Future-proofing Telecom Operations: Creating a Hyper-automated, 5G-ready Network

Abstract

The telecom industry is gearing up for the 5G era - right from setting the testing standards to conducting trials of new technologies. 5G will be a leap from the previous generation(4G) with exponential advancements in network availability, quality of service (QoS), latency and speed.

How can telecom operators prepare for a 5G world? The answer lies in embracing digital technologies sequentially- by leveraging a maturity model to achieve a digitalized network to maximize benefits. A carefully crafted network will lead to the creation of a hyper-automated system, a step towards future-proof operations. Moreover, a sequential incremental approach provides enough time to modify the system, in case of any shortcomings. This paper talks about digital technologies that will provide competitive advantages to telecom operators as they prepare for a 5G-driven future. It also highlights the order of deployment and the features they need to incorporate in such next-gen digital systems to maximize benefits.

Enabling 5G: Digital technologies to the rescue

5G networks are expected to support download speeds of 20 Gbps or higher and network latency of 1 millisecond or less. The ubiquitous network is projected to provide 100 Mbps connection anywhere. Achieving these milestones requires new technologies and an entire new way of thinking around how the network is structured. In the current scenario, network modifications take days or even months to implement, limiting the adaptability of the network. In the 5G environment, the network is expected to change characteristics in real time. The number of network changes and frequency of scaling will be higher. In such a scenario, a static environment could drastically increase the cost of network operations. How can telecom operators build a 5G-ready network?

When it comes to making existing telecom networks 5G-ready, the following key digital technologies come into play:

Virtualization technologies like Software Defined Network (SDN), together with Network Function Virtualization (NFV), decouples hardware and software to create a centralized management and change center. This allows network changes to be made in real time through an orchestration module, while reducing cost, time and inertia of network modifications, increasing network reliability and resiliency.

Artificial intelligence (AI), when coupled with SDN, results in real time implementation of modifications leading to efficient real-time monitoring and proactive fault prevention. This is the path to hyper-automation.

Microservices brings modularity and agility to applications in the network.

IoT is expected to form a major portion of telecom traffic in the future. 5G networks should be ready to handle various kinds of IoT traffic in a seamless and cost-effective manner. Network slicing and Edge computing are the two key network technologies being considered to make existing core networks IoT-ready.

Adopting a maturity model for creating a 5G–ready network

5G-enabling technologies cannot be implemented in an arbitrary manner. Adopting a maturity model that defines the sequence in which technologies must be implemented can help maximize the value of 5G initiatives. Digital technologies such as AI enhance edge computing while SDN and NFV optimize the network potential. In essence, a carefully crafted network will lead to the creation of a hyper-automated system that requires minimal or no human intervention. Moreover, such an approach allows telecom operators to modify their system over time to address any shortcomings.

Transformation from legacy networks to cloud is the starting point of network transformation. The ideal way to undertake cloud transformation is to test it on the part of the network that is non-critical in nature, in order to iron out the bottlenecks and create standard operating procedures (SOPs). Once these are in place, the cloud transformation exercise can move to the critical part(s) of the network. The steps involved in network transformation leveraging the proposed maturity model (as illustrated in Figure 1) include:

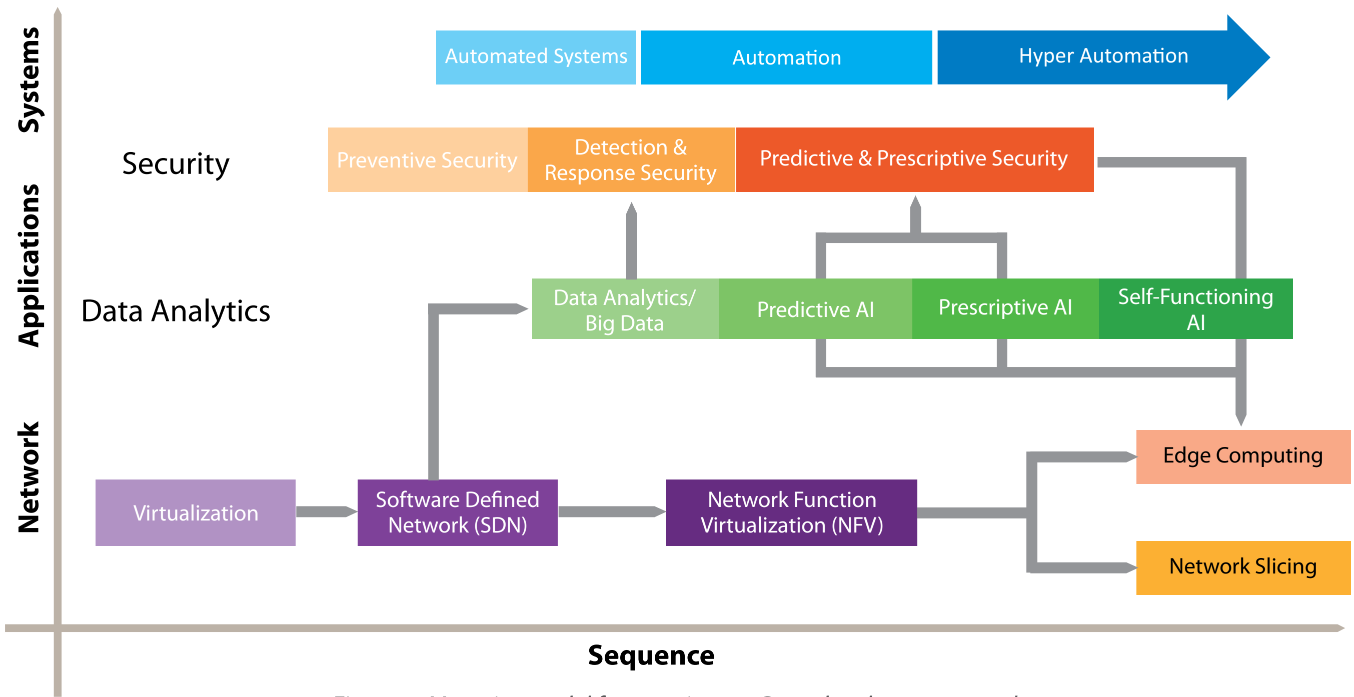

Figure 1: Maturity model for creating a 5G-ready telecom network

Implementing SDN: Here, the control plane from the nodes (routers/switches) is brought to the central server and put into a module called SDN controller.

Virtualizing functions through NFV: This enables the creation of an orchestration platform that controls and manages functions of the network from a centralized location. Changes made in/by the orchestration platform can be implemented across any node of the network virtually, in real time. For NFV to perform at its full potential, SDN must be in place.

Harnessing AI: AI software constantly analyzes data, predicts future network conditions and possible problems such as degradation or outages, and suggests changes. Network AI will mature and attain its final goal, self-aware AI (analyzing past and real-time data to create future scenarios and choose between them based on cause and effect relationship). A mature AI network will also reduce human intervention to zero, helping achieve a hyper-automated network scenario.

As AI technologies develop, automation will also mature in parallel. It will move from automated systems (data is analyzed to provide information for humans to take corrective actions), to automation (data is analyzed and corrective actions taken by system according to pre-programmed responses), and finally to hyper-automation (data is analyzed and corrective action taken by system which is unique to the situation and in cognizance of operating environment).

Combining SDN/NFV with AI also presents a unique opportunity for operators to enable proactive and real time security with monitoring of network edges and corrective actions at the nodes.

Leveraging edge computing: For IoT use cases, edge computing becomes imperative to maintain QoS and latency at par with 5G standards. Edge computing's potential can be optimized in a network where SDN, NFV and advanced data analytics/AI[1] are already in place. SDN makes the edges of the network function agnostically, ie the same edge may process data from different kinds of IoT services at various points in time.

[1] A concept recently coming up is AI on the edge. Instead of keeping AI module in the cloud, the concept is to distribute AI on the edges. This allows data processing and decision making at the edges; which eliminates the process of transferring data to the cloud and getting instructions from the cloud. This hugely improves the latency of network. It is beneficial for mission critical IoT use cases such as robotic medical operation, autonomous cars, and connected cars.

Edge computing and network slicing are supplementary technologies. Both serve the same primary objective of reducing latency in IoT processes. Hence, most telecom operators use only one at the moment[2].

SDN and NFV are imperative for network slicing, enabling the creation of virtual environment on physical network in which network slices (virtual pipes) can be created and managed, and extended to radio access network (RAN). Done right, network transformation serves a dual purpose – improving network efficiency and reducing operational costs and preparing the network for 5G traffic with desired QoS. Figure 2 illustrates various technologies and their value in network transformation.

<table>
<tr><th>Digital Technologies</th><th>Benefiting Technologies/ Systems</th><th>Functionality</th><th>Functional Benefits</th><th>Operational Benefits</th></tr>
<tr><td>Software Defined Network (SDN)</td><td>NFY, AI, Edge computing, Network Slicing, Security, Automation</td><td>Decouple control plane from nodes; brought to central server; then into SDN controller</td><td rowspan="2">▪ Assimilate data for analysis; enabler of changes
▪ Real time modifications at the nodes of network
▪ Real time network changes; automation with zero human intervention
▪ Create virtual environment on physical network to create and manage network slices
▪ Make the edge function agnostic; implement any function at any edge.</td><td rowspan="2">▪ Real-time network changes
▪ Latency reduction
▪ Cost reduction
▪ Improved network efficiency
▪ Faster time-to-market</td></tr>
<tr><td>Network Function Virtualization (NFV)</td><td>AI, Edge computing, Network Slicing, Microservices, Security, Automation</td><td>Enable creation of orchestration platform to control / manage functions from centralized location</td></tr>
<tr><td>Artificial Intelligence</td><td>Edge computing, Security, Automation</td><td>Analyze data, predict future conditions and problems, and suggest changes</td><td>▪ With SDN/NFV, enable real time network problem/ outage management and changes leading to automation
▪ With SON/NFV, enable proactive and real-time security.</td><td>▪ Real time, proactive network management
▪ Proactive security
▪ Automation</td></tr>
<tr><td>Edge Computing</td><td>Security</td><td>Push data storage and processing to "edges" of network</td><td>▪ Allow decisions and actions at entry point of network
▪ Enable distribution of AI on the edge to allow data processing and decision making at the edge</td><td>▪ Network efficiency and cost reduction
▪ Latency reduction
▪ IoT readiness
▪ Edge security</td></tr>
<tr><td>Network Slicing</td><td></td><td>Dedicated virtual channel for specific type of traffic over physical network</td><td>Allow simultaneous transfer of different kinds of traffic to pass through single network pipe</td><td>▪ Network efficiency and cost reduction
▪ Latency reduction
▪ IoT readiness</td></tr>
</table>

Figure 2: Digital technologies value matrix

[2] Telecom operators in the western side (Americas and Europe) are going for edge computing but are not vocal about network slicing; whereas peers on the Eastern Side (Korea and Japan) as going for network slicing but silent on edge computing

Becoming 5G-ready: Taking on the network in its entirety

Preparing the telecom network for 5G is a massive project. So far, only a few pioneering telecom operators are taking on the complete transformation of their core network. Others are waiting to identify better carrier-grade solutions[3] or partners who offer a holistic solution. But many telecom carriers are wary of vendor lock-in scenarios. What telecom operators need is an implementation partner that offers the scale and expertise required to handle such complex and massive projects. Such a partnership will be critical for telcos to realize the full potential of implementing digital technologies at the core of their network and improve RoI.

[3] Many operators are not happy with the current solutions as they are good enterprise solutions but not carrier-grade. They fail to ascertain the complexity and enormity of carrier network

About The Authors

Shubhadeep Sanyal

Shubhadeep is a Research Analyst with TCS' Marketing Transformation Research Group and focuses on the Telecommunications, Media and TBU segment. With over 12 years of experience across roles, from business analyst to research lead, he has provided support to large IT companies, mobile platform vendors and Communications Service Providers (CSPs). Shubhadeep has also authored whitepapers on the mobile industry.

Rahul Hak

Rahul Hak is a senior domain consultant with TCS' Communications, Media, and Information Services (CMI) business unit. With over 22 years of experience in IT and telecom, he heads the 5G practice for CMI NSG group. Rahul has lead multiple customer relationships for Original Equipment Manufacturers and Communications Service Providers across the globe. His expertise lies in product engineering, customer relationships, technology sales, conceiving and delivering business and technology solutions.

Contact

Visit the Communications, Media & Technology page on www.tcs.com

Email: global.cmi@tcs.com

Blog: Next Gen CMI

Subscribe to TCS White Papers

TCS.com RSS: http://www.tcs.com/rss_feeds/Pages/feed.aspx?f=w
Feedburner: http://feeds2.feedburner.com/tcswhitepapers

About Tata Consultancy Services Ltd (TCS)

Tata Consultancy Services is an IT services, consulting and business solutions organization that delivers real results to global business, ensuring a level of certainty no other firm can match. TCS offers a consulting-led, integrated portfolio of IT and IT-enabled, infrastructure, engineering and assurance services. This is delivered through its unique Global Network Delivery Model™, recognized as the benchmark of excellence in software development. A part of the Tata Group, India's largest industrial conglomerate, TCS has a global footprint and is listed on the National Stock Exchange and Bombay Stock Exchange in India.

For more information, visit us at www.tcs.com

TCS Design Services I M I 02 I 20