just

providing online customer services and online sales – it also needs to support process transformation with a focus on customer requirements.

Digitization and Internetization will reshape operators' traditional business models. New, agile digitized operations, services, and O&M management on infrastructure will provide a ROADS service experience. A flexible XaaS model will meet fast-changing and personalized user requirements, and big data will play a key role in data-driven decision-making and intelligent operations.

Carriers' next-gen digitized operations systems will be more than just a platform or a software and hardware product, and will offer different capabilities to different users. For users, the next-gen operations system will be like an e-commerce platform where digital services and products, including operator or third-party products, can be purchased and customized.

Operators will be able to use next-gen operations systems to perform agile operations like developing new services and solutions and carrying out marketing campaigns. For commercial partners, it will act as a channel and service development platform that invokes network capabilities with open APIs. So, next-gen operating systems will in fact be a business enabling system for operators, partners, and end users.

Next-gen operations systems also need to support E2E service and resource orchestration and coordination across the entire network to enable the lifecycle, decision, and workflow management of network resources and automated O&M.

The next-gen operations system will be a business enabling system for operators, partners, and end users. It will also need to support end-to-end service and resource orchestration plus network-wide coordination.

Time to wake up

Network transformation is a long-term process that has three main objectives:

Awakening speed: accelerating new service TTM from several months to several days; improving response speed to user demand, with subscriptions and modifications completed online with immediate effect; and shortening service innovation cycles.

Awakening functions: increasing the performance of opening network functions, providing unified open APIs to third-parties, flexibly invoking third-party applications, monetizing network functions, increasing revenue, and innovating services.

Awakening efficiency: cutting TCO by optimizing network resource utilization and traffic scheduling, and reducing OPEX by centralizing and automating tool platforms and boosting network O&M efficiency.

To achieve these objectives, operators need to follow a stage-based strategic plan.

Four steps

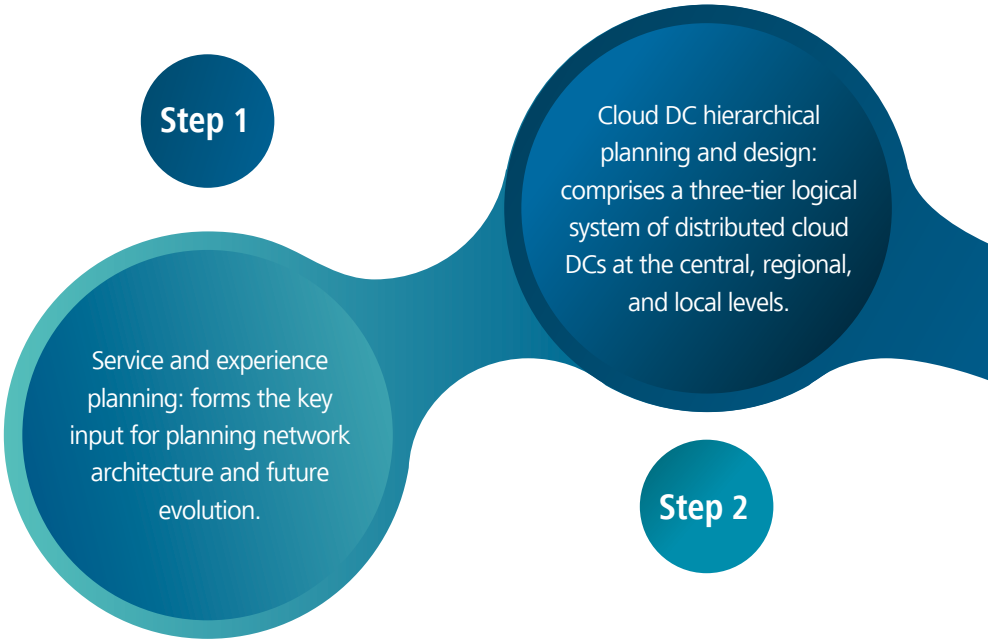
Step 1: Service and experience planning

Service planning involves generating roadmaps for operators' future services based on their business value, viability, alignment with strategic goals, and projected user numbers. Once the services are determined, experience planning can identify the main KQIs for user experience to incorporate into KPIs. These are used as key inputs for subsequent network architecture and evolution planning.

Step 2: Cloud DC hierarchical planning and design

Network architecture in the future will comprise a three-tier logical system of distributed cloud DCs at the central, regional, and local levels. Each DC tier will carry different services to meet different

SDN-based MAN and backbone networks will connect DCs to form agile end-to-end networks

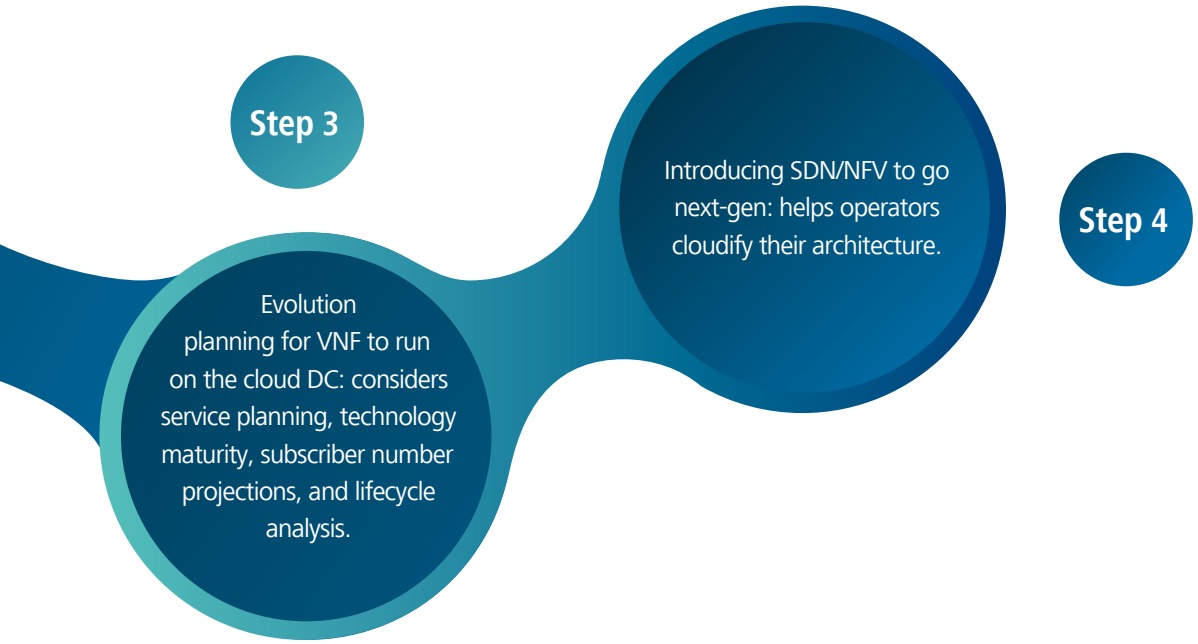


user experience demands. KPIs from early experience planning, such as latency and bandwidth, are crucial for selecting DC sites and designing hierarchy. Other factors that need to be considered include the deployment of existing network NEs, network topology and traffic, city and population, 2G/3G/4G coverage, and natural disaster distribution.

The central DC is usually used to carry centralized services such as public cloud services and centralized IT. The regional DC carries services with localized requirements or that contain sensitive information, for example, government and enterprise clouds, VAS, and provincial network or subsidiary network IT. Control plane and signal plane NEs can be centrally deployed in the regional DC. NEs where forwarding is sensitive because very low latency is required are mainly sent to the local DC. NEs on the user plane should be deployed down the network to the city-level, as close as possible to the end user to satisfy demands for services like HD video.

The three-tier division is just reference architecture that can be tailored to, for example, two or four tiers based on operator needs. For example, some NEs on the user plane where forwarding requires extremely low latency can be moved further down to edge DCs to meet the experience demands of future services.

SDN-based MAN and backbone networks will connect these DCs to



form agile end-to-end networks. Once planning is complete, designing and selecting the cloud DC infrastructure is necessary to deliver carrier-grade performance. This includes NFVI as well as utilities such as air conditioning, fire prevention, and power supply.

Step 3: Evolution planning of VNF run on the cloud DC

The evolution roadmap must take into account service planning, technology maturity, subscriber number projections, and lifecycle analysis on the existing network hardware. When VNF is implemented, current network equipment must be gradually replaced to ensure legacy network investment isn't wasted and services are smoothly migrated. SDN deployment takes the form of DCN > DCI > CloudVPN > SDN-WAN, and then develops from Overlay to Underlay. This centralizes and automates network control, creating a flexible, programmable network.

Step 4: Introducing SDN/NFV to go next-gen

When constructing a next-gen operating platform, the Infrastructure Enabling System (IES) orchestrates and coordinates services and resources E2E to support O&M management.

Step by step

Future transformation into cloudified network architecture takes time. Increasing network architecture elasticity and O&M agility and building capabilities must happen in increments.

In 2012, Huawei proposed the All Cloud architecture of the future: SoftCOM (Software-Defined Telecom Network). Open and unified, it can help operators cloudify hardware, networks, and services and internetize their operations.

Huawei has already completed many successful commercial trials of SDN and NFV with leading operators worldwide, with its OpenLabs in many countries involved in setting up open-source organizations and open ecosystems. Huawei hopes to build a new type of network for the future through collaboration and serve as the engine for network digitization.