MNS Consulting
Management – Technology – Engineering

MNS Viewpoint: The roadmap to Network Virtualization

1. Introduction

The telecoms market is experiencing an evolution like no other: Voice revenues are eroding, Web-based and Over the Top (OTT) services are cannibalizing operators' own services while total profits in the value chain are dropping. Operators need new ways to counter this erosion and new paradigms to follow in order to remain relevant in the fast-paced, user-driven telecoms market. Given that they are competing against new entrants in a new economy, telecoms operators are now starting to adopt technologies, concepts and processes from adjacent, successful markets, including the IT and Web domains. However, in order for these concepts to be truly disruptive and drivers of growth, operators are now finding out that they will need to transform their operations and businesses first.

2. Market trends

The explosion of smartphone adoptions, OTT services, Big Data, and the introduction of the Internet of Things are creating new major challenges for fixed and mobile operators:

their networks must be able now not only to absorb an incredible amount of traffic, but also to deliver top quality applications and innovative offerings while minimizing their costs to remain competitive.

Thus, operators need more and more flexible and "intelligent" networks to quickly deliver new services via software, at the lowest cost.

As a result, we see the evolution and the alignment of IT and Telecoms: SDN, Virtualization, and Cloud represent key IT flexible and cost effective concepts which are now entering mobile and fixed networks, attempting to disrupt established patterns for operations, deployments or maintenance.

3. New technologies mean new practices

Network operators have relied on traditional methods to design, deploy, maintain and upgrade their networks. However, as data traffic grows – sometimes faster than predicted – traditional network practices are no longer viable;

All IP and IPv6

Mobile and fixed networks are being overhauled to support IPv6 and to become all-IP. The first stage of this evolution in mobile has started with LTE, where the network is flat and services are powered in the IP domain. However, most LTE networks still have voice and messaging services in the circuit-switched (CS) domain, via plain CS networks (2G or 3G) or CS fallback. Network transformation is needed to replace the existing CS services with packet-switched (PS) ones that are easier to manage and to upgrade and Voice over LTE (VoLTE) is still – a major challenge.

IPv6 is also expected to change network management processes. The address pool and the number of devices connected to mobile networks (with the emergence of M2M and connected devices) are expected to grow exponentially, requiring operators to manage a much greater number of devices and the associated amount of signaling.

SDN and virtualization

Software defined networks (SDN) and virtualization are two concepts that are now widely used in the IT domain and raising interest from fixed and mobile operators:

SDN *(Software Defined Networks)*	NFV *(Network Functions Virtualization)*
• It allows more **efficient traffic handling by separating the control and data planes**, thus allowing routers, switches and other network equipment to be controlled and reprogrammed in real time. • It enables **high-level network automation**, and makes the **network more agile and dynamic.**	• allows the implementation of **network functions as software components** through virtualization technologies • Physical functions run as virtual machines (VMs) over **general purpose processors** (servers). Thus, we are replacing proprietary equipment with **commoditized IT platforms** that run virtual machines.
SDN represent 25 – 40% operational savings	**NFV reduces the number of servers by 30-50%**

These concepts are usually discussed in parallel, since combining them, results in greater benefits.

The combined concept of SDN and NFV is usually referred to as "telco SDN":

SDN simplifies network operations and administrations

+

NFV enables operators to rapidly deliver better services with High Flexibility

4. Need for network transformation

The technologies described above are examples of where networks need to be transformed to ensure that the operator business model remains sustainable and competitive. Networks will need to be simplified and transformed into new paradigms but it is not yet clear which party will lead this transformation. Operators are not likely to rely on internal resources for such activities due to the overhead and effort required to do so.

End-to-end infrastructure vendors are well-positioned to help operators, but there remains a question as to whether this will increase vendor lock-in. Specialist vendors that have a limited network footprint are also not likely to lead this transformation. System integrators and companies that are third parties and have experience in all network areas are the most likely to support operators for these transformation exercises.

What needs to be transformed?

The networks are undergoing extensive transformation in order to become customer-oriented and to adjust to subscriber requirements more closely.

Radio Access Network (RAN)

The RAN is the most expensive part of the network due to its distributed and geographically dispersed nature. As traffic increases rapidly in dense urban areas, operators are turning to small cells to enhance system capacity. Baseband pooling or cloud RAN is being discussed at the moment, where parts of the base station are semi-centralized and virtualized so that the network can adapt to unforeseen and unplanned traffic patterns that may disrupt a traditional network.

There are several challenges to overcome – apart from practical issues including power, positioning and maintenance of thousands of new nodes. The supporting network will need to adapt to a much greater number of base stations, while existing infrastructure must not be affected (particularly the interferences). The network and operator processes will need to change to adapt to this new environment, while virtualized equipment is likely to need new operational and maintenance procedures.

The RAN is likely to be the last area to be transformed when considering SDN and virtualization concepts, due to the high cost involved and the fact that it is unclear what new revenue opportunities are associated with this new RAN infrastructure.

Core network

Although virtualization and SDN are likely to result in greater cost savings in the RAN, it is the **core network that is likely to be the first** to see these concepts applied. The centralized nature of the core network and its ability to handle heavy traffic is the reason why virtualization and SDN are likely to be relevant, they will enable cost savings and also introduce support for new services.

In any case, the core network will require substantial transformation for these concepts to be applied, particularly when network components are implemented in IT platforms that reside in data centers. **Initial virtualization targets include the Gi interface** with service chaining, **firewalls or services for enterprise customers** (e.g., VPN) that can be modified in a flexible and scalable manner.

Signaling infrastructure

The emergence of M2M and connected devices is increasing signaling traffic. Operators have traditionally focused on data-plane traffic, which has been increasing constantly. Signaling is likely to require a more flexible infrastructure which may not follow current planning and deployment mechanisms.

Moreover, LTE and future networks will mean more application-centric services and the convergence of Wi-Fi and radio networks will also create new levels of signaling traffic. **Vendors will need to manage signaling traffic in parallel with network capacity**, rather than treating the two realms separately.

Services

A major issue for new networks and particularly LTE is the introduction of new services. The introduction of VoLTE and packet-switched voice is the start of a new era for operators: **All services are packet-switched and IP**, while voice becomes simply a prioritized data service. Service transformation means that IMS is the supporting platform for both the existing and the new services. It requires the network to be horizontal: Functional service silos are broken into horizontal parts and each service effectively becomes part of an Application Server (AS). The shift from vertical to horizontal platforms has been a topic of discussion for many years, but LTE, VoLTE and adjacent concepts (SDN, virtualization) make it very relevant now.

OSS

The operational support systems (OSS) are the elements that control and monitor the whole network. To enable network transformation, these systems will need to be transformed and simplified, especially when multiple subsystems govern a multivendor network.

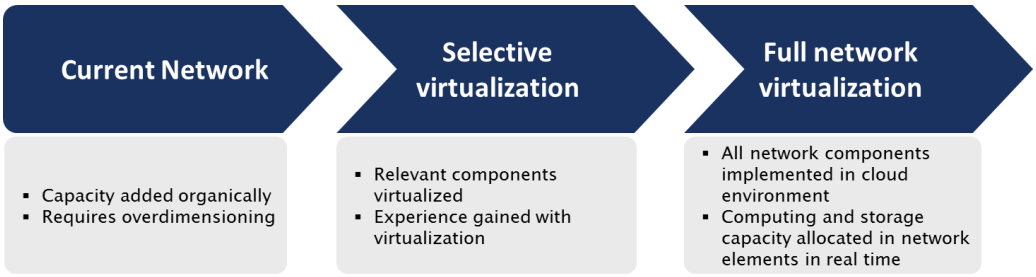
5. How is transformation likely to happen?

Legacy mobile networks are constrained in terms of capacity. However, LTE is likely to solve these issues, particularly when advanced techniques – Carrier Aggregation and hetnets – are introduced. The next level of transformation is likely to require a higher level of integration, which will lead to truly flexible and scalable networks.

Transformation in the core network

Network transformation will start in the core network, since it is a centralized and a fertile environment for network and service innovation. The core network transformation is expected to happen gradually, as illustrated in fig. 2.

Fig.1: Core Network transformation roadmap (source Informa Telecoms & Media)



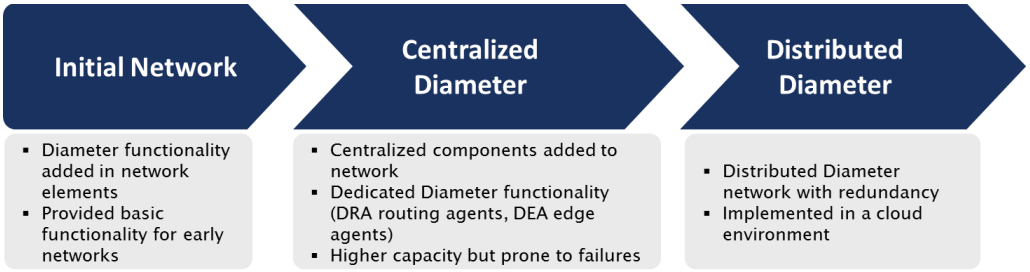
Selected relevant components are likely to be virtualized first, which will provide the necessary experience for both operators and vendors. This will lead to advanced hypervisors and virtualization technologies, which will allow the deployment of the concept in the broader network. Finally, the full network will ultimately be virtualized but this will require a significant amount of time, since the capex requirement for a full network upgrade is costly, time-consuming and may require network downtime.

Transformation for signaling

Signaling infrastructure – particularly Diameter – is likely to undergo an extensive transformation that will allow handling of thousands or even millions of new connected devices. Initial Diameter infrastructure relied on added functionality on legacy components (e.g., Diameter load balancers in MME or HSS).

However, operators soon realized that dedicated Diameter Routing Agents (DRAs) or Diameter Edge Agents (DEAs) are necessary to handle policy-based Diameter messages or roaming interfacing. The signaling network evolution is expected to follow the pattern as illustrated in figure 2.

Fig.2: Signaling Network transformation roadmap (source Informa Telecoms & Media)



The distributed network is likely to be the ultimate form of Diameter infrastructure but several barriers remain before this can be implemented. Diameter has roots in the IP domain and operators may require significant additional expertise to be able to successfully deploy and maintain Diameter – which many consider the nervous system of any LTE network. The ultimate goal is also to deploy virtualized Diameter infrastructure, which will allow adjacent elements to exchange resources to handle traffic demand.

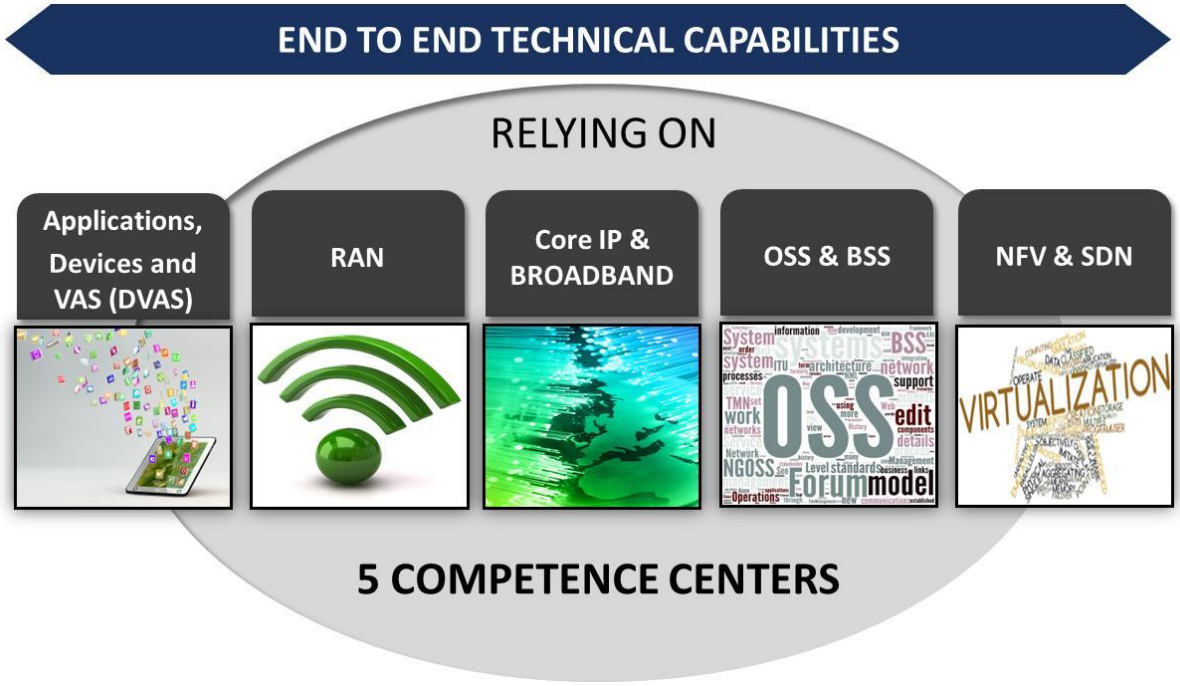
Transformation to all-IP networks and services

An area experiencing transformation currently is services, which is exemplified by the evolution of voice services to VoLTE. For the time being, operators are deploying an overlay on their existing networks: VoLTE is deployed in parallel to CS voice services; a total switch from CS to PS services is not expected soon. The challenge of mobility and handovers between legacy, 3G and LTE networks remain and is currently tackled by existing vendors. However, when LTE networks become more widespread and mass-market, mobility between these different network realms is expected to become a bigger issue. This is another area that may require extensive transformation and would benefit from virtualized architectures.

6. About MNS

MNS Consulting is an international management and engineering consulting firm specialized in the telecommunications industry. We have developed a unique expertise in Telecoms network domains. We distinguish ourselves with a strong combination of deep technological expertise and strategic vision that allows us to address the challenges of our customers. We are committed to delivering outstanding consulting services and highest value to our clients by helping them to drive growth, manage complexity, and improve operations and performance in a complex and fast changing market. Our engineering consulting capabilities are structured around the 5 competence centers below that allow us to have a full vision of the end-to-end network services management.

MNS is headquartered in Paris and has also operations in Africa and the Middle East.



For further information please visit: www.mns-consulting.com