

# DISRUPTIVE TELECOMS

*Enable. Innovate. Transform*

**WORLD REPORT**

January 2023

## Top Trends in Telecoms

*5G, AI, IoT, Edge Computing, Cloud Computing, Intelligent Networking  
and Open RAN are the Top Trends Driving Telecoms Today*



**Agility, Services, and Automation:  
Making the Leap to Services  
Defined Networking**

Jonathan Homa  
Ribbon Communications



**"We offer digital design and  
deployment capabilities for  
a faster 5G roll out": Nokia**

Tarun Chhabra  
Nokia India



**Introducing Gcore Cloud  
Infrastructure in Mumbai, India**

Seva Vayner  
Gcore



**"IDEMIA's 5G SIM card functionalities  
will ensure higher level subscriber  
privacy protection"**

Rahul Tandon  
IDEMIA



**TSSC - Strengthening  
the Value Chain  
of Talent in India**

Arvind Bali  
Telecom Sector Skill Council

# ACCELERATING NETWORK TRANSFORMATION

THOUSANDS OF SERVICE PROVIDERS AND ENTERPRISES  
AROUND THE WORLD DEPEND ON OUR BUSINESS-DRIVEN  
NETWORK TRANSFORMATION SOLUTIONS

**IP OPTICAL NETWORKING**

**SECURE CLOUD COMMUNICATIONS**



# From the Editor



**Zia Askari**  
Editor, TelecomDrive.com

## 5G, Digital Transformation and Smart Grids

**Highly efficient 5G networks can drive national energy transformation with the help of Smart Grids**

When it comes to envisioning digital transformation, 5G networks can play a big role in terms of enabling energy transformation with the help of smart grids.

Smart grid ecosystems integrate information, telecommunication and automation into traditional power systems reinventing the way energy is stored, delivered and further sold to consumers. Smart grids are now regarded as a key component of national energy strategies in many markets, including the USA, Europe and China.

In essence, smart grids are based on the principle that everything in the grid is connected, monitored and controllable. The data on usage, network status and performance, and energy supply from generation sources is collated centrally.

And hence, the communications system fabric for the smart grid is a crucial component which links all the power generation, transmission and distribution assets as well as the management systems together. And it is this communication system that

can be powered with the help of 5G networks and take digital transformation to a whole new level and direction.

Energy saving and highly efficient 5G networks can enable two-way transmission of data between sensors and monitoring systems; between control systems and energy generation, storage and transmission assets; and between control systems and end users' smart meters – therefore driving energy transformation with the help of digital transformation of smart grids.

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# Top Trends in Telecoms



**T**he telecom industry is undergoing a digital transition to remain competitive in 2023 and beyond. To recover from the COVID-19 catastrophe and confidently position themselves in the future, telecom enterprises have started leveraging technologies such as 5G, AI, and cloud computing. By gradually moving away from traditional business models, advanced tech solutions can help them become more customer-centric, more efficient, and add better profits to the business.

Digitalization of consumer channels, content creation, and communication services has contributed to the development of a new ecosystem of value, a more integrated market, and a robust infrastructure. In this digital era, suppliers are attempting to

implement high-performing networks to fulfill all customers' needs and expectations.

Here are the top five technology advancements driving a significant shift in the telecom sector.

## **Expansion of 5G:**

As per various industry reports - the worldwide connections to 5G networks are expected to exceed 1.34 billion the coming year. Telcos are targeting industry sectors with 5G apps and IoT devices to amplify the position of network systems and streamline business processes. Telemedicine is being used in the healthcare industry to offer cost-effective and timely diagnoses and care. The transportation and traffic infrastructure is also improved by connected autos. As the world accustoms to the new normal

due to the Covid-19 scenario, the education sector is turning to e-learning to transform and improve education. The 5G network, with its diverse range of technologies, is helping telecommunications aim for significant enterprise growth.

## **Artificial Intelligence:**

By 2025, the percentage of operators investing in AI technologies to upgrade their infrastructure is predicted to rise to 70%.<sup>2</sup> Artificial intelligence opens up new avenues for network maintenance, predictive maintenance, and customer service cost reduction with real time decision making. It enables operators to create customized offers for their B2C and B2B clients.

AI can also detect network issues, allow self-preservation, and safeguard networks from fraudulent activity.



It also aids operators in monitoring equipment startup and predicting failure based on patterns. In short, AI can help improve root cause investigation, allowing for more efficient resolution of visible and potential hardware defects.

### **Internet of Things:**

Analysts suggest that by 2025, close to 4.15 billion IoT devices will be linked to cellular networks worldwide, offering enormous prospects for telecom carriers.

Furthermore, IoT in Home Automation is one of the most promising domains since it provides superior mobile and network services to intelligent home mobile apps and real-time surveillance systems.

To commercialize IoT solutions, the telecom industry is bringing in new methodologies and applications to leverage these technologies, reinvent themselves to go beyond

core network connectivity. Communications service providers (CSPs) can also unleash greater possibilities to offer a wide range of services for various industries, including healthcare, education, manufacturing, automotive etc.

### **Edge Computing:**

By the end of year 2025, the worldwide demand for connected edge computing services will reach \$7 billion by 2025. The Edge Computing ecosystem is rapidly evolving. It brings processing capabilities closer to the device's location in real-time, eliminating the need to transport data to a cloud data center and lowering waiting time. The data becomes more relevant and beneficial to the end-user with faster speed and on-time delivery. Edge computing also helps businesses, and their customers reduce total network traffic and

improve performance. Not only that, but it also boosts network security by offering low-cost local encryption and security features.

### **Cloud Computing:**

As per the recent studies - the telecom cloud market is set to touch \$74.36 billion by 2026. As a result, we can see the industry pivot towards virtual network and witness a tremendous transition of communication service providers (CSPs) to the cloud in the years to come.

Most telecom companies rely on colossal computing infrastructure to serve various applications, manage data, and charge services. Migrating to the cloud lowers internal computing resource requirements, reduces internal costs, and boosts revenue streams.

With the pay-per-use service model, telecoms can launch new

services, lower service costs, and work more efficiently while responding to evolving market demands. In addition, the industry can benefit from the cloud technology by moving essential business processes to the cloud. Single-product carriers can also use the cloud to broaden their service portfolio and expand at the pace demanded by today's market.

### The Era of Intelligent Networking

Telecoms need to be able to incorporate new technologies and next-generation connectivity such as 5G to customers and end users. To achieve these ambitious goals, they need to optimize their networks – make them more intelligent if you will. Some of the tools needed include artificial intelligence (AI), machine learning (ML) and artificial intelligence operations (AIOps).

This is a new area for many in the telecom industry, so the focus will be on the requirements, tools and approaches that have been deployed, and some potential future scenarios for intelligent networking and AI/ML tools.

Telecom operators are first and foremost technologists, but the reality is that there is constant pressure to increase the efficiency and capacity of operators' infrastructures to delivery more

services to customers for lower operational costs – to make the business work more efficiently.

The software industry, leveraging virtualization, cloud native approaches, agile methodologies, and test-driven development has long been able to build applications and infrastructure flexible enough to be seamlessly modified multiple times a day.

Could and should the Telecommunications industry, with its stringent requirements for high availability, and its distributed service delivery models, adopt these methodologies for its own infrastructure and systems? As software defined networking (SDN) becomes more robust, operators have found that it is not enough to just convert everything to software, step back and expect it to all work.

Based on the information submitted by participating operator and vendor organizations, the level of sophistication about intelligent networks is still relatively low, with little cross-departmental and cross community sharing or tools. This leads to further silos, fragmentation of development and research activities, and less efficiency across the industry. It has been said that data is king and that is certainly true for any kind of AI tools.

Machine learning needs lots of data, the more data to analyze; the

more effective the results will be. As an example of this phenomenon, the problem of how to translate texts effectively and efficiently was long thought to be unsolvable. Then Google applied copious data sets in a brute force method that worked. Google Translate is a reasonably workable method of text language translation.

One of the most pressing problems is the lack of an understanding of the data itself and how it needs to be organized and processed to successfully apply machine learning to improving network efficiencies.

There is a need for intelligent networking tools both in support of internal as well as customer facing processes. The amount of data needed to track network workflows to effectively create AI tools that will be able to do real-time predictive modeling. In summary, not only is there a very long list of components that need to be part of the Intelligent network, but capturing the right data and at the level of granularity that is needed to produce results is still very much more an art than a science.

### What is Driving Intelligent Networking Adoption?

- Market and Business Expansion: For many telecoms, the consumer market has long been saturated, so there has been a strong push to look



for new market opportunities. Technology changes have opened growth potential for digital transformation, which puts additional demands on network services.

- **Network Technology Evolution:** The industry's embrace of 5G, network slicing, Infrastructure and Network Functions Virtualization (NFV) and other cutting edge technologies, has put pressure on companies to develop new features such as flexible resource allocation and dynamic scheduling, as well as the need to support disaggregated network, software and hardware models.
- **Optimization for Operations Management:** As the complexity of networks and network interoperability increase, it becomes more difficult to support traditional network operation and maintenance management models. AIOps models could be a way to improve efficiency by aiding in process coordination, information screening and automation of operational management workflows. Some of the possible applications are service subscription, fault monitoring, and quality optimization.

Intelligent networking as a tool in the telecom industry is becoming more urgent as business and technical pressures increase. In order to gain a better understanding of the state of the use of AI and intelligent networking in the industry, a survey of 65 telecom operators and vendors was conducted.

### Defining Intelligent Networking

Starting from a general definition of AI, according to the European Commission's High-Level Expert Group on AI, AI systems are software (and possibly also hardware) systems

designed by humans that, given a complex goal, act in the physical or digital dimension by gaining an understanding of the environment through data acquisition, interpreting the collected structured or unstructured data, applying reasoning to that information, or processing the information, derived from this data and finally, deciding the best course of action to take to achieve the stated goal.

AI systems can either use symbolic rules or a numeric model, and they can also adapt their behavior by analyzing how the environment is affected by their previous actions.

Clearly, that definition is far too broad to apply to intelligent networking. A better approach is to establish a common understanding of what it is within the telecommunications context. However, it is quickly apparent with a web search that AI, ML, and AIOps mean different things to different groups even within the networking and telecommunications industry.

While AI and machine learning is often understood to be how automation can be used to optimize the network, making sure the networks, connections, and packet flows remain optimized as traffic naturally shifts over time. That optimization can happen within a telecom's own infrastructure or it might be tools that customers apply to their own networks.

This can also be more broadly applied to operational aspects of the telecom infrastructure, which implies the use of AI/ML outside of the network itself, often referred to as AIOps. According to Gartner, AIOps combines big data and machine learning to automate IT operations processes, including event correlation, anomaly detection and causality determination.

For the purposes of this document, intelligent networking is a network empowered by AI technologies

and systematic integration of AI and communication network on hardware, software, systems, and processes. This includes but is not limited to transforming network software and hardware into an AI system, as well as the operational intelligence represented by the AIOps components.

The relation between intelligent networking and AIOps could be further explained this way. The ultimate goal of intelligent networking is to turn a network composed of software and hardware into an AI system, which covers but is not only subject to AIOps.

There is still a long way to go to achieve intelligent transformation for networks with many challenges along the way. However, the industry must incorporate these technologies into the infrastructure to meet the demands for telecommunications in the twenty-first century.

- In general, the telecom industry is still in early stages of intelligent transformation, with relatively low levels of autonomous, intelligent networking deployed.
- As part of the overall industry intelligent transformation strategy, leading operators and vendors should introduce and coordinate intelligent network applications through a unified understanding of AI platforms. A consensus could be reached that developing a unified platform is essential to reach the goal of intelligent network autonomy.
- For now, operators are most interested in AI applications for operations and maintenance, service assurance, and network optimization.

Therefore, operational personnel are encouraged to improve AI-related skills.

- Establishing a cross-industry shared data model poses considerable challenges; however, data sharing amongst



not only operators, but between operators and vendors as well brings significant benefits.

### The Rise of Open RAN

Although the Open RAN market is still in its early days there are active deployments across the globe, where MNOs are testing the technology in greenfield, rural, and emerging markets.

Even though deployments are starting slowly, they could easily double in 2021. Government's funding R&D initiatives to foster the development of Open RAN readiness in US, Japan or Europe, together with Tier 1 operators joint initiatives to accelerate adoption, it is now clear that the transformation of radio access networks towards a more open and disaggregated architecture is a given.

While the ecosystem develops fast and the expectations remain high around innovation growth, cost savings and vendor lock-in avoidance, there are still many concerns to be addressed on technology maturity, adoption scenarios and networks lifecycle management.

The disaggregation of hardware and software solutions with open interfaces and APIs leverages the adoption of COTS hardware, which can lower costs and foster innovation

### Open RAN

RAN sharing involves the partial

or complete sharing of the RAN network elements, such as the network core and spectrum, in order to accelerate deployments while reducing costs RAN Sharing Network slicing enables Telcos to create multiple logically isolated networks on top of the physical infra while private 5G represents the creation of a dedicated network in which the customer has full control

### Slicing and Private 5G

The usage of massive MIMO antennas, smaller cells and mmWaves will help to define the best way to densify 5G networks, securing higher bandwidth connectivity and enhanced QoE to end users and enterprises

### Small Cells & mm Waves

Edge Computing brings computing power as close as possible to the data sources (e.g. IoT devices such as sensors monitoring environmental conditions), thus supporting reduced latency and backhaul bandwidth consumption

The usage of cost effective and data driven automation powered by AI/ML, Open API, data analytics and DevOps, enables Telcos to overcome the operational complexity added by 5G

There are several technology trends being leveraged by the new generation of mobile communications. These can not only create new business opportunities but also

enable Telcos to reduce costs while increasing their network capacity and operational efficiency.

Open vRAN refers to a disaggregated approach of deploying virtualized mobile networks by using open and interoperable protocols and interfaces, implemented over a common propose hardware in a multi-vendor software environment, allowing an increased flexibility over traditional RAN architectures, aiming to provide OPEX and CAPEX savings while fostering innovation.

Traditional RAN Protocol stack that runs on proprietary hardware Radio Unit and BBU are connected via proprietary interfaces Single vendor provides both Radio Unit and BBU Openness in RAN

Big Benefits of Open RAN

TCO Efficiencies

Fosters innovation

Player diversity

Reduce Time-to-Market

There is wide recognition of Open RAN's potential to disrupt the existing marketplace. At the same time, the low maturity of the technology presents challenges that need to be addressed fast.

Standardized software centric approach based on commoditized Hardware Open standard interfaces that ensure deployment of multi-vendor RU and CU/DU ecosystem, powered by an open source AI/ML based platform designed for non and near real time network functions (i.e.

a RAN Intelligent Controller)

Open RAN based solutions are stepby-step going towards the maturity phase, in which they can be seen as a mainstream solution. Not only there are major technology vendors incorporating or planning to incorporate open RAN solutions in their portfolio, but relevant Telcos have been moving from trials towards initial deployments in live networks. For this technology to succeed, the industry to adopt the specifications being defined by standards organizations like O-RAN Alliance and live performance and reliability of Open RAN based networks reach similar performance levels and feature parity of traditional architecture.

However, as the technology becomes mainstream, with a higher number of deployments and field trials, not only in rural areas but also in dense urban markets, new challenges are expected to be found. This may create an initial feeling of “disillusionment” that will presumably disappear as Open RAN solutions become fully mature, which can take 3 to 5 years.

The Open RAN market is expected to grow and overtake traditional

RAN solutions in both public cellular and enterprise & industrial cellular segments over the next decade. In the long term, the enterprise & industrial cellular market has the potential to become bigger than the public cellular market if enterprise vertical requirements are addressed.

Policy makers and governments around the world show interest on RAN supply chain disruption and support market development of alternative vendors to expand the ecosystem and avoid having their country’s communications infrastructure being based on a single vendor only. This has accelerated the emergence of Open RAN startups such as AltioStar, Mavenir, Accelleran, Airspan or Parallel Wireless, which offer solutions compliant with the O-RAN architecture.

### The Cloud Advantage

Carriers around the world know that their current method of designing and deploying mobile networks will not hold up to near-term demands, let alone future demands. Multiple waves of change are sweeping the network. The COVID-19 pandemic and the

pressures that it has placed on the network illustrate that the world has moved beyond simply connecting people to one in which always-on access to digital services is seen as a basic need.

### Carrier Journey to the Cloud

Carriers started with software-defined networking (SDN) and the separation of the control and data/user plane using the OpenFlow protocol. They quickly discarded the centralized control plane as not a viable solution for carrier-scale networks. However, the carriers kept the separation of control and data in a decentralized architecture. OpenFlow was discarded as an open source building block, but it is still used in what are essentially proprietary implementations.

The idea that operational efficiencies and agility could be gained by the separation of the control and user planes. They also kept the overall concept of a move to software solutions. Network functions virtualization: Much more work than we thought

When network functions virtualization (NFV) emerged as



a network architecture in 2012, the hope was that it would enable carriers to move away from proprietary, appliance-based network solutions and toward software solutions running on commercial off-the-shelf (COTS) platforms. The aim was to lower costs, avoid vendor lock-in, improve network agility, and simplify the network. Some of these goals have been accomplished in some networks. However, the virtualization of the network has hit hurdles at each point in its evolution:

- **Scale out:** For virtual network functions (VNFs) that are highly distributed—residing at hundreds or thousands of points in the network—virtual solutions ran into problems early on with the performance of protocols such as OpenStack. These protocols were written for the data center, not for highly distributed and robust carrier networks. Virtual solutions also had issues with the integration and interoperability testing required if the network was supporting a heterogeneous set of software solutions. The same issues hold true for traffic traversing multiple different COTS devices, where sessions collect delay at each device, which can affect the user experience.

- **Scale up:** For VNFs handling high traffic volumes, carriers frequently had to revert to appliance-based versions of the solution to get the performance needed.

- **Interoperability:** While a multi-vendor environment was the goal, carriers were left with the choice of either standardizing on a reduced set of features from multiple vendors or becoming locked into a single vendor. Complexity was also multiplied with multiple software updates, particularly if multiple platforms were used.

- **Management:** There are multiple methods for managing a VNF, including, but not limited to, both VNF managers and VNF domain

managers.

### Going Cloud-Native

Early in the implementation of VNFs, carriers realized that they were trading an appliance based version of a product (e.g., a firewall) for a software-based version with the same features and functionality—and sometimes not even that. These VNFs were not written for the cloud and did not take advantage of the DevOps style of development. Cloud-native brings with it a move to containers, the implementation of Kubernetes to manage those

containers, the ability to scale up and out quickly, and lower costs since the applications are realized in microservices. But it is still not clear to carriers if a move to cloud-native network functions (CNFs) will solve the challenges they have had with NFV and VNFs.

Although carriers have learned much from the cloud providers of the world, the one lesson that they have not internalized is the primary reason for using proprietary elements. These elements should not be used just to add features, functionality, differentiation, and competitive advantage (though they should provide all of that). Rather, their key advantage should be to simplify and

lower the cost of the network. As the next decade of network architectures and development approaches, “simplify” will be the guiding principle—whether through open source, COTS, proprietary systems, or a combination of all three.

Carriers are seeing a cloud-native network as the goal, but they are not sure of the path that will provide the greatest ROI. Carriers such as India’s Reliance Jio and Telefónica are innovating on a foundation of cloud-native development. However, Japan’s Rakuten Mobile is out in front in the move to cloud-native with its fully virtualized, automated, and software-centric LTE network.

Rakuten Mobile—like pioneers in the NFV space such as AT&T and Telefónica—did much of the integration work itself. It has also done development work to fill some of the critical gaps in VNFs or tools needed in the management and orchestration (MANO) layer. While the network may seem to have appeared on the market overnight, 12 months of development went into pulling it together. Fullscale commercial service on the network launched in April 2020 with about 4,000 sites, and Rakuten Mobile has since been continually expanding its base station buildout. One of the carrier’s integration challenges was building a solution that could scale; it had to create a software platform that could orchestrate VNFs over a large number virtual machines.

Rakuten Mobile’s radio access network (RAN) is completely virtualized, where each mobile site is only a remote radio head from different antenna vendors. All other components are implemented as virtualized functions running in different data centers and facilities in different locations (virtualized distributed and central units). The resulting solution can instantiate a cell site in under nine minutes after physical installation is complete.

**Carriers are seeing a cloud-native network as the goal, but they are not sure of the path that will provide the greatest ROI**

# **“We offer digital design and deployment capabilities for a faster 5G roll out”: Nokia**



*At a time when telecom operators are looking forward to rapidly deploy 5G networks and cater to the growing demands from consumers – Nokia’s digital design platform creates a Digital twin of the network that can visualize ‘what if’ scenarios to design and optimize the network performance, before the actual physical implementation.*

*Nokia’s deployment capabilities include Digital site survey using drones and 3D cameras, Digitalization in site acquisition, ‘zero touch’ and ‘plug and play’ commissioning, Digital site acceptance and Digitalized Logistics functions.*

*Tarun Chhabra, Head of Mobile Networks Business, Nokia India speaks with Zia Askari from TelecomDrive.com about the company’s strategy on tapping India’s 5G market and how the company is driving innovation while enabling 5G networks with latest technologies.*

### **With 5G rollout in India to expedite in the coming year, how is Nokia prepared to deliver 5G network gear to the telcos in India?**

Since the launch of 5G services in India in October 2022, both the major CSPs, Reliance Jio and Bharti Airtel, have been rolling out their 5G networks at a very fast pace. The size and scale of 5G deployment in India will be at par with some of the biggest markets in the world.

We were preparing ourselves quite in advance for the 5G deployment in India -whether it was the upskilling of our people, increasing the production, or hiring of skilled work force. Having announced major 5G deals with both Reliance Jio and Bharti Airtel, Nokia is already partnering with both the CSPs and supplying 5G equipment for their infrastructure built up.

We have already been manufacturing 5G radio equipment at our Chennai factory for the global markets and are now leveraging it for the domestic market. We are deploying several thousand sites in the country every month. To manage and execute such a massive scale of deployment, we have been steadily ramping up the manufacturing capabilities of our Chennai factory to keep up with the demand.

### **What are the major 5G use cases that you foresee getting a major push in the country?**

5G is more than just a new generation of technology - it

brings a paradigm shift in the role of mobile technologies beyond connectivity. Based on our global 5G experience from different markets, some of the major 5G use cases we believe would see wider adoption in India include:

- **Fixed Wireless Access:** FWA can be offered to consumers and enterprises as an alternative to fixed broadband and for providing high speed connectivity to remote areas and locations where fiber laying is not feasible
- **Video:** Video applications are already very popular and 5G brings significant improvement to enhance the overall experience
- **Immersive experience:** AR/VR (Augmented Reality/ Virtual Reality) and cloud gaming will piggyback on the 5G for low latency, higher bandwidth, and seamless experience
- **Smart venues:** Live video streams, AR displays, 3D hologram footage for sports events, concerts, festivals etc.
- **Industry 4.0 and private wireless:** Industrial grade private wireless is best suited to cost-effectively implement the widest range of Industry 4.0 applications and use cases at scale with minimal infrastructure.

### **With PLI and other initiatives by Government to push the**

### **manufacturing of telecom equipments in India, how is Nokia contributing to the indigenous manufacturing?**

The production-linked incentive (PLI) scheme was introduced to provide a focused push to the ‘Make in India’ initiative, covering telecom and twelve other sectors. With a booming digital economy, coupled with the launch of 5G, the demand for telecom gear has grown multi-fold in the country. Nokia is fully aligned with the ‘Make in India’ mission and is one among one of the major investors and producers under the PLI scheme.

As one of the first global telecom companies to start manufacturing in India, we have invested over INR 4,200 Cr in driving value creation in the country. Our Chennai factory manufactures a range of telecom products, including 4G/LTE radio, 5G NR (new radio) and 5G massive MiMo radios among others - 50% of which is exported to global markets. The site has till date delivered over 6 million telecom equipment units. Nearly all 4G radios for the domestic market are manufactured locally and we aim to follow the same trend for 5G as well. Further, we are looking at expanding our manufacturing line up to include IP/ optics and fixed networks.

Recently DoT (Department of Telecommunications) has approved 42 companies for receiving benefits under the design-led PLI scheme,

sometimes referred to as PLI 2.0, for manufacturing telecom and networking products - we are proud to be part of PLI 2.0 as well.

**Industry 4.0 with 5G technology will be game changer for the enterprises. Would Nokia be collaborating directly with enterprises or would you partner with telcos instead to move forward in the area?**

Enterprises across the globe are looking at offering new services and enhancing their delivery capabilities to serve more customers and increase their revenues. They need to transform and digitalize to become more responsive, more agile, and more innovative. This is where Industry 4.0 and 5G can be the game changer— leveraging new and transformative applications of technology to drive industrial growth and profitability.

Nokia has delivered value for over 1500 mission critical customer networks across the globe. We are the recognized global leader in private wireless networks. Our solutions enable the enterprises to create a digitized business experience, improve cost management and drive economies of scale.

We have good footprint across all CSPs in India and look forward to partner with them for offering connectivity and private wireless solutions to their enterprise. However, we are also open to work with enterprises who want to deploy their own private network. We are here to help them achieve their goals of sustainability, automation, and efficiency.

**What are the innovations that Nokia is focusing on to make sustainable network rollouts across the globe and India?**

The radio access network (RAN) accounts for about 80 percent of all mobile network

energy consumption. We are constantly working towards maximizing the energy efficiency of our radio products, outlining our commitment to climate change and zero emission. This is enabled by continuous improvements in software functionalities and new mMIMO product variants based on our latest ReefsharkSoCs (System on Chip).

We have developed an innovative

**Nokia has delivered value for over 1500 mission critical customer Networks across the globe**

network design approach that focusses on reducing the network power consumption. Our Digital Design for Energy Efficiency approach monitors each individual cell with respect to interference, load, and site configuration. This results in a cell optimized configuration with an overall lower transmit power, lower CO2 footprint and a reduced energy bill – without compromising on network performance and end user experience. We are also adding several advanced energy efficiency features based on machine learning, to our self-organizing networks (SON) solution.

Further, we offer digital design and deployment capabilities for a faster,

more sustainable, and higher quality 5G network roll out. Our digital design platform creates a Digital twin of the network that can visualize 'what if' scenarios to design and optimize the network performance, before the actual physical implementation. Our deployment capabilities include Digital site survey using drones and 3D cameras, Digitalization in site acquisition, 'zero touch' and 'plug and play' commissioning, Digital site acceptance and Digitalized Logistics functions.

**How do you think the Indian market will adopt 5G on the consumer end?**

The strong appetite for data in the country makes 5G a very attractive proposition for the Indian consumers. The tech savvy generation spends almost 8 hours per day online and India is ranked among the top data consuming nations worldwide. Average data per user per month in India grew 3x in last five years and reached 17GB/ user/ month as per Nokia MBit report 2022. This trend will get a further boost with 5G and the per user data consumption is expected to grow 2x to 3x in next four to five years with 5G.

India is leading the world ranking in digital payments and has completed nearly 70 billion digital payment transactions in 2022 as per market reports. 5G will further boost the digital economy and the volume of such digital transactions in the country.

Mobile 5G services are forecasted to generate US\$9.0 bn, equivalent to 37.7% of total mobile service revenue in India, by 2026. Further, with India being a mobile dominated country when it comes to internet connectivity, we will see wider adoption of 5G and Fixed Wireless Access to bridge the digital divide and provide high speed reliable internet connectivity to remote, underserved and/ or unserved areas.

# Agility, Services, and Automation: Making the Leap to Services Defined Networking

*By Jonathan Homa, Senior Director of IP Optical Solutions Marketing, Ribbon Communications*



**T**oday's communications service providers (CSPs) are able to handle ever-growing bandwidth demands without increasing Capex by leveraging advances in aggregating, routing, and transmitting network traffic. Their more pressing challenge is on the services front, from competition, substitution, and the inability to maximize revenues, concerns which reduce the top line and restrict their ability to maneuver.

What CSPs need is the agility to offer services quickly and efficiently,

enabling them to increase revenue by capturing new customers and to reduce churn by offering existing customers new services as they become available.

And the competition is fierce: the three largest webscale service providers (WSPs), AWS, Azure, and Google Cloud, already own a massive 66% of the global cloud market. They have transformed business computing, moving IT structures into the cloud, and are now offering high bandwidth services that connect business locations to the cloud, with link speeds ranging from 1G to 100G, as well as dedicated wavelength services.

In many cases, WSPs offer these services directly, over a dark fiber infrastructure. AWS alone boasts over 275 points of presence globally, although they still mostly collaborate with large CSPs to deliver the services. This is where the squeeze comes in.

At the low end, the CSPs provide basic transport, getting bottom dollar while the WSPs make all the margins. At the high end, the WSPs repackage and resell CSP connectivity services, often bundling them with their cloud services. The CSPs make better margins, but lose their contact with the end customers. Worse, they will likely lose large chunks of those revenues in the future as the WSPs build out and move business customers to their own network infrastructures.

Numerous industry segments rely on high bandwidth and reliable communications as an essential part of their business. In theory, these industries could turn to CSPs to fulfill these requirements, but in practice, they build private networks to satisfy many of their communications needs and control performance and economics. Private networks are tailorable to specific business needs and first costs typically pay back within a few years compared to CSP services. Ongoing network

management is often contracted to system integrators.

These private networks are a huge missed revenue opportunity for the CSPs. This gap will likely continue to grow as they incorporate new technologies like 5G and IoT. System integrators devoted to specific industry segments will work with the WSPs to create even more customized communications solutions and CSPs will be left with low dollar dark fiber infrastructure revenues, and only smatterings of higher margin managed communication services.

On the consumer side, communications services have traditionally been shaped to meet basic needs like standard and higher speed Internet access, and limited or unlimited mobile data. Today's consumers require more complex offers for home working, real-time gaming, experiencing virtual life within an AR/VR metaverse, and more.

This market is waiting to be stratified with a range of services offering varying guarantees on bandwidth, latency, and availability. CSPs who take the plunge and begin to offer these options will have access to massive upside revenue potential. But in order to do so, they will need to re-engineer and optimize their networks to be service-driven, providing the agility and capabilities to maximize profitability, and not just minimize cost.

The three key pillars to this ability for service providers to automate and optimize their networks to drive value from their existing investments, and gain the ability and agility to quickly deliver new revenue-generating services are: Automation; Optimization; and Openness.

That's the approach we at Ribbon are taking with our IP Wave framework, which is designed to create service-driven IP Optical networking solutions that enable service providers to address major network and operational challenges



by building, deploying, managing and future-proofing their multi-layer data and optical networks.

These solutions fuse optimized hardware and automation software within an open architecture to give service providers the agility they need to rapidly create and deliver innovative services. Additionally, this complete offering delivers advanced IP routing, Optical Transport, and Automation and Orchestration software, all supported by world-class professional services.

IP Wave software enables service providers to automate operational processes gradually and at their own pace with a combination of analytics, workflow engines, and closed loop processes. It also delivers practical automation, from human-assisted to intent-driven, while supporting multi-domain, multi-vendor environments.

The last few years have shown exponential growth in the number of different participants that can be involved in a single service, adding complexity to the network, and creating new demands on network management, making it more important than ever to have the right tools to guarantee delivery and GoS.

In fact, this new world demands a harmonized approach between network hardware optimized for the service being delivered, and 'smart' network software automation.

Looked at another way, this means that the services layer and transport layer must understand each other. The two must be in lock step, synchronized and acting as one in order to maintain agreed service standards for every service being carried. This level of service delivery requires an orchestration system that provides network and service integration, automation, and end-to-end control. Too often today, the transport, or IP, part of the network has no idea of the requirements of the service that it is carrying. It cannot hope to fulfil service specific

requirements because it has no visibility of them and is little more than a dumb A to B pipe. That is a network no longer fit for purpose for the services being developed now.

Software defined networks (SDN) have become a popular topic in recent years. The concept has been that with the greater use of software within networks, new services or upgrades could be rolled out more efficiently and much faster than in traditional, hardware-centric, network environments. Perhaps it is time to re-assess what SDN really means because as software begins to dominate in the delivery of specified services, then maybe what we are witnessing is the emergence of networks defined by the services they are delivering.

### Services Defined Networking

Focusing on services provides the context for SDN to deliver network functionality that fits the specific service being carried. Service defined networks are fit for purpose networks. They rely on communication and comprehension between the service, transport, and orchestration layer. The goal of such a network is to deliver software that is able to adapt to the business needs of the customer with service requirements "pushed" down to the underlying network elements. And while the control software might be best suited to a cloud-native environment, it is the integration, automation, and understanding between the network layers that ensures the services are delivered consistently and to specification.

It is unlikely that one company will always supply all three pieces of this network puzzle, but understanding all three pieces of the puzzle and being able to integrate them so that the whole is greater than the sum of its parts is non-negotiable.

The truth is that the network, and the network technology, has changed

beyond all recognition – adding complexity, capability and flexibility to the range of services and delivery methods at its disposal. Yet, as the old adage goes, the more things have changed, the more they stayed the same. Today's networks still primarily focus on guaranteeing delivery of the service from point A to point B. With IP Wave, we recognize the network has to change, which will require an understanding of the services it is carrying and an integration between hardware, software, and orchestration. In a way, IP Wave changes SDN from Software Defined Networking to Services Defined Networking.



*Jonathan Homais Senior Director of IP Optical Solutions Marketing at Ribbon Communications, where he focuses on optical networking and domain orchestration solutions. Jonathan joined Ribbon from ECI where he held the same position. In notable prior roles, Jonathan was VP Architecture Marketing at Nortel Networks, and VP Business Development at Xtellus, an optical switching startup that was sold successfully. He served on the Board of Directors of the Alliance for Telecommunications Industry Solutions and the Multiservice Switching Forum. Jonathan's career journey has taken him from Canada, to the United States, and currently Israel, where he makes Jerusalem his home.*

# Comviva – Reinventing Monetization Possibilities for Telecoms

*When it comes to driving innovation with AI and Analytics, Comviva has been at the forefront and helping its global customers reinvent monetization possibilities and delivering unique experience for their end customers.*

*With the help of its latest innovative offerings such as BlueMarble and MobilYtix – Comviva is supporting major telcos to improve their customer experience journeys for increased revenues and customer retention.*

*Amit Sanyal, EVP & Chief Operating Officer, Customer Value Solutions, Comviva interacts with Zia Askari from TelecomDrive.com on how the company is driving innovation for telecoms with the help of AI and Analytics.*



## How is AI and Analytics currently contributing to enable a sophisticated customer experience management for telcos?

Data science and AI have become vital to the telecom sector and becoming more so as the industry evolves with time. With the steadily increasing use of smartphones and other connected mobile devices, the amount of data flowing through telecom operator networks has increased and the network operations, customer service operations, and infrastructure operations of telecom companies all generate massive amounts of data. AI and ML is going to revolutionise customer experience and uplift

revenues significantly more than any other factor in telecom put together. One big play that AI and analytics currently has, and which is expected to continue for the next five to seven years, is personalization at scale.

As the technology evolves and we enter the next phase, the telcos are able to make personalized recommendations based on a user's behavioural patterns and content preferences. AI and analytics is also helping in detecting and fixing potential issues for customers even before they're apparent to the end-user, therefore leading to more personalized experience for every telco customer.

## What are the different areas where AI and analytics can be leveraged by telecom companies?

The telecommunications industry has gone through several stages of automation. The use of artificial intelligence (AI) and analytics has been clearly advancing and has recently picked up pace in the telecommunications market. Communication service providers (CSPs) are using AI and analytics to examine their massive amounts of data and derive actionable insights that can lead to improvements in customer experience, loyalty, and

ARPU, increasing their profitability, improving customer satisfaction, and increasing efficiency, particularly by detecting issues and recommending the best course of action before they affect customers as well as increased efficiencies. AI is heavily used now in telecom for channel management, field force optimization. On the network side, for predictive fault finding, self-healing network, software defined networks.

According to me, some of the major use cases of AI and analytics in the telcos business are

- Improvement in customer experience
- Monetization of existing telco assets
- Decluttering

AI and analytics is helping revolutionise telco operators and reinventing monetization possibilities for CSPs. The next phase is now on application of data analytics into revolutionary business outcomes or towards customer experience, asset monetization and decluttering. Machine learning and AI will be hugely useful in personalization at scale and decluttering which means the relevant communications will be disseminated to relevant customers at the relevant time.

**Customer experience has become a top priority for telcos in the recent times. What are some of the solutions provided by Comviva to help move telcos transition beyond traditional network connectivity?**

Comviva has been behind telecom revolutions of multiple regions across the world. We have been supporting major telcos to improve their customer experience journeys for increased revenues and customer retention. One of our majorly adopted solutions is **BlueMarble** which is a modular commerce, order management, customer care and partner management digital platform.

The end-to-end digital transformation

stack of this solution is helping operators navigate smoother digital transformation journeys. Specifically designed for Communication Service Providers (CSPs), it is a 5G ready, cloud-native, microservices based, open and digital platform that delivers business agility to rapidly offer personalized customer experiences and journey. Our solutions are being leveraged by customers like TATA Sky, Airtel, Vodafone Idea in India and many such prominent CSPs across the world.

**MobiLytix** is another leading marketing technology platform globally that unifies customer engagement, loyalty & rewards management, data science and intelligent AI-driven automation capabilities within a single platform to execute campaigns real-time and at scale. By engaging customers with the right message, at the right time, across any channel, organizations can improve customer experience, increase customer lifetime value, and drive revenue growth. With over 200 million deployed customer base and clients achieving high incremental revenues, MobiLytix™ has a proven track record of customer success.

**What are the key enablers for traditional CSPs to move towards a more digitalized infrastructure?**

Enabled by 5G deployments, increased cloud adoption, and higher uptake of AI, Metaverse & Edge, the telecom industry is entering into an era of accelerated change. New waves of technology, new ways of working, and new ways of engaging with customers will drive the next wave of business value creation, bringing about unprecedented change, opportunity, and threat.

Service providers have previously sailed through various transformations and emerged much stronger than ever before. Even today, CSPs that reimagine the customer experience, restructure their business model, and

rethink their technological foundation are more likely to ride the budding next digital wave.

Key enablers that CSPs may immediately align to are:

- AI / ML modelling based customer journey management at each customer interaction point
- Digital touch points & incentives to drive digital interactions
- Data Lakes for mass data aggregation
- Review the need and implement a Customer Data Platform for a 360 Degree customer view in a single consolidated platform.

**New-age technology has enabled industries to revolutionize their business models and solutions? What are some of the challenges that AI and Data Analytics can help CSPs to address?**

AI and analytics will be able to declutter the telco's interaction with the customer, which means the number of communications is dramatically reduced, which will also reduce the load on the telcos internal systems and create bandwidth to do proper service. Telcos with significant investment in AI and ML have also been able to significantly reduce their cost of operations.

The number of telephone subscribers witnessed a decline to 1,170 million in October, as against 1,171.92 million in September, thereby showing a monthly decline rate of 0.12%, according to the Telecom Regulatory Authority of India (TRAI). The importance of customer retentivity has increased by many times as nearly all firms started losing their consumers due various reasons and as empirically known with the fact that customer acquisition is pricier event. AI and analytics is one such technology which can propel the customer experience and help telcos retain their customers.

# Airtel and Esri -Enabling Transparent Network

**B**harti Airtel Limited is a leading global telecommunications company. Headquartered in New Delhi, India, the company ranks amongst the top three mobile service providers globally in terms of subscribers.

Airtel needed expert help to develop a map based solution. As the developer of the world's most powerful mapping and analytics software – ArcGIS – Esri became a preferred choice.

## The Solution

When it came to developing a map-based solution, Airtel needed expert help. As the developer of the world's most powerful mapping and analytics software — ArcGIS — Esri became a preferred choice.

ArcGIS applies The Science of Where to connect everyone, everywhere through a common visual language. It combines mapping and analytics to reveal deeper insight into data. With the help of the innovation solution from Esri, Airtel is able to deliver unique network transparency to its customers in India.

Esri India provided the ArcGIS Server-based platform to Airtel. The entire application was designed, conceived and hosted within 10 days, which typically takes about 3 – 9 months. It became operational in February 2016.

## Impacts of the Deployment

### The solution helped Airtel to:

- Carry out hotspot analysis and network route planning on web.
- Access to various web services in a thin client with Esri content.
- Provide GIS based content & user management system.
- Flexibility to integrate with open source API with a heart of Esri geospatial framework.
- To perform the raster analysis on telecom coverage files like .grd and .grc.

### The most important benefits of this technology have been:

- Easy rollout.
- Quick deployment.
- Easy and flexible enterprise rollout options.
- User friendly rest API's for easy integration.



Headquartered in India, Airtel is a global communications solutions provider with over 500 Mn customers in 17 countries across South Asia and Africa. The company ranks amongst the top three mobile operators globally and its networks cover over two billion people. Airtel is India's largest integrated communications solutions provider and the second largest mobile operator in Africa. Airtel's retail portfolio includes high speed 4G/ 5G mobile broadband, AirtelXstream Fiber that promises speeds up to 1 Gbps with convergence across linear and on-demand entertainment, streaming services spanning music and video, digital payments and financial services. For enterprise customers, Airtel offers a gamut of solutions that includes secure connectivity, cloud and data centre services, cyber security, IoT, Ad Tech and cloud based communication.



Established in 1996, Esri India Technologies Pvt. Ltd. (Esri India) is an end-to-end Geographic Information System (GIS) solutions provider. As a market leader, it has successfully delivered cutting-edge GIS solutions, powered by ArcGIS, to more than 5000 customers for applications in Land management, Utilities, Water, Infrastructure, Disaster Management, Telecommunications, Urban Development, Smart Cities, Forestry, Natural Resources Management and more. For Indian customers, it has engineered a unique product called Indo ArcGIS.

# Introducing Gcore Cloud Infrastructure in Mumbai, India

By Seva Vayner, Director of Edge Cloud stream at Gcore

**G**core's mission is to help you go global faster and make the internet more reliable and secure.

That's why we're excited to announce our new Cloud Point-of-Presence (PoP) in Mumbai, India. This location is now part of our powerful cloud infrastructure with over 20 PoPs and more than 6,500 peering partners, providing our customers with an average latency of 26 ms worldwide. You can deploy and scale projects in just a

few clicks, connect virtual instances, cloud storage, load balancers, and a wide range of cloud services to grow quickly with minimal infrastructure investment.

## **Gcore Cloud Edge. Global. Powerful. Secure.**

The new Point-of-Presence provides customers in India with access to a variety of cloud services and products, including the following:

- **Virtual Instances.** The Point-of-Presence in Mumbai offers

users a choice of production-grade instances designed for a wide range of workloads and predictable performance. Use it to deploy projects faster with ready virtual machine images. Take snapshots to quickly roll virtual machines back to their original state when needed. Easily ensure the availability of your applications during traffic spikes by managing infrastructure load through APIs or using Terraform.



- **Bare Metal servers.** In addition to virtual instances, customers are provided with high-performance, single-tenant physical servers to meet business needs. Get unlimited compute resources and deploy applications and services on high-performance, isolated servers.
- **Cloud Storage.** Object Storage is fast and scalable cloud storage that allows customers to store any amount of data and retrieve it anytime. You can use it to store static data needed to build and run websites and apps, for backups and archiving, for media file distribution, or data analytics.
- **Managed Kubernetes.** Fully managed Kubernetes solution with no additional cost, rapid deployment, and 99.9% uptime SLA. The service continuously monitors the health of your nodes and automatically updates and restarts them as needed. In addition, clusters

can automatically increase or decrease the number of nodes in your pool (a group of instances with the same configuration running in the same cluster). Customers pay only for worker nodes (virtual machines and volumes) and network resources (load balancers and floating IPs).

Gcore Cloud’s global architecture, located on five continents, is based on powerful Intel® Xeon® Scalable processors. It also gives you advanced security options, including DDoS Protection against L3, L4, and L7 attacks, Bot Protection, and Intel SGX technology to secure sensitive data.

We value our customers’ trust and comply with ISO/IEC 27001 requirements to keep your data safe and guarantee that only those who have the right can access it. Gcore’s infrastructure also meets the needs of PCI DSS and provides a sufficiently high level of security to store information on bank accounts.

users, with 658 million users in January 2022, it is essential for businesses and developers to have a powerful and easily scalable infrastructure here. Our new PoP with instantly deployable virtual machines and high-performance bare metal servers helps accelerate your sites and applications without you overpaying for computing resources. Gcore’s capabilities have much to offer for a range of industries, from Gaming and Entertainment to Retail and Healthcare,” commented Seva Vayner, Director of Edge Cloud at Gcore.

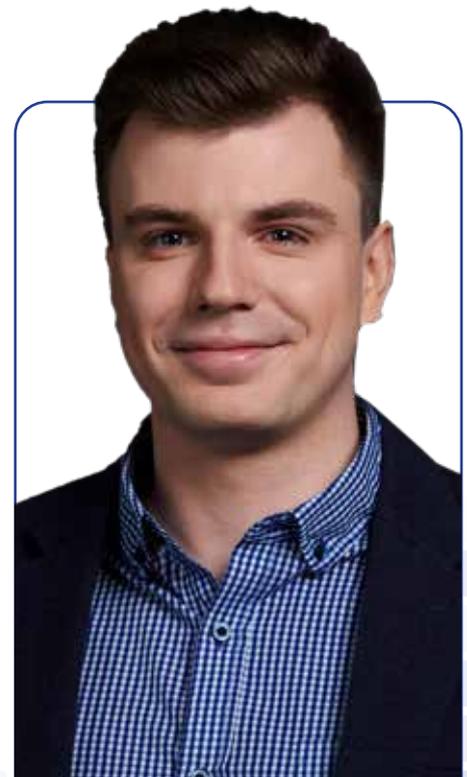
Gcore is focused on making it easier for businesses to deploy and scale their applications, and we are incredibly excited to see what we can build together in India. Learn more about Gcore Cloud Edge and its features.

### Hello Mumbai!

Mumbai, India, is an obvious choice for opening a new Gcore cloud infrastructure Point-of-Presence. According to the IDC Worldwide Semi-annual Public Cloud Services Tracker, India’s public cloud services market revenue, including IaaS, PaaS, and SaaS solutions, was \$2.8 billion in the first half of 2022. Moreover, the Indian public cloud services market is expected to reach \$13.0 billion by 2026.

With the growth of digital innovation, enterprises in India are looking to bring new products and services to market faster through digital streams and increase their investments in technologies. Access state-of-the-art edge computing and secure public cloud technologies to accelerate your company’s growth in this high-demand market.

“Since India is one of the countries with the largest number of Internet



*Seva Vayner is working as the Director of Edge Cloud stream at Gcore. He is responsible for management of Gcore public cloud development, development of new cloud services and applications and promotion of Gcore cloud platforms.*



# “IDEMIA’s 5G SIM card functionalities will ensure higher level subscriber privacy protection”

*IDEMIA is a global enabler in Augmented Identity for international clients from the Financial, Telecom, Identity, Public Security and IoT sectors. With close to 15,000 employees around the world, IDEMIA serves clients in 180 countries. With India fast embracing 5G era – our networks are delivering advanced features such as higher throughput, reduced latency, lower power consumption, in such a scenario - IDEMIA’s 5G SIM card functionalities will ensure higher level subscriber privacy protection in both consumer and IoT segments.*

**Rahul Tandon, SVP, Mobile Operator Business IDEMIA** speaks with **Zia Askari from TelecomDrive.com** about the company’s business strategy and its future plans.



### How are 5G SIM cards going to transform the subscriber ecosystem?

As 5G networks open-up advanced features like higher throughput, reduced latency, lower power consumption and increased coverage, IDEMIA's 5G SIM card functionalities will ensure higher level subscriber privacy protection in both consumer and IoT segments. For consumers, enhanced mobile broadband will offer an improved experience in major public venues or smart homes. Connected vehicles, smart cities, healthcare and the metering of utilities, as well as critical communications used by fire, police and other emergency services, will all benefit from 5G high reliability. With the 5G SIM, mobile operators can ensure and control the end-to-end security and subscriber privacy protection from within this tamper-proof secure element to their core network. IDEMIA has partnered with over 500 Mobile Operators worldwide, and with factories across the globe, we are ready to support the rapid distribution of 5G SIM cards. We also offer a full range of 5G enabling solutions such as OTA Quality of Experience monitoring and security services for the IoT, including for critical and massive communication.

### What is the IDEMIA Connectivity HUB (ICH)?

IDEMIA is working hard with device manufacturers towards the security implementation using an interoperability layer. This will secure the device without a major change in the device hardware. The IDEMIA Connectivity Hub (ICH) is capable to manage smart connectivity with device lifecycle management, by engaging device manufacturers in India, by securing their devices with inbuilt interoperability secure layer. The ICH is the first in India provide a secure platform to connect the device

security helping device manufactures to test interoperability in the IDEMIA Device test lab.

### What is your outlook on the Indian IoT/M2M industry today?

The IoT/M2M industry is highly fragmented with a large number of use cases belonging to critical connected infrastructure, automotive, health energy and other business segments. The need is for vendors

**With the 5G SIM, mobile operators can ensure and control the end-to-end security and subscriber privacy protection**

to come together to create device standardization, secure integration and deployment. Besides overcoming the challenge of fragmented markets, the IoT/M2M technologies must ensure security. There's a need to create robust devices, secure connectivity and networks for various industry verticals by implementing connected solutions, including utilities, connected vehicles, agriculture, healthcare, transportation, and security for businesses and homes. Security challenges are a major concern largely for networks, devices, connectivity and applications. The industry must address these challenges to usher in a truly connected, automated era.

### How are the e-sims which are used in automobiles different from that used in a phone?

The e-sim used in automobiles and phone are different. The Broad level Differentiator between consumer and

automotive M2M SIMs are:

Machine-to-Machine (M2M) SIMs are more robust compared to smartphone SIMs, having higher resistance and temperature range of -40°C and +105°C.

M2M SIMs generally also have a longer life-span (around 10-15 years), higher endurance to ensure harmony with a device's lifecycle.

In M2M SIMs environmental factors such as humidity, vibration-tolerance, acceleration shocks, etc. had become more relevant in their tolerance level needs. For Automotive, M2M SIM quality is further enhanced to comply with standards (such as PPAP, AEC-Q100) and larger data retention span (15-17 years).

From Solution Architecture & design perspectives, also they differ as for consumer eSIM (Phone/ Tablet etc.) the MNO Profiles are pulled, whereas in M2M case, the profiles are pushed through GSMA standardized secure routing architecture.

### What is your outlook for 2023 as India with the 5G rollout happening in India?

As India ushers in 5G connectivity, it opens up many new capabilities to enhance productivity and safety of not only online transactions but Machine2Machine (M2M) transactions as well. The network technologies 5G, 5Gi, 4G and under Low power Wide Area Networks (LPWAN) such as Narrow Band IoT (NB-IoT), LTE-M, Long Range Radio (LoRa), ZigBee and SigFox are creating new business opportunities around these technologies. Indeed, the magical combination of these technologies will change the contours for connectivity, security and analytics. However, we also believe it is time for the industry to define the scope of connected technology with respect to its security for all aspects, such as devices, connectivity, secure deployment and their physical security.

# TSSC - Strengthening the Value Chain of Talent in India



*Telecom Sector Skill Council or TSSC has become a backbone for enabling talented workforce for India's telecoms segment. With its unique focus on skill development, TSSC is enabling talent with the latest technological knowledge in urban as well as rural parts of the country. Catering to the current needs of the industry, TSSC courses cover the latest knowledge necessary for an individual to excel in any segment within the telecom sphere.*

**Arvind Bali, CEO, Telecom Sector Skill Council** interacts with **Zia Askari** from **TelecomDrive.com** about TSSC's focus on enabling talented workforce for the telecom industry.

### **The need for a ready talent workforce is the need of the hour, with 5G network shaping up in India. How is TSSC contributing to this rising demand?**

TSSC has been actively working with various stakeholders of the telecom and skill development ecosystem to ascertain the needs of the country at large. When it comes to telecom, we have aggregated the demand from the industry for effective rollout of key initiatives and technologies like 5G, Smart Cities, PLI, EMC 2.0, ESDM, Bharat Net and PM Wani.

Additionally, we have been working with the Department of Telecommunications in a series of round-table discussions where government is also trying to understand the roadmap for 5G. We plan to setup centres of excellence in a hub and spoke model to cover all major cities of India and create smaller more accessible skill labs for deeper penetration of our courses. Lastly, we have moved our offerings on a digital platform to create an equality of opportunity for youth in both urban and rural markets.

### **What are the different job opportunities shaping up in the telecom sector with the rollout of 5G taking a peek in the coming year?**

Telecom offers many opportunities for budding young technical and non-technical candidates. The sector comprises of four sub-segments namely services, network management, passive infrastructure. Retail jobs are also included in telecom. These refer to the store promoters, sales representatives, and field sales executives. New roles are constantly being created with advancements in technology.

5G creates many new jobs by virtue of new components, communication standards and

network frameworks. Apart from this, other futuristic technologies linked to 5G offer multitudes of use-cases for enterprise, industrial and commercial usage. This includes drones, ML/AI, IoT, M2M communications, cloud computing, blockchain and robotic process automation. The data being generated by these technologies is also leading to the proliferation of data science and big data job roles.

### **What are the key areas where India will witness a rise in demand of skilled workforce with the 5G technology in India.**

Mandates like 5G, PLI, Bharat Net, PMWani will generate the most jobs. Moreover, use cases of 5G like drone technology, ML/AI, data science, M2M communications will also create new verticals and business cases. Currently, the top job positions in telecom include network engineers, machine learning engineer, site maintenance technicians, and data scientist.

Digital assistants have undergone a revolution thanks to deep learning. Network operation and maintenance has the high employed talent. Network operations and maintenance and project engineering has a high proportion of women's talent compared to other job roles. Project engineering holds the highest median base pay, followed by network security and data handling- network managed services among the occupation levels. Project engineering and communication electronics hold the highest pay for frontline workforce talent.

### **With the adoption of new-age technologies in Industries, how do you think the demand-supply gap can be narrowed, as India has a huge potential workforce ready to be trained or employed?**

The most important aspect is to

strengthen the value chain of talent offerings in the country. There is a mismatch in the talent coming out of universities and training centres which leads to many intermediary finishing/bridging courses to make a candidate employable. This can be mitigated through a cohesive collaboration between industry and academia. At the candidate front, providing holistic courses which offer both hard and soft skills training with practical training needs to be ensured.

At Telecom SSC, we have created a model for a network of excellence where there is deep penetration in both urban and rural markets. Our courses cover the latest knowledge necessary for an individual to excel in any segment of telecom. We dovetail out offline courses with online content for maximum knowledge transfer. Our on-job-training is conducted with leading industry bodies to ensure real-world applicability of the relevant skillset.

### **What are the new courses and infrastructure being introduced by TSSC, being a major industry body for skilling in this sector?**

We are working in line with new government and industry objectives. We have launched courses on semiconductors, satellite communications, network surveillance, web development, embedded engineering, in-building solutions and much more. These courses will supplement our recently launched 5G courses. Additionally, we offer courses in drone technology, cybersecurity, data science, among others. The objective is to elevate the base-level of youth in telecom job roles. We need to offer aspirational jobs to ensure maximum participation across all segments of society. Telecom SSC is actively working to create skilled workforce on par with global standards.

# ‘Portable Office’: a Dream Concept to Reality

By Sujitesh Das, Chief Operating Officer, HealthWorksAI

**B**efore Covid, the idea of work-from-home was a fantasy to many. With the onset of the pandemic, multiple businesses were forced to close their office set ups and operate remotely. This definitely accelerated the concept of work-from-home, beyond its discrete existence amongst the tech companies earlier. But a complete work-from-anywhere avatar was something, that almost no firm

had executed on.

However, with Covid having receded and people immunised, it has obviously taken a strong hold, with many enterprises allowing their employees to choose their workspace - whether they want to work in the office, remotely, or in a hybrid work model - while few have opted to let their employees work-from-anywhere permanently.

According to PwC’s India Workforce Hopes and Fears Survey 2022,

about 81 per cent of employees in India believe that their jobs can be done remotely. Almost 73% of the occupiers in India are evaluating hybrid working arrangements going forward, according to the ‘2022 India Office Occupier Survey’ by real estate consulting firm CBRE. Since the epidemic, the number of remote job posts on LinkedIn has also grown by over five times. Better frameworks and policies from the government are coming in place to properly regulate



and make continued work-from-home feasible, while an area where planning and implementation is an absolute necessity is guidance for adapting to prolonged remote online work.

At HealthWorksAI, our organization's mission has been to achieve productivity through engagement from employees regardless of where they operate from. The work-from-anywhere culture has benefited us as well as our employees. Companies no longer need to provide office equipment and physical infrastructure, which reduces the costs of maintenance or services and helps redirecting the operational expenditures to other strategic investments within the organisation.

When an employee works from home, she or he is in their respective comfort zone, that has several encouraging effects on the outcome. There is no need to leave home early with the intention of arriving at the office on time, packing office supplies such as bags, and even dressing up! Also, remote working for employees with physical disabilities or mental health concerns can drastically improve their lives. Not only are their own homes more equipped to help them thrive while working, they're also able to provide themselves with adequate self-care as needed.

Work-from-anywhere culture promotes work-life integration to yield positive results. Our employees communicate with peers and supervisors electronically; holding virtual meetings help protect the environment by reducing automobile emissions and carbon footprints. This benefits the environment and can help position companies as good corporate stewards.

But there are a few drawbacks too of virtual communication- one of the major challenges is the collaboration - the key that builds a team on the foundation of relationship among

the employees and ultimately an organisation. Groups and individuals are impacted by continued remote work that doesn't offer or permit a setting conducive to camaraderie and partnership. In a world where everyone is connected through technology, it is difficult to disconnect both digitally and physically, which poses a serious issue of being overburdened with work and becoming burntout. Doesn't all work and no play make Jack a dull dude and Jill a gloomy gal?

But today's youth is much more aware of their priorities in terms of mental health, work-life balance and social issues, and has a completely different working style than what existed even a decade ago. As a result, it has become critical for organisations like ours to adapt to changing times in order to focus on the employees' needs while maximising productivity. During the pandemic, we too transitioned to an office-less model and then a 'no-office-at-all' version, leveraging the benefits of this growing work-from-home culture. We have always believed in employer-employee trust and mutual respect and hence the transition to work-from-anywhere has been smooth.

We have also come out with multiple democratised ways to ensure continuous interactions and team collaborations. One such unique and interesting concept is of the 'Portable Office', that focuses on employee bonding through weeklong work retreats at different destinations like Goa, Mussoorie, etc, once every quarter! Our employees travel to the retreat location from more than thirty different home locations, could be a village, town or a city, traversing states and districts, to socialize with the organizational herd, ultimately recharging themselves and cherishing the companionship of their colleagues, otherwise visible and heard on digital screens!

These retreats involve working from a co-working resort or a bleisure hotel, aligning with one of our stated company values- 'Work Hard, Play Hard'! A combination of slog and fun, these work retreats provide an avenue for employees to huddle face to face, addressing needs of socialization and carry our company culture forward in the physical format - from all hands meetings, OKRhuddles, peer knowledge sharing sessions to sight-seeing and DJ nights - we have it all. To facilitate and promote the health dimension, we have baked in mindfulness sessions and fitness-driving games. And not to forget, the invitation to our 'Portable Office' is extended to those who have been offered by us and are yet to join!



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# Future-Proof BSS in 5G Era



**B**usiness Support Systems (BSS) software has traditionally been designed as a monolithic package to support a specific service or set of use cases. But as 5G and IoT evolve, the services they enable will be more granular. These dynamic environments will therefore require access to granular support system functionality. Customers may only need part of an overall package, or require a billing or charging function for a very short time, such as an offer of content from an OTT partner designed around a localized, live event like a world cup cricket match.

The vision of Telecom Service Provider, Internet Service Provider, Communication Service Provider

(TSP, ISP, CSP)-as-a-platform is that partners will be able to self-design and order services such as these on a telco platform, with network fulfilment, security, policy, charging, billing, and customer interaction being provided as required.

Only fully automated processes, scaled to demand, could meet this vision economically and practically. Now, microservices-based architecture has come to fulfil such expectations for 5G and IOT services.

BSS is the heart of telecom operations and will be heavily impacted by 5G and IOT-based applications and services. Next-generation BSS and network markets provide capabilities that have become vital requirements

for all types of TSP, ISP, and CSPs, including integrated legacy carriers - fixed, wireless, and cable, internet, Multiple System Operators (MSOs), and Over-the-Top (OTT) providers. Previously, the BSS market was driven largely by a need to consolidate operational support and billing, as well as to prepare next-generation, IP-based networks and services.

To monetize 5G and IoT services, different parties need to interact with each other more tightly. Therefore, TSPs, Mobile Network Operators (MNOs), CSPs, ISPs and Network Service Providers (NSPs), and verticals will have to share spectrum, network, and IT resources to build a cooperative digital ecosystem. Automated and standardized process

flows across these parties will be needed in the control plane, user plane, and management plane as well as in the BSS system.

Additionally, 5G will require BSS support for network slicing, both in terms of administration of slice allocations, including Service Level Agreements (SLAs), and billing for slices and usage. TSPs will also require BSS to support Massive Internet of Things (MIoT) systems enabled by 5G.

IoT billing and settlement will become significant in the near term while, in the longer-term, IoT authentication and authorization will be a key market for the next generation BSS ecosystem.

As 5G matures, service providers will introduce many new services and business models, such as Virtual Reality (VR), new forms of partnership, different apps, and gaming, all of which will require next generation BSS support.

In the future, 5G and IoT will allow us to offer many critical use cases, and will require full BSS infrastructure automation from both the front-end and the back-end. This is essential, given that service providers will be working with several different industry verticals and seamlessly onboarding a high number of partners to monetize their 5G investments.

The BSS system needs to be flexible, agile and must simplify management. It's here that cloud native, microservices, and DevOps-based approaches will play a vital role. A microservices architecture, for example, decomposes a monolithic application as a set of small autonomous services that are independently deployable.

Each microservice executes on its own process and is designed to achieve a single business capability.

Further, the modernization of BSS systems will enable service providers to become Digital Service Providers

(DSPs) that need to respond quickly to meet the evolving needs of their subscribers. From service ordering to orchestration, billing, device management, and customer experience, legacy BSS systems are not geared to meet the needs of a DSP.

### Expectations for a next-gen BSS Solution

The evolution of 5G, IoT, high-speed internet, and a smarter subscriber base have given rise to an increase in demand for next-generation, value-added services, making it crucial for service providers to offer multiple services over multiple networks while staying profitable.

Service providers are facing a critical time in driving their investments in areas that afford them a winning edge over their competitors. Rapidly changing markets and competition have led service providers to focus on two key areas – the monetization of data services and an enhanced customer experience to reduce customer churn.

With next-gen BSS systems, operators can expect the following attributes:

- Service providers are looking for solutions that will allow them to move away from legacy systems and monolithic applications and adopt agile, flexible, cloud-based microservices architecture. BSS systems must become faster, more effective, more reliable, and more resilient, and enable them to rapidly introduce new and innovative offerings
- Simple processes to add increasingly more partners
- Support for operation staff to customize their own dashboards as per their own requirements
- Dynamic framework support in product lifecycle management, payment, product catalog, other

modules, and for customization and plug-in support

### Enhanced Customer Experience: for increased transparency

- Service providers need a next-gen engagement platform that addresses the needs of both retail and enterprise customers, from discovery, acquisition and onboarding, to gaining actionable insights, and self-care
- The ability to provide a consistent user experience across multiple channels for customer engagement such as call centers, web portals, PoS, mobile apps, and SMS

Platform Modification: 5G and IoT services allow service providers to offer different use cases, and this demands that the BSS infrastructure is automated from both the front-end and back-end. This is essential considering service providers will be working with several different industry verticals and seamlessly onboarding a higher number of partners to monetize their 5G investments.

The BSS system needs to be both flexible and agile.

### Challenges in Transforming BSS

Service providers face several challenges in customer engagement at different levels. Customers expect service providers to keep pace with the digital experience provided by web-scale/OTT players, for instance.

The problem is that legacy BSS is not designed for digital experiences. Service providers can ensure an uninterrupted and positive customer experience only by being able to innovate quickly, add new services and features, and seamlessly integrate these with their existing range of offers. The modernization of BSS systems is also imperative in service providers' own journey to becoming DSPs that need to react quickly to meet the evolving needs of

their subscribers.

From service ordering to orchestration, billing, device management, and customer experience, legacy BSS systems are not geared to meet the needs of a DSP. To achieve this, service providers must digitize their existing BSS systems.

Applying a microservices and webscale-enabled approach to operation and business support systems, and combining this with DevOps practices, is the best way to achieve BSS transformation.

One of the biggest shortcomings of existing telecom mainframes is their rigidity. Telecom software development is painstakingly slow, as vendors have to ensure their systems' integration and interoperability with all components available on the market — or with a significant portion of them, at the very least. For this reason, service providers are used to overhauling

their BSS systems every couple of years or so when newer equipment becomes available — and this can be costly.

Legacy systems consist of multiple hardware and software components that cannot be easily reconfigured. Any update, upgrade, or adjustment entails significant expense and leads to a high Total Cost of Ownership (TCO). What's more, scaling legacy systems is complicated, as adding more capacity does not remove bottlenecks that are structural, not operational.

Service providers should consider transitioning to microservice and cloud-native BSS through virtualization. They can now replace hardcoded network functions delivered through a piece of equipment with Virtualized Network Functions (VNFs), enabled via a virtual environment. The result of this is that scaling the system up and down or reconfiguring it entails

no significant capital expenditure and the system itself has minimal operating expenses, leading to a substantially reduced TCO.

Microservices for telco BSS are the next step, as they allow you to split any application or function into a bundle of independent functions running in separate Docker containers. The key benefit of running various BSS components in telecom domains and networks as microservices is that you can launch, stop, and restart them independently.

This means you can manage, update, and scale each virtual network function seamlessly, without stopping the whole system. Docker containers run atop a Kubernetes cluster, while Prometheus and Grafana solutions, available from the Cloud Native Computing Foundation, can help you monitor such clusters.

Microservices can interact with each other and any number of external tools using RESTful APIs.



This allows you to quickly add them to an existing system without the need for major investments and reorganization.

You can monitor complex microservice systems with the help of message brokers like Kafka or RabbitMQ, which help you track the performance of BSS in real time and ensure the transparency of logging.

Importantly, as microservices run in separate containers, a security breach in one container doesn't affect the entire system. This reduces security risks, which are always a concern when handling complex software and hardware platforms with a multitude of customer-facing endpoints.

Microservices-based architecture offers increased agility, which makes for easy adoption of DevOps culture. The final step before the complete development of microservices is to set up a Continuous

Integration and Continuous Deployment (CI/CD) pipeline, which enables easy auto-scaling, the seamless upgrade of various microservice versions, and the dynamic deployment of individual services without impacting any existing service component.

The final, important factor is that multiple vendors already use microservices and DevOps in developing IoT products, big data analytics, machine learning solutions, and AR/VR platforms. Using microservices for back-office modernization ensures interoperability, and easier integration of new functions, and significantly reduces potential expenses. That is why a microservices-based approach to OSS/BSS is now being seen as the preferred foundation for next generation OSS/BSS for digital and 5G services.

New verticals will need to be charged differently than in the traditional subscriber-based consumption models of previous

releases. For example, in IoT type scenarios, the value may be based on the number of connected devices, the location from where the devices connect to the network, or even the mobility profile associated with a particular device.

The rapidly expanding IoT and the new capabilities available in 5G have opened up a wealth of opportunities for service providers beyond their traditional markets, particularly in verticals such as automotive, healthcare, agriculture, energy, and manufacturing.

**Service providers should consider transitioning to microservice and cloud-native BSS through virtualization**

To monetize these, service providers will need to meet the expectations of a broader range of stakeholders and be able to handle complex ecosystems.

Service providers are focusing on establishing creative new partnerships which enable IoT and other new services. As a result, one of the primary roles of BSS will also be to manage these business relationships by keeping track of agreements, handling orders, generating reports, sending invoices, managing debt handling, and so on.

Network slicing is widely considered to be an important enabler for monetizing 5G, as it allows service providers to deliver unique and efficient service customization and flexible, on-demand service catalogs.

Enterprise customers will self-manage network allocation and capabilities through policies, dashboards, or other BSS services, while the carrier will manage the overall experience across the network.

5G-enabled remote healthcare services like remote patient monitoring, connected ambulances, HD virtual consultations, video-enabled prescription management, and medicine delivery will consume a large amount of data. These use cases can't be implemented without 5G technology as it offers capabilities like lower latency, high bandwidth, increased reliability and security, network slicing, and an increased capacity for the number of connected devices.

To support this, applying containerization and microservices will assure the scalability of the BSS solution to meet the increased throughput demands of the network.

### Final Thoughts

The evolution of the 5G network and IoT presents service providers with the opportunity to transform themselves from traditional network developers to digital service enablers. 5G, evolved BSS enhancements, and new capabilities provide the opportunity for operators to develop new business models and services for 5G and IoT. Along the way, this journey opens up substantial new revenue streams in verticals such as industrial automation, security, health care, and automotive.

In summary, service providers are required to enhance existing BSS with cloud native and microservices-based architecture, along with an IT-based, 5G core network.

This transformation will not only help operators achieve agility, flexibility, and scalability, but also derive granular insights, which can be leveraged to deliver a superior customer experience and enable new business streams.

# Connected Cars Enabling Smart Transportation



**A**s a significant component of modern economy, transportation accounts for 6-12% of the gross domestic product (GDP) in many developed countries. Although transportation has greatly improved our lives, quite a few costly problems remain unsolved, including traffic accident, congestion and vehicle emission.

Smart transportation has recently become a hot topic in the Internet of Things (IoT) area, and is considered as the solution to the problems mentioned above.

Based on the market size and the demands for mobile network, we have identified four major opportunities for Mobile Network Operators (MNOs), including telematics service with

Usage Based Insurance (UBI) and Fleet Management, smart parking service based on the Narrow-Band IoT (NB-IoT) network technology, Emergency Service Network (ESN) based on Long Term Evolution (LTE) network and enhanced Advanced Driver Assistance Systems (ADAS) based on LTE-V or 5G network.

For MNOs, the three categories of connected car service – infotainment, telematics and data-enhanced automated function – all have their business opportunities in the market.

• In the area of infotainment, along with the rise of sharing economy, more and more people choose to travel without driving by themselves. This has posed opportunities for the in-car entertainment business.

MNOs could provide business-to-

business (B2B) data plans to service providers, like Uber or Didi, to help them provide differentiated services.

• Telematics is still an area that needs to be explored by MNOs. With more favorable policies and regulations, a higher awareness of road safety and the growing number of vehicles, there are many opportunities in the aftermarket. When compared with original equipment manufacturers (OEMs), MNOs have their own advantages, including wider customer base (generally speaking, the concentration of telecom industry is higher than that of automotive industry), mature sales channels, well-developed call centers, higher awareness of data security and privacy, and better service continuity across automotive brands. For MNOs,

to quickly enter into the telematics market, they could enhance their capabilities through acquisitions or partnerships with telematics service providers (TSPs). In the long term, telematics service will focus on the new car market. With the capabilities built up in the aftermarket, MNOs could cooperate with OEMs and play a greater role in the new car market.

In the area of vehicle-to-everything (V2X) and autonomous driving, MNOs shall actively participate in the development of technical standards and the building of network, to ensure the realization of V2X and autonomous driving. As the business case remains unclear, leading MNOs need to act more proactively to lobby government for legislation supports and standard selection, convince OEMs to establish partnerships, and cooperate with different service and solution providers for total solution options.

Smart parking market will continue to grow in the next few years. Different countries are in different development stages of smart parking service, with various market demands. In general, this is still a fragmented market. Smart parking is usually

Smart Transportation is regarded as a part of smart city, and MNOs could become the end-to-end service providers in the smart parking market through partnering with government authorities. NB-IoT based smart parking solution features smaller investment and wider applicable areas, thus could ensure the realization of smart parking functions. In addition, the upgrade of network infrastructure will bring about benefits for the overall smart city program, which could be leveraged to obtain parking resources.

Governments have realized the key role efficient Emergency Service Network (ESN) could play in case of emergency to save life and reduce economic loss.

Compared to separate dedicated

networks, ESN that is based on MNOs' LTE network could save a great deal of cost for governments. MNOs in countries with no ESN shall lobby their governments to be aware of the importance of ESN, and MNOs in countries with ESN shall provide service with higher quality and lower cost, so as to win over more business opportunities. Especially in countries with limited spectrum resources, MNOs shall exchange network resources with the government for more benefits.

All in all, MNOs have unique advantages, in terms of policies and regulations, customer base and technology, to facilitate the development of smart transportation. Beyond keeping upgrading network and providing quality network services, MNOs shall consider playing an all new role in smart transportation in the coming years.

The development of transportation is considered as the most significant driver for social progress. It allows people to interact and enables delivery of goods and services around the world.

While such development has greatly improved our lives, there are quite a few costly problems remaining unsolved: vehicle emission has been one of the major causes of global warming; traffic congestions has caused incredible amount of logistic fee for enterprises and huge time consumption for daily commuters.

Along with technology development, "smart things" have permeated people's daily lives, such as cloud computing, big data, evolution of wireless network, Machine to Machine (M2M) and IOT. Government authorities and thousands of business enterprises have conducted numerous studies from multiple perspectives and they believe that the development of information and communications technology (ICT) will greatly benefit economics and residents' life qualities.

Considering the significant influence of transportation on the whole economy and people's daily lives, we focus on smart transportation in this paper, which draws wide attention from various vertical markets, such as automobile, insurance, logistics and smart parking.

### All About Connected Cars

Connected cars are defined in various ways by different professionals, businesses and end users. Without an official definition, one concept is certain: connection to the Internet is no longer its definition. Having internet access has gradually become a basic function of modern cars. Thus, without a standard definition for connected cars, we chose to categorize the connected car services into four different stages, and each stage involves technology improvements, business case developments and social/government acceptances.

### Connect to the Internet – Focus on driving entertainments

With modern technology and high demand for internet access, drivers and passengers' habits have changed dramatically since the invention of smartphones. Today, the demand for in-car infotainment access has become a must for attracting end users. DVD players, touch-screen media modules and real-time navigation system have become the standard equipment on all cars. In addition to those hardware, as 4G network matures, many in-car infotainment facilities are designed to operate via WiFi hotspots on the end users' demands.

### Connect to remote service – Focus on remote services

Through embedded or plug-in modules, vehicles are enabled with add-on services by real time data collections such as vehicle status, driving behavior and vehicle locations

to achieve safer conditions for the vehicles, the drivers and the passengers. Vehicles are connected to remote service providers through a network.

Such features include e-call, remote vehicle control functions or real-time vehicle locator, vehicle status or to provide additional support to the driving experience, such as real-time navigation and vehicle maintenance alert. The existing business cases include telematics services provided from car makers for new vehicles' market and also some MNOs' products for the aftermarket as add-on service selection.

### Connect to immediate surroundings – Focus on driving safety

The vehicles are designed to be connected via different methods to achieve safer driving. With hardware and software supports, connected cars are well equipped to achieve collision prevention by communicating with its immediate surroundings, such as roadside infrastructure, other vehicles and pedestrians – the so called V2I, V2V and V2P. In this stage, technologies including collision avoidance system and advanced driving assistance are used to prevent accidents.

### Fully connected – Focus on full connectivity and ultimately autonomous vehicles

In this final stage, vehicles are designed to be able to communicate with extended surroundings and other vehicles to avoid collision and traffics. Through highspeed network and cloud services, each vehicle on the road will be able to communicate with other parties that are sharing the area. With the functions of V2X and driving assistance hardware, the ideal is to achieve safer and more economical society. With the help of connected car technology, drivers could be freed from the wheels.

### Connected Cars - Opportunity for MNOs

Safer and more enjoyable driving experience are the two main drivers of connected cars market development. The existing services in the connected cars market could be categorized into three focuses – infotainment, telematics and data-enhanced automated functions.

According to Telefonica's survey conducted in Spain, Brazil, US, UK and Germany, which attracted more than 5,000 participants, safety and telematics related services are topics mostly mentioned. Although consumers are more likely to pay for safety (V2X, Telematics) than just infotainment, infotainment is a "nice to have" function without paying extra fee for passengers, which means data plan for infotainment could be sold in B2B market.

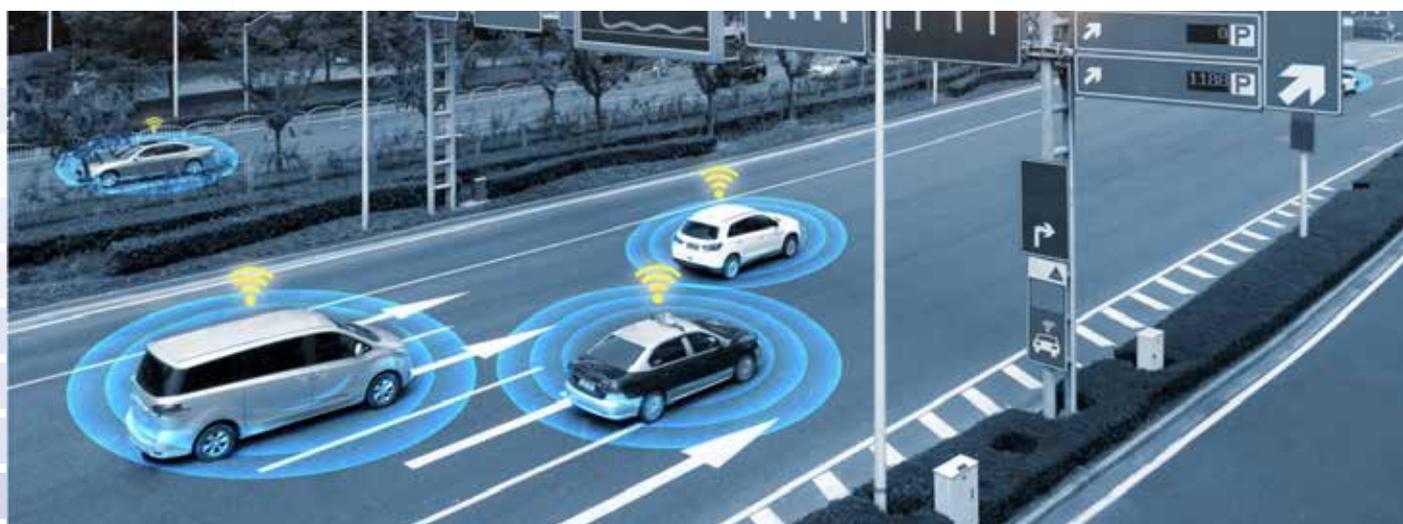
### Driving Infotainment

In this dimension, MNOs take the leading role in the value chain of selling data plans to end users. With embedded vehicle hardware, plug-in devices or smartphones, end users enjoy the connection of Internet in their vehicles as an extension of mobility. With development of sharing economy, the mindset of car ownership is changing.

Sharing ride is a rapidly developing vertical market, more and more people are getting used to the more economical and flexible urban mobility option. It is said that a third of urban mobility will be sharing ride in the future. It will also change the demand of in-car entertainment, as more people do not need to drive by themselves. In-car WiFi could be a competitive advantage for some sharing ride companies, such as Uber or Didi.

### Delivering Telematics

Telematics is the most popular star that attracts all the attention from OEMs, MNOs, TSPs, device manufacturers, solution providers and other content providers, especially on the consumer market. The end users get features such as emergency connections, road-side assistances, real-time navigation, UBI, remote diagnostics. It is well accepted by both new vehicles market and after-market.



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