TATA COMMUNICATIONS
TRANSFORMATION SERVICES

White Paper

Optimizing 5G Management & Operational Complexity

Summary:

While the end-users are excited about the new, diverse services and the flexibility that 5G will offer, the Communications Service Providers (CSPs) will face challenges in maintaining the balance between meeting these expectations and transforming current network operations. The Network Management System (NMS) used today to manage and operate the existing networks has its limitations in managing 5G and next-generation networks. CSPs need effective end-to-end service lifecycle management process to minimise 5G networks' complexity and reduce operational costs. Tata Communications Transformation Services' (TCTS) next-gen comprehensive Network Management System (NMS) and Orchestration framework defines complete end-to-end service lifecycle management for 5G implementation. It supports multi-vendor, multi-network domain and multi-technology resources to eliminate complex interoperability issues in 5G deployment. This white paper aims to help the CSPs that are in the process of deploying 5G networks, along with managing their existing legacy network.

5G and the next-generation wireless networks are revolutionising and fundamentally changing how communities and businesses communicate and interact with each other using new and enhanced services.

Those new services will be beyond what we have seen in the past, and will ultimately require faster application access, low latency, and excellent end-user experience. While the end-users are excited about the new services and applications, Communication Service Providers (CSPs) will face challenges in delivering the expected services and meeting end-user expectations.

CSPs need to balance both – Transform operations and meet end-user expectations

One of the challenges that CSPs face is in managing and operating their networks while providing services reliably and securely to their end-users. Although 5G and next-generation technologies create new business opportunities for CSPs, their current complex, siloed network architecture may stand in the way of rapid new business innovation and digital transformation. Their existing OSS/BSS network, founded on vertically integrated monolithic design, to run vendor-specific hardware and software applications, makes automating deployment and management of new services difficult, and spirals network maintenance and assurance into a complex cycle.

As shown in the figure-1 below, the challenges are multi-dimensional, and they require fundamental architectural transformation to manage and operate a complex and multi-layered solution network. No matter how efficiently we build the network, there are always going to be challenges along the way because the network needs to handle many applications, it will be built-up by many vendors and technologies, and will be deployed in many locations & environments (edge-cloud, private cloud, data centers, etc.).

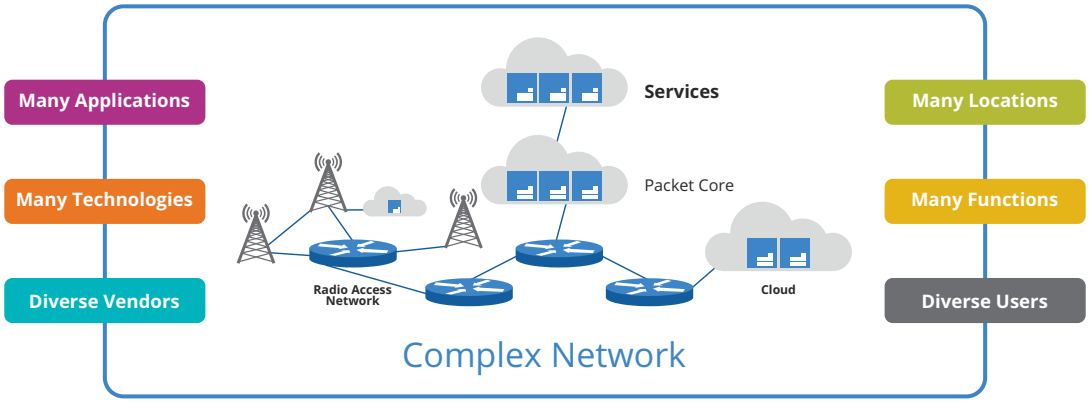

Figure-1: High-level next-gen network architecture

In addition to network complexity, CSPs have to combat fierce competition with new players like OTTs in the market who use more efficient, agile and DevOps methodologies to meet speed-to-market demands. With network and technological complexity coupled with fierce competition, CSPs will face profitability pressure, forcing them to explore innovative ways of building and managing their next-gen networks.

Therefore, they must develop new business models with simplified network design, deployment and operations, and rapidly launch new services to maximise their revenues and profit margins.

Need for effective end-to-end service lifecycle management process to minimise 5G network complexity and reduce operational cost

As shown in figure-2 below, 5G networks will be built by creating different network slices to create a flexible and adaptable network. Network slicing takes advantage of virtualisation that enables dynamic and separate logical networks for specific applications addressing individual use cases. Many network slices will be built on the same network infrastructure to deliver many different use cases, each slice with varying capabilities of management and performance objectives.

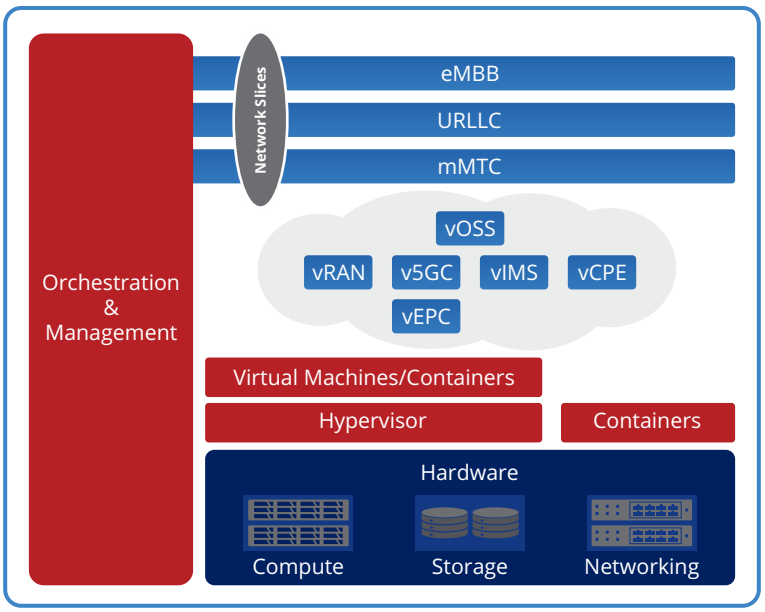

Figure-2: High-level next-gen network architecture

The breakthrough technologies that will be an integral part of next-generation wireless, such as network slicing, software-defined network (SDN) and network function virtualisation (NFV) require a new set of network design, deployment, management and operational approach. This new monumental approach will come with inherent benefits and drawbacks. The benefits, as mentioned above, are providing enhanced mobility, low latency and reliable services. The drawbacks are building the complex network management and operations, and the cost associated with it. To minimise the network's complexity and reduce the operational cost, we need to evaluate how we build the end-to-end service lifecycle management.

Figure-3 illustrates some of the steps that require detailed evaluation at every stage of the process.

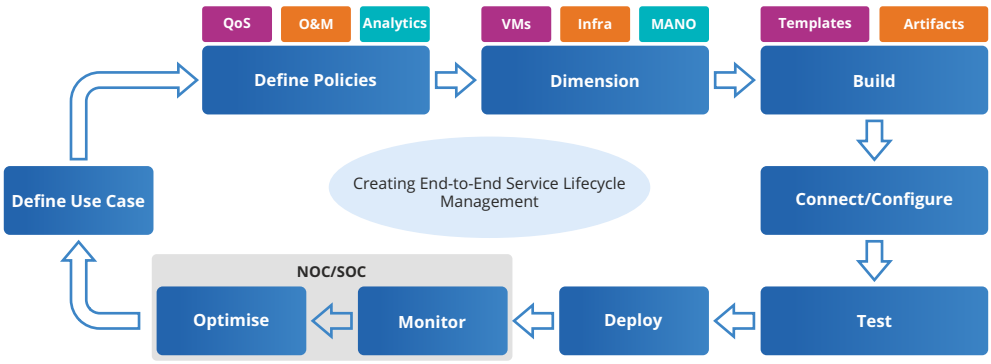

Figure-3: High-level lifecycle management process

Let's take a look at a few critical steps described in figure-3.

1. Minimising complexity at an early stage of network design

Defining the use cases at the initial stage of the design process will be critical to minimise the complexity of the network and avoid complex management and orchestration solutions. During this design phase, CSPs need to identify the traffic pattern (such as services types, QoS requirements, demographics, etc.), user behavior and characteristics of their services (such as frequency of busy hour service request, busy hour data consumption, simultaneous session setup, etc.) in the area of deployment interest. In some areas, depending on the traffic pattern, CSPs may need to build and deploy a network that must support many network slices to support diverse users and devices. In contrast, some areas may require fewer network slices to support a few necessary use cases. The CSPs need to evaluate the use case requirement for every region and cities as the demand for services will vary based on the geographical location and demographics. As an example, rural communities may initially only require enhanced Mobile Broadband (eMBB) services, while cities in urban areas may require a mix of eMBB, Massive Internet of Things (MIoT) and Ultra-Reliable Low-Latency Communications (URLLC) services.

Therefore, identifying and defining the use cases at the initial stage of the design process will minimise network complexity and its management and orchestration solutions.

2. Building robust architectural and operational framework and policies

CSPs need to define and implement policies that outline end-to-end physical, virtual and services relationships and dependencies to provide high-quality end-user services for CSPs to architect and deploy robust design networks. Specifying the policies, rules and processes for E2E QoS, O&M and analytics at the early design stage of the network design will be critical. Especially, having O&M (monitoring, root cause analysis, self-healing policies, etc.) and analytics (resource utilisation, service behavior, E2E KPI correlation, etc.) framework defined correctly at the network design stage is very critical to closely manage and analyse the end-user behavior and their traffic pattern. The framework and policies will allow the CSPs to deal with resource utilisation and allocation and scale up/down to adjust to demand variations in the network post-deployment elastically.

The framework and policies defined at this design stage must include a comprehensive design environment framework that provides potential tools and skills required, resource dimensioning for the necessary services and management and control functions, workflows and repositories for resources and services.

3. Streamlining operations and maintenance complexities and optimising cost

We know that the Operations Support System (OSS) will remain a vital component of the next-gen network architecture in all CSP networks to configure, monitor, and manage all the operational activities required within a network. The critical components of the OSS are Network Performance Management System, Fault Management System, Configuration Management System, Service Provisioning System and Network Inventory System, and collectively called Network Management Systems (NMS).

Traditionally, CSPs have been facing multiple challenges concerning network management and operation due to siloed NMS implementation for different network domains. Also, the multiple NMS solutions from different vendors are proprietary, hardcoded services and technologies, lack interoperability, and need lengthy software development and integration cycles to incorporate any changes. In addition, several OSS platforms, which are from different vendors for different network domains (e.g. one OSS RAN from one vendor, another OSS for core network from another vendor), exist in the network and lack interoperability and end-to-end KPI view.

Figure-4 illustrates the challenge of using the current OSS for next-gen services and processes. The legacy OSS architecture cannot enable automation, horizontal scale, end-to-end network visibility and open interfaces to dynamically deploy and manage next-gen services in a new network environment such as a cloud-native network (including the underlying infrastructure).

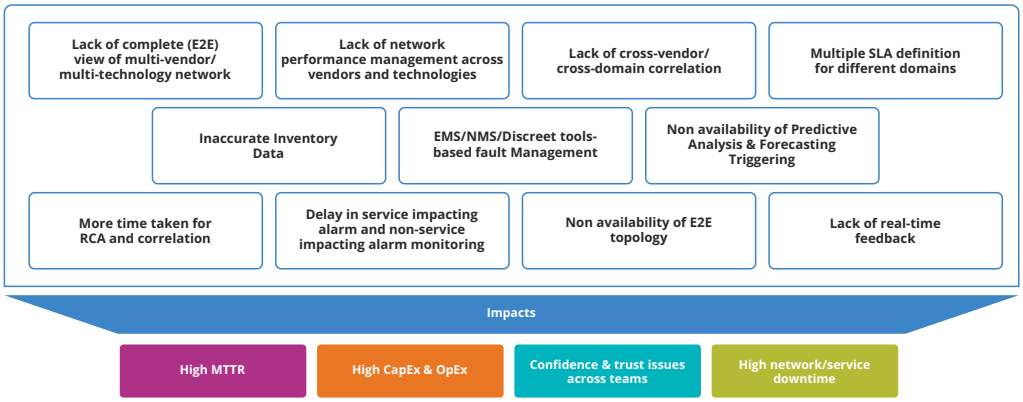

Figure-4: Current challenges and impacts

Therefore, creating a unified and interoperable Network Management and Orchestration System with a clear end-to-end view of the entire network plays a vital role in next-generation networks.

In addition, CSPs must also focus on their business flexibility by integrating people, processes and tools within their solution development and operations organisation. Employees in the different organisations must be upskilled in new technology areas and should be encouraged to work across different organisations to break the traditional vertical organisation working culture.

Industry's view in addressing 5G implementation challenges

From technology and solutions perspective, several vendors have introduced different promising capabilities as part of their OSS portfolios, which can automate the network elements deployment and operation. Still, provisioning and managing services on the virtualised environment (which are dynamic to respond to traffic load changes in the network) and introducing microservices to NFV seem to pose a different set of challenges.

Open Source Communities have taken many initiatives to tackle some of the next-gen network management and operational challenges. As an example, Open Network Automation Platform (ONAP) initiative addresses some of the challenges by providing a unified operating framework that is vendor-agnostic services lifecycle management. The framework provides end-to-end real-time network management and orchestration capabilities for design, creation and lifecycle management of next-gen service. The overall ONAP framework still requires critical use cases and field implementation, integration and testing under various network conditions and deployment environment, but it promises to provide a different network management and orchestration approach. The architecture is a bit complex, and it requires new skillset to implement and manage the infrastructure. Visit **www.onap.org** for more information about ONAP initiatives.

TCTS' next-gen comprehensive NMS and orchestration framework

At Tata Communications Transformation Services (TCTS), we work closely with CSPs to transition from legacy service architecture to a new cloud-native based environment. We evaluate and leverage the open-source communities' (such as ONAP) development effort to facilitate agile and resilient network management and orchestration solutions.

To address the current challenges, TCTS has developed next-gen comprehensive NMS and Orchestration framework that defines complete end-to-end service chain information, including physical, logical and virtual network resources, and provide the information in real-time to its clients. The framework supports multi-vendor, multi-network domain and multi-technology resources to eliminate complex interoperability issues.

TCTS, as a Managed Service Provider in this area, has been developing and implementing various tools and methodologies to consolidate CSPs' NMS solutions and tools with varying degrees of success and challenges. These tools and methods did allow CSPs to address some of their challenges, such as creating a single end-to-end KPI control and managing some of their network domains. Through our framework implementation exercise with CSPs, we have experienced that many design and process changes are required at different stage of network design to develop effective Network Management and Orchestration Solutions for 5G and next-generation Services. These changes need much more network and process design considerations which go beyond replacing or consolidating existing tools. Next-generation network management must not only address the future networks but also resolve the current legacy network management challenges as our future networks and legacy networks will co-exist for quite some time.

Conclusion

CSPs must adopt the new way of designing and deploying a next-gen network that supports diverse applications and users to minimise the complexity and reduce their operational cost to be more agile and competitive. To minimise network complexity, they have to first eliminate their domain-specific design approach and move towards an end-to-end design and deployment approach where the entire organisation focuses on creating one unified network design and deployment framework. Every step of the new design process needs to be evaluated at an early stage of the design process, including people, processes and tools required to deliver the services. The end-to-end design methodology will eliminate siloed and vendor-specific network implementation to avoid proprietary, hardcoded services and technologies.

The current network management requires a total transformation to support the new use cases and diverse applications, such as interactive gaming, video and VR/AR applications. Addressing some of the challenges by providing a unified operating framework, which offers vendor-agnostic services lifecycle management, will be critical. While creating the next-generation network management system, we have to also keep in mind that the current legacy network management will co-exist for quite some time.

Tata Communications Transformation Services (TCTS) provides end-to-end wireless network design, deployment and operations services, understands the complexities in wireless network architecture and knows how to tackle the design and deployment challenges. TCTS has a technology- and vendor-agnostic model for next-gen network deployment and operations. TCTS has proven experience in managing partner ecosystems needed to run telecom-grade communications services in an agile and cost-effective manner.

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Asfaw Negeri is Lead - Solutions Engineering at TCTS North America, which provides Managed Services for Network & Business Operations across telco lifecycle areas, as well as Consultancy & Business Enablement services to global enterprises and telecommunications companies. Asfaw has vast experience in end-to-end wireless solution design and deployment, strategic New Product Introduction (NPI) and business readiness planning and development. He also has several granted patents in wireless service offerings.

About Tata Communications Transformation Services (TCTS)

Tata Communications Transformation Services (TCTS), a 100% subsidiary of Tata Communications Ltd, provides leading business transformation, managed network operations, network outsourcing and consultancy services to telecommunication companies around the world. TCTS delivers operational efficiency, cost transformation and revenue acceleration solutions for all the stages of the carrier process lifecycle including but not limited to network engineering and design, implementation and operations functions.

TCTS is a part of the USD 100+ billion Tata group. Tata group comprises of over 100 operating companies in seven business sectors. TCTS leverages the market expertise of Tata group's global telecom operation capabilities and globally established IT, process and consulting skills. It carries the rich traditions and business ethics of the Tata companies.

TCTS is headquartered in Mumbai, India with global offices in Europe, North America and the Middle East. TCTS has two world-class India delivery centres in Pune and Chennai. These facilities operate entirely independent from its parent affiliate, preserving full confidentiality in managing all customers' business processes.

For more details on TCTS and how we can help your company build, operate and transform, please contact us at tcts.contactus@tatacommunications.com or visit www.tatacommunications-ts.com To hear more from TCTS experts, join us on **LinkedIn https://www.linkedin.com/company/tata-communications-transformation-services and follow us on Twitter https://twitter.com/Tata_TCTSL**

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