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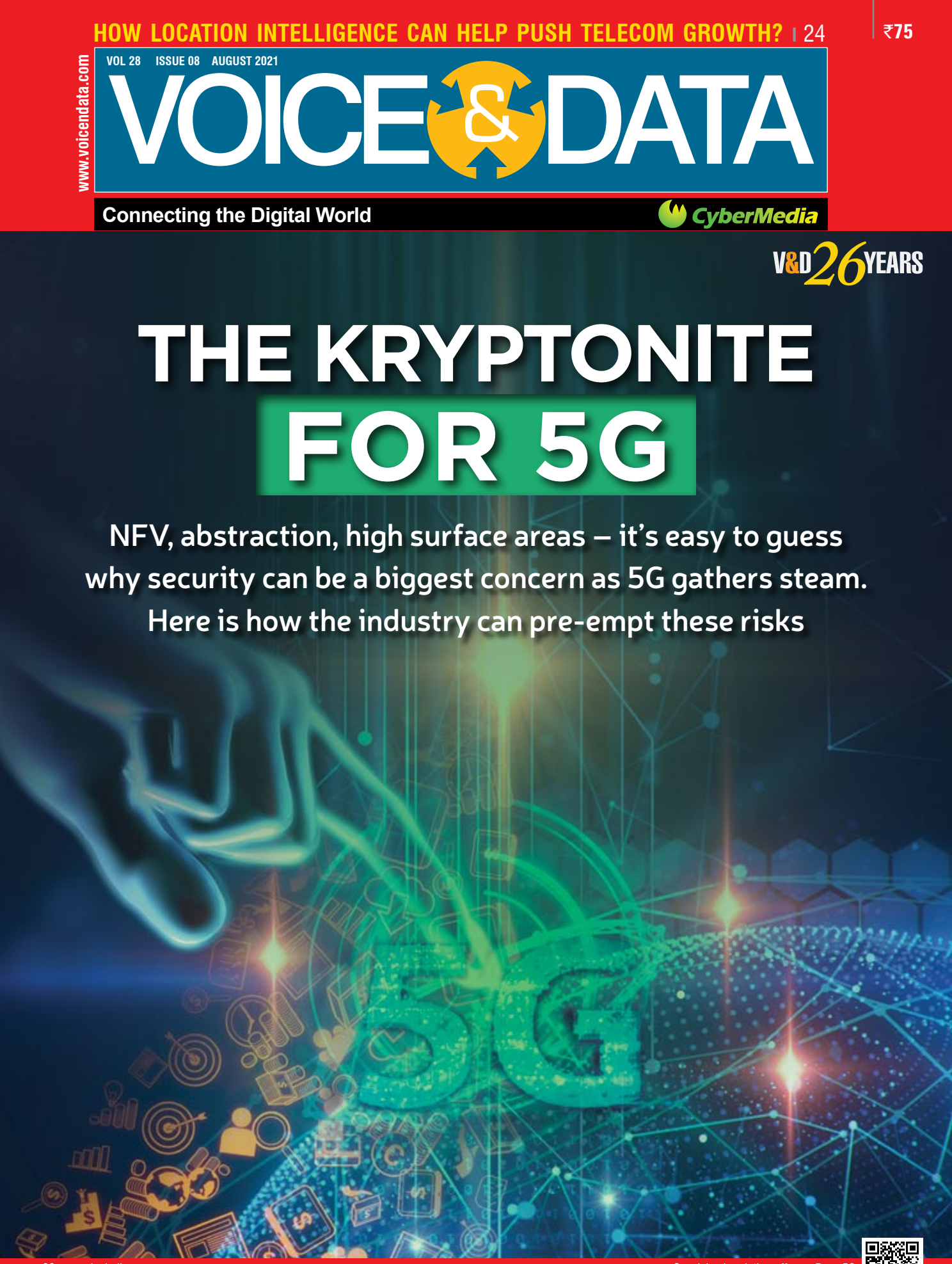

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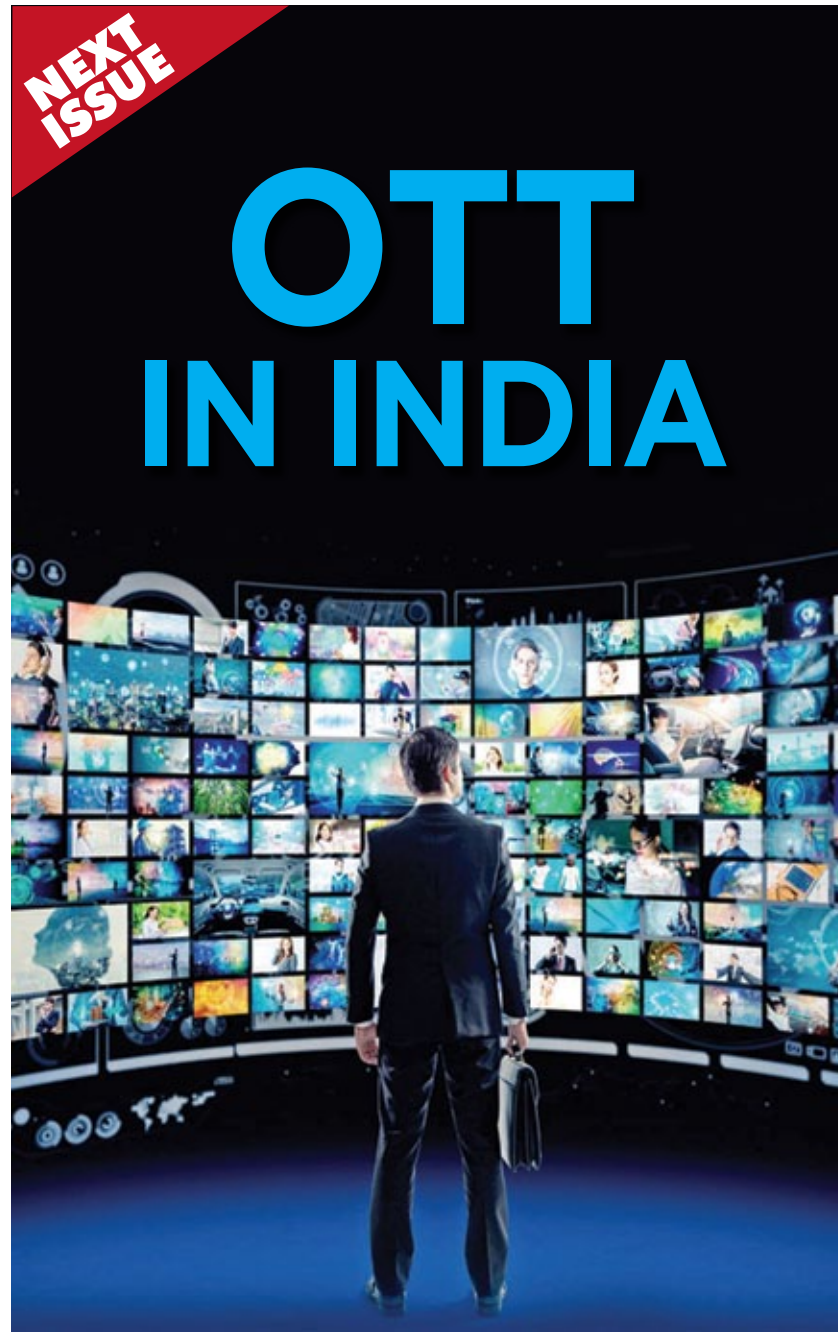

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[OPENING NOTE]

Don't ignore telecom: It's at the heart of post-pandemic life

Have you ever wondered how many of the 195 countries do not have mobile phones? I tried to search the answer but could not get an authentic number. However, we certainly know that by the end of 2020, over 5.2 billion people – 67 % of the global population – subscribed to mobile services. We also know that mobile technologies and services generated USD4.4 trillion of economic value added globally during the CY 2020. The GSMA report, 'The Mobile Economy 2021', estimates this economic impact to grow by USD480 billion and touch USD5 trillion by 2025, particularly with the launch of 5G that is expected to drive improvements in productivity and efficiency.

India has also witnessed a massive uptake in the use of digital technologies since April 2020, after the pandemic outbreak. Health and human services (HHS) organizations reported the highest adoptions of digital technologies, according to a research report, 'Embracing Digital: Is Covid-19 the catalyst for lasting change?', based on a survey by EY and Imperial College London's Institute for Global Health Innovation in Australia, India, Italy, UAE, the UK, and US.

In this survey, 51% Indian respondents indicated an increase in the use of digital technologies and data solutions, while 74% believed the adoption led to an increase in staff productivity. Nearly three-fourth of the Indian respondents reported positive experiences with digitalization, leading to better collaboration and efficiency in the operating model. Educational institutions, government and private organizations, ecommerce, entertainment and others too have gone digital like never before.

We know that a major portion of broadband subscribers in India are wireless – 757.53 million – as compared to 22.74 wireline one, according to the TRAI's May-end data. The top five service providers constituted 98.80% market share of the total broadband subscribers: Reliance Jio Infocomm (434.23 million), Bharti Airtel (192.73 million), Vodafone Idea (119.64 million), BSNL (22.47 million), and Atria Convergence (1.87 million). This clearly show the critical role that the telecom service providers have to play in enabling Digital India and the government's vision of making India a USD5 trillion economy by 2024-25.

Against this background, the recent crisis in the telecom sector triggered by the Supreme Court decision to disallow any re-calculations on AGR dues of telcos to the government is not just a setback for Vodafone Idea, it can impact the overall telecom sector growth and economy with a duopoly looming large. It will also impact the 5G rollout in India – the silver bullet that is expected to steer the country's dream of becoming a global economic powerhouse.

While a stitch in time could have saved a lot of uncertainty – for the government certainly knew what was coming and how hard it will hit, it needs to act fast to help the company survive and ensure India does not falter at the first step of the new-generation tech rollout.

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THE KRYPTONITE FOR 5G

IDC projects the number of 5G connections will go up to 1 billion and 5G will represent 8.9% of all mobile transactions by 2023. Each of these devices is a potential entry point – and securing them will require a Zero Trust mind-set

NFV, abstraction, high surface areas – it's easy to guess why security can be a biggest concern as 5G gathers steam. Here is how the industry can pre-empt these risks

BY PRATIMA HARIGUNANI

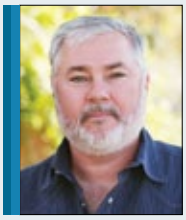
5G is big. It is arriving and will attract huge investments too. But there is a concern. Despite the massive application versatility, payback, disruption and low-latency impact it promises – or perhaps because of that – 5G could find security as its Achilles' heel. Is this heel big and vulnerable enough to stop 5G from running fast? And can 5G open new back-doors on security-related fears?

Weak-spots: Why and where?

The very fact that 5G is exciting and raw makes it on the hot list of attackers and adversaries. And that's a pattern that has proven itself for everything that is new on the maturity curve because that's not just industry-readiness but also standards and collaboration are half-baked.

Steve McGregory, Senior Director of Cyber Security R&D Keysight Technologies points out that historically, new technology comes with unknowns and potential security weaknesses. "It takes time to mature the technology, get enough eyes on it, and vet out the issues. Looking specifically at 5G, the industry is adopting a much more open model that has positives and negatives. So, we will see a lot of open source options and this is great from a cost perspective. On the other side, this will provide access to the internal 5G systems that were not available in prior proprietary models. This exposure offers opportunities for cyber criminals to research and find 0-days that can be used to exploit 5G networks."

While the technology holds immense potential to benefit organizations and users, aspects like safety and privacy, especially for the emerging internet of things (IoT) ecosystem, pose the greatest risk to 5G, explains Venkat Krishnapur, Vice President of Engineering and Managing Director, McAfee Enterprise India. "It can possibly increase the likelihood of denial-of-service (DoS), distributed denial-of-service (DDoS), or even attacks due to the sheer number of connected devices."



"We will see a lot of open source options and this is great from a cost perspective. However, this will provide access to the internal 5G systems that were not available in prior proprietary models."

Steve McGregory, Senior Director, Cyber Security R&D, Keysight Technologies

But about 3% of enterprises overall don't see addressing security concerns as their responsibility. As per the GSMA Intelligence Enterprise in Focus Survey 2020, many enterprises, especially smaller ones, tend to fall victim to basic attacks. This is mainly due to lack of baseline protection and a minimum level of digital hygiene. About 37% of those that haven't amended security practices expect IoT solutions to already be secure. Also, 44% of operators have seen increased growth in demand for security services from their enterprise clients – this is because of COVID-19.

As many as 45% operators consider it extremely important to invest in security to help achieve a long-term enterprise revenue goal. Operators also see not having enough knowledge or tools to discover and solve upcoming security vulnerabilities as a top challenge; as experienced by 48% of surveyed operators. There were also strong hints of a limited 39% pool of security experts that the industry has.

Krishnapur breaks down the security problem in a granular way. "Today, telecom companies are dealing with two specific types of attacks – one that looks to gain access to their organization, network operations and data, and the other that indirectly targets the company's subscribers. While the first could lead to loss of valuable company information, impact finances and reputation, the latter could lead to a loss of customer trust. Through a successful advanced hacking attempt, bad actors can potentially gain access to a telcos customer database, and then be able to indirectly exploit customers' mobile devices.

The big IoT playground

Network pervasiveness and an expanded surface area due to IoT are also the prime reasons that make 5G vulnerable on security. As Prakash Bell, Head of Customer Success, Regional SE Lead, Check Point Software Technologies, India and SAARC explains, the transition to 5G technology is much anticipated by organizations and consumers alike. This new technology will immensely expand capabilities in delivering new business solutions, data-heavy applications, and ubiquitous high-speed connectivity. However, as with any data connectivity that enables a farther reach with more end-points connected, it does bring a set of challenges.

He puts the spotlight on network ubiquity here. "As 5G makes mobile networks more powerful, employees and business devices may start to use them for newer applications, which were limited by bandwidth capabilities of current technologies. This emphasizes the need for taking security services to the edge; with more smarter and disparate devices connecting to business, utility services etc. This would put SASE (Secure Access Service Edge) at the core of securely connecting, managing whilst delivering applications in a seamless manner."

"It can possibly increase the likelihood of denial-of-service (DoS), distributed denial-of-service (DDoS), or even attacks due to the sheer number of connected devices."

Venkat Krishnapur, Vice President, Engineering & Managing Director, McAfee Enterprise India

"Full network visibility combined with ML and AI for detecting abnormal behaviour and hence taking action in real time will become standard operating procedure."

Gaurav Agarwal, Senior Director – Enterprise Sales, VMware India

As for IoT, he cautions that historically, IoT devices have had poor security, creating potential gaps in an organization's security, while expanding its attack surface.

5G private networks have a bigger attack surface as they focus more on IoT, connecting more devices, echoes the GSMA Intelligence survey as well. What has been pointed as a disturbing finding here is that some enterprises still don't regard data from IoT devices as important. 5G SA has been explained here as more secure than any previous network generation. But the problem begins when the attack surface expands and convergence of IT/OT and IoT continues which is where any security breach has a company-wide impact.

The security side of 5G is a big cause of concern. Yong Zhou, Security Solutions Architect, Keysight Technologies tells this is so because 5G provides critical enterprise and national infrastructure and enables mission-critical applications like industrial IoTs (IIoTs), connected automotive, and robotic medicines. Add to that the fact that the 5G network architecture is more open, disaggregated and virtualized, plus the support to user equipments (UEs), greatly expands its attack surface for cyber threats comparing to previous generations of monolithic networks.

5G will bring with it many benefits, but the newfound connectivity between devices will exponentially increase the surface of vulnerability, making it simpler for cybercriminals to infect devices, stay hidden, and cause widespread damage. For cybercriminals, an increased attack surface can only mean increased opportunities to exploit for their nefarious gains, Krishnapur reasons.

"Earlier this year, McAfee Enterprise researchers discovered a cyber espionage campaign targeting telecommunications companies linked to 5G technology. The campaign, 'Operation Diànxùn', used branded phishing domains to lure telecoms workers into downloading malware to their work computers, with strong focus on German, Vietnamese, and Indian telecom companies," he informs.

And it's not just IoT that we need to be worried about.

Abstraction – The big plus, the big fear

A major novelty about 5G is that its network infrastructure design hinges a lot on disaggregation of network functions from the underlying infrastructure. It works a lot through Software Defined Networking (SDN), Network Function Virtualisation (NFV), and cloud-native architecture. So when we think of 5G, we are also thinking of 5G-specific aspects like Multi Edge Cloud (MEC), Non-Public Network (NPN), virtualization and software-ization that could definitely affect security in a big way.

Bell avers. "Yes, Carriers today have largely adopted NFV bringing in VFN into multiple areas of their network. Moreover, the voice services are delivered over IP data networks allowing rapid scalability, switching performance and quality. With more and more software-defined capabilities in their networks, securing the 5G infrastructure in itself is very important."

"The open source, virtualization, and anyone can deploy 5G-aspect, will have a greater attack surface and potential for broader impact on vulnerabilities since all the deployments must be managed and patched. We see delay in patch management throughout the industry and this will likely convey to 5G," wars McGregory as well.

As to Software-ization and virtualization, they are expected to have a considerable impact on forthcoming 5G deployments as they guarantee to accelerate innovation of network architectures. Software-defined architectures become important in a high-speed, low-latency ecosystem such as 5G where network and bandwidth optimizations, for example, need reduced hardware dependences. However, when software-

"One of the best, innovative approaches is to use 'nano' footprint plugins that can work on any device or operating system across various environments."

Prakash Bell, Head, Customer Success, Regional SE Lead, Check Point Software Technologies, India & SAARC

based components are offered by different vendors, the potential of security holes due to integration complexity also intensifies, adds Krishnapur.

In the GSMA Survey report, it has been explained that the 5G network core will be based on SDN and NFV which make heavy use of the HTTP and REST API protocols. "These protocols are well known and widely used on the internet and are thus hackable," reminds the report. As many as 41% of operators highlight vulnerabilities related to network virtualization.

Gaurav Agarwal, Senior Director – Enterprise Sales, VMware India explains the aspect of virtualization and software-ization here, and whether it affects or aids security in a big way. "A software-defined network delivers visibility into the entire network, providing a holistic view of security threats. Operators can create separate zones for devices that require different levels of security, or immediately quarantine compromised devices so that they cannot infect the rest of the network and SDN supports moving workloads around networks quickly. For instance, dividing a virtual network into sections, using a technique called NFV allows telecommunications providers to move customer services to less expensive servers or even to the customer's own servers."

Now the disaggregation of Core and RAN makes security a very important consideration as the attack surface increases dramatically and all players in the supply chain will not have consistent secure frameworks. "Full network visibility combined with machine learning (ML) and artificial intelligence (AI) for detecting abnormal behaviour and hence taking action in real time will become standard operating procedure. Perimeter Security will have to be complimented with East to West traffic visibility and security to prevent lateral movements."

As Krishnapur dissects it, compared to traditional telecom networks, MEC has undergone significant changes in network architecture and operational models, which have spawned new security threats and challenges. "MEC often contains data assets of operators and industrial customers, making it necessary to manage each party from the aspects of authentication, authorization, and monitoring to secure MEC nodes."

Then there is the aspect of a NPN. Typically, a NPN is intended for the sole use of a private organization, providing coverage and private network services to devices that are within the organization's defined premises, explains Krishnapur. "An NPN can be secluded from external networks and stay behind corporate firewalls. However, the standardization work on the use of NPNs in 5G systems is still in its infancy. The increased adoption of 5G will require NPN to combine the security and configurability benefits of a private network with the significant advantages of 5G."

What makes 5G risky?

- IoT exposure
- Network sprawl
- Virtualized assets
- Multi Edge Cloud (MEC)
- Non-Public Network (NPN)
- Legacy spillover

> Historically, internet of things (IoT) devices have had poor security, creating potential gaps in an organization's security, while expanding its attack surface.

Plus, there is the legacy baggage again. Just a minority of 5G private networks will be greenfield; and most will have to integrate and interoperate with existing (legacy) technologies. The GSMA Survey report tells that merely a quarter of surveyed operators see it as a challenge.

Filling the gaps – In time

Security cannot be an option – especially when we expect 5G to touch a lot of citizen applications and state infrastructure as well. All this has prompted many governments to look at security aspect of telecom operators, drawing up guidelines for telcos to adhere to, as these networks form part of any nation's mission critical infrastructure. Bell suggests that security is fundamental and is to be embedded in the architecture, design and operations of such infrastructures; and cannot be an afterthought.

What it takes to secure 5G network

M5G private networks have a larger potential attack surface because of IoT exposure, physical mobility of devices and the interplay between enterprises, mobile operators, manufacturers, IT/OT vendors and suppliers.

Operators will need to offer logical isolation mechanisms and physical radio layer protections (jamming protection). To fulfil the requirements for a single trust domain, additional end-to-end encryption and integrity protection mechanisms need to be in place.

With 5G, enterprises and providers can be jointly responsible for security. End-to-end security requires vendor collaboration, but enterprise customers have a role to play too. They have work to do in ensuring their data is protected as they are in charge of their own devices and the data generated by them, regardless of where it is stored.

Zero trust architecture alleviates both the risk of an external attacker getting into the network and the risk of lateral movement in the event of a security breach. 5G specifications are aligned with zero trust creeds.

Machine learning models capable of detecting unknown threats will grow in importance. Security by design, which includes automation and is able to dynamically apply security policies, will be able to keep up with the speed of 5G networks.

Source: GSMA Intelligence Enterprise in Focus Survey 2020

> The connectivity between devices will increase the surface of vulnerability, making it simpler for cybercriminals to infect, stay hidden, and cause widespread damage.

Forrester's report – 'The CIO's Guide To 5G In The Public Sector' tells how only 34% of public sector decision makers recognise the technology's ROI (compared to 42% across all industries) and 32% remain unconvinced of its ability to increase operational efficiency. It suggests that we should be making security and privacy imperatives to protect citizens and government data. "To build trust, data protection technology must be integral to any 5G solutions in the public sector."

A lot of measures can be taken. We can lock the stable doors well in time before the horses stroll out. For instance, there is a need to take care of the IoT surface-area. Suggests Bell, "Given this huge volume and variety of products, many of which will have extremely limited or zero security capabilities, organizations would need an easy way to deploy and manage security on any type of device. One of the best, innovative approaches is to use 'nano' footprint plugins that can work on any device or operating system across various environments. These 'nano' software agents control every attribute that goes to, and from, the device on the 5G network and connects to the consolidated security architecture to enforce protection."

Agarwal illustrates how, for the rollout of new services, Airtel felt limited due to its existing legacy networking and security architecture. "Despite the size and the scale of its operations, Airtel found it challenging to adapt to the changing preferences of its consumers. Hence, Airtel decided to transform its traditional security operations to a software-defined network security model. Previously, their legacy physical firewalls added layers of complexity during mission-critical troubleshooting. The lack of automation and inconsistency in configuration also limited policy information. Deploying NSX SDFW turned this around by optimizing their firewall policies by reducing their firewall rule count by over 30%."

As Zhou weighs in, there are two side of the security concern – one is supplier related and the other is related to service provider. "Because of the 5G network architecture, securing the supply chain of the 5G network elements is the foundation of a secured 5G." Also securing its networks, communications, and operations is the key of a secured 5G network, which includes (but is not limited to) zero-trust architecture, network security controls at the perimeter and internal zone/segment, end-to-end encryption and continuous security assessments and monitoring.

Zhou stresses on the 'Security by Design' principle and advises that MEC/virtualization requires trusted computing at the infrastructure and host layer, authentication at the MEC application layer and encryption at the transport layer, while service APIs should be another security emphasis. "Third party/open-source software (applications) bring in additional risks to the end-to-end security, therefore we need to follow the above-mentioned guidance of supplier security."

Bell also recommends use of automation and strong security posture management solutions that would simplify governance and enforcement of compliance easier. Krishnapur points out that there is a need to develop governance, ensure compliance, strengthen design, to deploy and operate secure network infrastructure and services. "To ensure this, users, devices, software, networks, and back-end infrastructures all play an important role in improving the security of 5G devices."

In response to the dynamic nature of threats, CSOs and CTOs will need to invest in security solutions that are agile enough to evolve alongside threats, he adds. "Practices like employee awareness and training, policies, and tools to reduce insider risk, protection of intellectual property will need to be updated. Training should be provided and good practices rewarded."

Thankfully, according to the GSMA Intelligence survey, over 45% of operators have considered it extremely important to invest in security to help them achieve a long-term enterprise revenue goal in 2021. And certainly, the realisation and awareness matters.

There is no doubt that 5G will have its chinks. But the Achilles heel can still be in the left foot if the industry puts the right foot forward and uses it smartly, wisely and with a mind-set that does not forget or side-step security but prioritises it. Tip-toeing may help too. Until we feel sure-footed enough.

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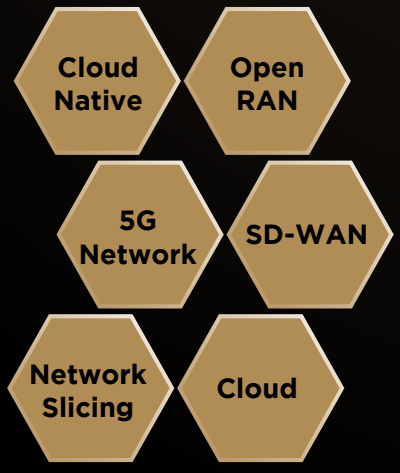

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India's 5G challenge

High cost of network, lack of infrastructure, and massive number of user are some of the issues that telcos need to grapple with as they plan to roll out 5G in India

BY VINAY K MAYER

The arrival of 5G will introduce many new technologies and devices, but it also brings with it new security risks, especially as we move into the era of IoT.

Tomorrow's mobile connectivity could bring even greater speed and lower latency than it does today. Imagine being able to download a movie in less time than it takes you to read this article! But the only way 5G will be 5X faster than 4G, is if the infrastructure that supports it has improved as well.

While 5G is just around the corner and everyone seems to be excited about its promises to usher in the next generation of mobile connectivity, telecom operators and the government are working hard to develop the ecosystem for India. And the question that bothers many is how India will be able to deploy 5G when there is a lack

> To increase the adoption of 5G, it is also important to make sure that affordable handsets work on the new network as well.

of infrastructure. Will 5G be any different than its 4G predecessor? Here is a list of the reasons why India must undergo structural changes for 5G technology to become a reality.

The roadmap for India

The smartphone market is undergoing an enormous shift during this time of technological development, fast internet speeds and new advances in entertainment, and it is nearly undeniable that more individuals will be turning to smartphones to supply their every need. Most nations are expected to progress technologically using 5G technology within the next few years because having all of the technology needed to keep up with the rest of the world is vital for competency and wealth when participating in the global economy.

In India, most industries are involved in various ways to help launch 5G in the country. The country has been making a significant investment in R&D for all mobile companies and the government alike. The process that's currently taking place is working on finalizing a nationwide plan for where to set up 5G networks, what spectrum will be used, who will utilize it, and how it will interact with older technologies that still have some time before they're fully phased out.

A blueprint to prevent technical snags

The arrival of 5G will introduce many new technologies and devices, but it also brings with it new security risks, especially as we move into the era of the internet of things (IoT). For example, the new technology will create opportunities for advanced patient monitoring, remote surgery, and automated driving, but it will also introduce the risk of unwanted attacks and spying.

India will need a much-improved digital infrastructure if it is to have a 5G network. A digitally enabled society is well underway in India that will propel it to become one of the world's biggest markets for internet use. Therefore, now would be the best time for building new networks to deliver improved communications with faster speeds and greater network stability. However, there are currently some roadblocks when it comes to

Fact of the matter

5G has been deployed in over 60+ countries. When compared to 4G, the technology is being adopted immediately. The buyers are very happy with the high speed and low latency.

With 5G, we can experience augmented and virtual reality at faster, uniform data rates, with lower latency, lower costs, and improved smartphones.

5G will redefine an array of industries over mobile devices, including sales, manufacturing, and transportation, healthcare, and asset performance. The Indian market currently offers 4G (and 3G prior to that), which provides improvements in data transfer speeds for smartphones; 5G will allow the entire range of products to communicate. The number of devices that can be connected to the network with 5G is increasing dramatically, reaching a trillion per square mile.

> The 5th generation wireless network uses a C-V2X communication protocol. This could present new security challenges when it comes to battlefield applications.

these new fibre optic cables being installed leading to potential problems down the line.

Challenges, threats, security solutions

The high cost of setting up the network, lack of infrastructure, and sheer number of users have been major challenges for telecom companies in India. However, the recent announcement of 5G trials shows that telecom service operators are getting the gist of this new technology.

According to reports, India plans to launch its 5G network by August 2022. A series of auctions will be held for engineering, procurement, and construction of the 5G infrastructure later this year. As part of its 5G development efforts, it has launched test projects in Mumbai and Gurgaon with Bharti Airtel and Reliance JIO. However, there are still some other significant factors at play that will affect 5G rollout

Small cells for 5G: Small cells are the network's sturdier 5G foundation. They are deployed anywhere from 200 to 250 meters apart through our infrastructure, on electricity poles near you, on streetlights, and above metro pillars. There are hundreds of ways that small cell technology is interacting with the built environment around us and this makes them an integral part of creating a hyper-dense network that can support speeds of up to 10 Gbps!

Tech-laden devices: A significant number of premium 5G phones will soon be available in India. Mobile phone companies like Samsung, Huawei, and OnePlus are launching their premium phones to boost the adoption of 5G for a better future overall. To increase the adoption of 5G, it is also important to make sure that affordable handsets work on the new network as well.

Security and privacy issues: This can be a major concern anytime when large amounts of information are being sent over a network. The 5th generation wireless network uses a C-V2X communication protocol that will enable broad coverage for many more devices. This could present new security challenges when it comes to battlefield applications, commercial operations, medical fields, and consumer devices like smart homes.

Deploying 5G in India

Recent discussions indicate that telecom operators are expanding their assets by increasing the capacity of their BTS sites and turning to microcells for rural coverage. A MIMO technology upgrade will also boost

Barricades ahead

To make 5G a reality, telecom companies need to spend more on buying airwaves and building the infrastructure.

- Indians are not yet ready to pay the high price of 5G service as the cost of bills will increase significantly with the emergence of 5G technology.
- The telecommunications industry in India is not in good shape. Many telecommunications companies suffer from high debt and pending taxes.
- 4G technology in India is not yet fully developed in India and in this state switching to higher technology is not a wise option.

> The transition to 5G networks will differ from the way we transitioned from older 3G systems to 4G in the past, where we had to insert a new SIM card into the device.

bandwidth speeds for customers. Experts believe the integration of 5G into our current technologies will create a "leapfrog" effect, which will bring improvements in communication.

4G vs 5G network architecture differences include latency, potential download speeds, base stations, and OFDM encoding and cell density. 5G is expected to be about 100X larger than 4G. Those speeds are possible because most 5G networks are built on very high airwaves, also known as the high-band spectrum. High waves can transmit a lot of data, much faster than 4G.

Besides, 5G networks use 256-bit encryption, which is a substantial improvement on the 128-bit standard used by 4G. 5G encrypts the user's identity and location, making it impossible to identify or locate them once they are on the network.

Reports also indicate that 5G cellular networks will be so fast that one won't need individual SIM cards. Experts say that the transition to a completely new generation of 5G networks will differ from the way we transitioned from older 3G systems to 4G in the past, where we had to insert a new SIM card into the device.

Experts point out that some industries may benefit more from 5G, particularly those requiring high speeds, low latency, and 5G network capacity. Smart factories, for instance, can use 5G to enhance production and efficiency by using industrial Ethernet. Other technologies, including autonomous cars, may take advantage of this technology since they will send signals to a cloud-based computer, which analyses the situation and sends signals back to the car.

What does the industry expect?

The 5G network architecture will include ultrahigh capacity as a leading design feature due to its ability to operate at higher speeds. This internet infrastructure will enable multiple networks to work together as if they were one cohesive network, giving it greater flexibility and control. As a result of 5G's intelligent and resourceful use of IT or information technology, it recognizes the importance of capacity usage and energy efficiency, allowing operators to send data on demand, improving the speed of data delivery to locations whenever and wherever they may be.

The methods for modulating, demodulating, and coding differ depending on the communication type (2G, 3G, or 4G) and which network a person may be using. The most common modulations used in these types of communications are GSM and TDMA for legacy cellular networks, T-DMB for digital TV broadcasting, and DVB-H & DVB-T for digital terrestrial television broadcasting. While some standards have been set with 5G technologies, like MIMO communications, many are still under development.

Another way to maximize your cell phone network's efficiency is to reduce interference and maximize the capacity of available channels. Researchers have found that the 4G network increases overall capacity by reducing interference between signals and letting various sets of base stations work together more effectively. A similar approach is used in 5G network planning because studies have shown that multiple coordination technologies can improve capacity.

India happens to be on the forefront as it is working towards becoming a 5G contributor with its Digital India program. When this novel technology has been fully implemented and is available for use, it could revolutionize our everyday lives in a way yet undiscovered. Understanding that 5G will open up incredible opportunities in all fields, it may mean even more bandwidth is required so we should start thinking of ways to allocate resources wisely at this juncture. Because we do not want India to fall behind with regard to its infrastructure development, let's take proactive steps towards exploring our options regarding how best to implement this ultra-advanced technology right here in our own country so that when it becomes available, we are prepared and ready for its inclusion into our day-to-day lives. 😍

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"THERE IS A STRONG MADE-IN-INDIA EFFORT EMERGING IN THE INDUSTRY"

CHRIS RICE
CEO, Access Solutions, STL

What is your strategy and portfolio for the 5G roll-out in India?

5G has the potential to improve quality of life by bridging social inequalities and providing equal access to the latest technologies. 5G will also add economic advantages as it will drive relentless innovation, open new streams of revenues and generate millions of employment opportunities. STL plans to participate in the 5G ecosystem as a supplier of Open RAN solutions, software and services for delivery and deployment of these systems. Our range of products includes open radio units, both indoor and outdoor, in various frequency bands; the RAN Intelligent Controller (RIC) software platform, and additional components and services for delivery of 5G.

How is STL enterprise strategy different from others? Also, what about private LTE and captive 5G pockets here?

Along with 5G gears, our approach has been to prepare the network infrastructure with as much of 5G technology as possible. We are focusing on providing many of the features, functionalities and benefits of 5G. Fibre is an important element for 5G. In collaboration with government and private players, we are working to fibrerize towers across India and the globe. We have expanded our plant capacity from 18 fibre km to 33 fibre km to meet the growing need for fibre.

We have radio units for indoor 5G, coupled with investments and alliances with an enterprise 5G baseband unit supply. This radio and baseband unit combination allows us to provide an end-to-end enterprise 5G indoor solution that provides true 5G wireless coverage and capabilities, but can be installed like WiFi – structured wiring, power over Ethernet, etc.

Tell us something about the role of standards and patents in 5G adoption?

5G has similar properties to other wireless generations relating to Standard and Essential Patents (SEPs). The leading industry-standard 3GPP tracks more than 700 technical specifications and technical reports related to 5G and over 87,000 individual patents. That said, 5G is the first time that there is an interoperable specification for interconnection and APIs in the RAN. These Open RAN specifications are detailed in O-RAN Alliance specifications.

Would pilots or phased-trials be the right way to go forward with 5G?

All technologies roll out in a trial form. This helps suppliers and carriers vet the technology and see how it performs in limited production environments, allowing for enhancements to occur. The potential of 5G can be extracted with continuous 5G trials. New-age test solutions are developed to accommodate complex use cases and overall advancements in architecture. This has evolved the need for advanced emulation and verification technology.

What's your take on the state of 5G spectrum in India – bands, availability, and pricing, etc?

We are somewhat agnostic to spectrum as a supplier of 5G Open RAN technology. But we think that spectrum will be the lifeblood of 5G and is critical for the larger ecosystem from a policy, allocation, and pricing perspective. We are glad to make equipment to cover any band. The more spectrum that opens up, the more opportunity for broadband to the larger portions of the population. Broadband is known to drive economic development and access to information and applications for users, reducing the digital divide. 5G is opening up

more spectrum, providing more broadband speed for a given amount of spectrum, and delivering low latency applications never imagined previously.

What does India lack and what are its unique strengths when we compare its 5G curve with other regions?

While 5G provides some impressive new capabilities, it does require significant investment for a full rollout. That investment needs to be recouped through new subscriber growth, higher-speed wireless plans, or new applications across the user base. India has a large population of about 1.4B people. There are almost 1.2B wireless subscribers, and of those, about 44% are on 4G today. Many parts of the world have rolled out 5G already and are growing their 5G subscriber base. India has an opportunity to drive 5G adoption and can do it in a way that is unique using new lower cost, more interoperable Open RAN 5G equipment. This equipment is lower in Capex and Opex and is more widely available from a broader ecosystem of suppliers.

Do you feel that the current state of geopolitics will affect 5G evolution in India in any major way? Based on market dynamics and some geopolitical issues, there is a strong Made-in-India effort emerging in the industry, opening new economic opportunities for India and driving job growth. The general open networking efforts and the Open RAN wireless area specifically are opening up new opportunities in India to be a global wireless supplier.

Should we also start thinking about 6G-readiness as we embark on 5G? Any suggestions or any attempts on your side?

Even though there are discrete steps in wireless evolution, like 3G, 4G, 5G, etc., innovation in wireless are something that happens on a continual basis. As referenced above, the over 87,000 patents in the 5G area is something that happens from daily work to improve wireless technology, and then those innovations are debated and codified in standards. Once consensus is agreed to, there is a specification that represents the next "G" of wireless. That work for 6G is happening now in labs all around the world, even as 5G is rolling out in operator networks today.

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5G to unleash digital verification era

The 5G rollout will enable world to harness mobile-based security and authentication in a big way, paving way for elimination of paper-based processes

BY NAVEEN CHAVA

India has the world's highest data usage per smart phone at an average of 9.8 GB per month, a new report by Swedish telecom equipment maker Ericsson said, adding that this will double to 18 GB by 2024. Globally, the 4G service is expected to peak in 2023 and start declining, and the 5G subscriber base is expected to touch 1.9 Billion by 2024.

The mobile phones today are the smartest devices with not just connectivity, but also biometrics for verification like facial and voice recognition and fingerprint authentication, pin pad for payments, OTP verification etc., giving seamless, reduced cycle times and digital access from anywhere. Mobile phones are also the easiest device available for Video KYC that is needed for digital on-boarding, irrespective of the geographic limitations.

Coverage of geographic boundaries is required for travel mostly, and requires detailed traveler information like his current address, emergency contacts etc., which is always outdated and needs to be dynamically updated. In a way, the mobile phone of today is the device for verifiable identity as well as a payment terminal. The user base is the standard of valuation for businesses now and the growth user base is mostly coming from mobile phones whose count will be same as the world population soon.

Efficiency of business is measured by the user experience and retention which happens not just from the presentation but also from faster response, throughput, and capacity management. All of this will be even more possible with 5G which will improve the bandwidth by 10X and ultimately deliver the user experience on mobile phones.

With the advent of 5G, the payments, eRetail and eCommerce will continue to grow along with the mobile usage and growth. With 5G coming, we will have data speeds much faster than most of us see on our desktops and laptops or using broadband, and deliver higher multi-Gbps peak data speeds. It will also allow massive network

> 5G will expand mobile ecosystem to new industries and user experiences such as boundless extreme reality (XR), seamless IoT, and local interactive content.

capacity, with a more uniform and higher performance and reliability. Improved efficiency will empower new user experiences across existing and new industries.

Narrow Band-internet of things (NB-IoT) and Cat-M technologies will account for close to 45% of cellular IoT connections in 2024. Emerging industries with new additional devices like IoT devices, drones for emergency services, remote surgeries, autonomous driving and many others will connect everything and everyone. 5G will expand mobile ecosystem to new industries and cutting-edge user experiences such as boundless extreme reality (XR), seamless IoT capabilities, new enterprise applications, local interactive content and instant cloud access.

We also live in a mobile world where people are always moving around with the need for access to things happening dynamically around us and the instant need for being on top of things and getting things done instantly keeping the concept of anywhere and anytime. Digital identity management will be the key to protect online usage whether it is for shopping or mission critical communication or any transaction. Authentication should be seamless to the user and at the same time, digital verification should happen instantly. The users should have the ability to choose as many levels of authentication whether it is biometric, pin-based or OTP-based verification. All of this will be possible with seamless apps which are able to utilize ultra-low latency, more reliability and increased availability of network enabled by 5G cellular network which was not possible in the past due to low data rates.

Considering the current worldwide situation, where we are all confined to home and everything is mostly happening online, the digital identity management and verification has become even more important and this can be implemented with the current lesser bandwidth of LTE. However, the user experience can be improved enormously with 5G.

The future of security

Key of the future for an individual will be their digital signature, which will eliminate all paper-based transactions with higher level of authentication since it can be easily done over uninterrupted and robust 5G network instantly with data security and identity protection, including verifiable consent to access and share data.

Today, the need for digital signatures exists in all verticals—travel, banking, financial transactions, land transactions, employee verification, welfare scheme disbursements, healthcare, insurance claims, employee remote on-boarding and corporate transactions. The next step will be to enable digital verification and on-boarding of customers, agents, vendors where KYC of any stakeholder is needed with real-time authentication and on-boarding possible on mobile and done instantly with a network and data bandwidths available over 5G.

Imagine ID verification needed for not just eCommerce or cab companies, it is needed for every corporate for employees, their agents, their customers who are buying, selling and delivering. This requires a lot of cellular airtime that is possible with 5G. Digitally-signed, authenticated documents from doctor, diagnostic labs or government might become a basic document for people to cross borders or go to work at their office in the future and this is what is possible with 5G network coverage.

We will also need to also explore the idea of having healthcare bands and devices capturing data that will have identity management, ADAS cars with verified identity before using the data to upload. All of this will be a reality in the near future.

These could be regularly happening transactions like legally binding contracts or agreements, financial submissions or one time Instant e-Consent or e-Sign for additional product selling within bank, NBFC or platforms can also be done. The vision of bank on-boarding and instant bank account access will be possible with 5G without the need of a physical visit.

The leap to an all-digital world of e-signed contracts, digital identity, truly digital banking, digital vehicle identity will be cut short by a at least a few years and instead of 2030 a lot more adoption will happen in 2021 itself because of the pandemic.

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How location intelligence can help push telecom growth?

Now is the time for telcos to embrace the power of 'where' and 5G with the combined prowess of spatial technology, data and analytics and shape industries of the future

BY ABHIJIT SENGUPTA

India is the world's second-largest telecommunications market with a subscriber base of a staggering 1.16 billion and it is no surprise that the Indian mobile economy has been rapidly growing and contributing substantially to India's Gross Domestic Product (GDP) in the last couple of decades. The growing consumer demand, backed by liberal and reformist policies of the Government of India, has largely been instrumental in driving this growth. Additionally, easy market access of telecom equipment and a fair and proactive regulatory framework has ensured the availability of these services to consumers at an affordable price too.

However, telecommunication is a highly competitive industry and the only way a telecom can gain a competitive edge (besides cost) is by innovating and integrating future-ready services at an early stage of its rollout. Add 5G to the mix and a whole new world of opportunities opens up. Technologies such as multi-access edge computing (MEC) are already bringing resources closer to the edge to process data atmuch higher speeds. This, combined with 5G, is going to revolutionize the way we live and conduct business, especially within the telecom industry. In this backdrop, companies that ready themselves and invest in their future will steer the gateway to internet of things (IoT) devices, smart vehicles and more. Like any business or industry though, profitability for the telecoms industry will be underlined by optimizing investment in the right technologies.

Powering the next wave of growth

The idea of using location technology and data isn't new for India Inc. In line with this, location intelligence has always been a key mainstay across industries, from ride-sharing apps to targeted digital promotions, retail marketing, and connected vehicles. But now is the time for connectivity industry to fully embrace the power of 'where' with the combined prowess of spatial technology, data and analytics.

Technologies such as multi-access edge computing (MEC) are already bringing resources closer to the edge to process data atmuch higher speeds.

Historically, telecom companies have relied on location insights to surface marketing insights and drive consumer engagement. Location innovation is shaping the future by helping the telecom industry drive intelligence, business innovation and stay ahead of the curve in terms of market disruption by network planning, enhancing business operations, streamlining the workforce, safer driving, and creating new opportunities.

Driving effective network planning

Location intelligence can help gain vital insights into business operations to determine which and how many customers a telecom can reach, the number of towers they need to build and connect, as well as ways to optimize the existing network. Keeping the 'where' dimension in focus, organizations can model and test the best site locations for network towers for optimum coverage. Besides enabling effective network planning, leveraging location intelligence can also help in managing the assets after installation.

As we continue to build a world that will thrive on remote working, 5G and MEC will enable unprecedented levels of

High-precision maps, advanced edge AI perception, and low latency provided by 5G MEC pave way for enhanced road safety and precise localization for navigation.

compute and network performance with high bandwidth data transfers and ultra-low-latency connections to power autonomous services globally. Location intelligence will be crucial to the deployment of 5G MEC networks. To support the infrastructure required for this new 5G MEC, which requires a dense and complex network of small cells instead of the usual spaced out cells, rich visual information and geospatial context will further support the process of network planning and optimization.

Enhancing business operations

By deploying location analytics and data, telecoms can also automate several processes that ensure they're identifying and communicating their current total addressable market to partners, including location of services, product availability and pricing. This can enable companies to get the bottom line out of the way and instead focus on the available information to directly load rate cards andlists, load and add in application programming interfaces (APIs) to keep data actionable and updated.

Integrating location data and analytics into day-to-day business operations can help companies make their workforce smarter, fasterand efficient. With data visualization tools such as HD maps, project managers can identify faults alongwith recurring maintenance tasks andoutages, thus speeding up the collaboration process. Rich topographical insights can also help plan upgrades of legacy networkensuring the right people can solve these challenges.

Enabling safer driving

While location intelligence already plays a crucial role in ensuring safer driving, throwing in the power of 5G into the mix will potentially transform vehicle safety. High-precision maps, advanced edge AI perception and low latency provided by 5G MEC pave the way for enhanced road safety and precise localization for navigation.

For example, a leading global telecom player which is finding ways to make roads safer by making use of mobile networks, has unlocked capabilities of less than 10 milliseconds response time between base station and the location of the server (where mobile data response times are usually between 50 to 200 milliseconds). With these super-high speeds, coupled with the right kind of connected vehicle technology, geospatial information and real-time traffic updates, drivers can gain insights into road conditions, traffic congestion and any sudden movement of pedestrians onto roads and respond quickly to avoid road accidents.

Creating new opportunities

One of the biggest fallouts of the pandemic is that it has forced us to rethink how we live. And that includes the idea of advanced technologies to build smart cities that can help with better mobility for citizens. As our urban ecosystems grow ever larger, challenges like population pressure, deforestation, traffic congestion, deteriorating infrastructure, crime and resource crunch will grow as well. But the use of technology has the potential to dramatically improve the systems on which the cities run: whether it is public safety, healthcare systems, public distribution systems, urban planning, or governance. This is where a plethora of opportunities for telecom players will lie. As demand for smart mobility options such as connected vehicles and electric vehicles grow, telecom operators will have to take advantage of new opportunities emerging from the convergence of location data and the expansive powerful 5G network. This means being able to empower enterprises with wide access to location-powered solutions such as visual positioning services, 3D positioning algorithms analyzing images and videos in real time that will demand widespread, higher bandwidth, lower latency, and the connectivity necessary for enabling a more connected world.

In short, location-based technology holds the key to maximize revenues, enhance the user-experience and subsequently execute long-term solutions for present and future challenges. As we realize the vision of a digitally connected world, telecom companies will have to continue thinking in this direction and leverage location-led innovation to build capacities and capabilities to shape the industries of future.

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TV RAMACHANDRAN

Time to look beyond the UPI

For India to become a global digital economy, the country needs to quickly fix its inadequate and sub-optimal infrastructure and define stringent data security measures

India is the largest and fastest-growing digital economy in the world. The digital banking space is projected to grow with a compounded annual growth rate (CAGR) of 27% during 2020-2025, from transactions worth Rs 2,153 lakh crore in FY20, to a humungous Rs 7,092 lakh crore in FY25, according to IVCA and EY. The 'Digital India' mission is to establish a 'Faceless, Paperless, Cashless' society. We shall not settle for less.

It is gratifying to cast a fleeting glance at our remarkable progress and the promising path forward.

Cashless India: An incredible journey so far

Over 80% of Indians have bank accounts. While not all of them are actively being used, this is a milestone – a laudable first step. 42.71 crore bank accounts have been opened just under the 'Pradhan Mantri Jan Dhan Yojana' (PMJDY) program. Deposits in these accounts have reached Rs 1.44 lakh crore. Also, the Budget 2021 has Rs 1,500 crore earmarked to help the digital payments sector. We are surely moving well.

As Indians now appreciate, digital financial inclusion can ease many a burden. Even the humble vegetable vendor realizes it in the country today. India is the third-largest economy in purchasing power parity and in 2021 the cash circulating in our economy has gone up 14.7%! A cashless economy is an excellent engine for economic growth. Moreover, cashless transactions constitute powerful weapons for the government to fight corruption, and theft. Additionally, all recorded and legal transactions will count and contribute to our GDP.

Greater penetration of digital banking and mobile payments services offers financial security. Stashing cash at home makes it susceptible to theft, invasion of privacy, and damage. Without online banking, many individuals fall prey to money lenders and loan sharks. Access to a basic financial account is not enough. Many people lack wider services like savings accounts, loans, insurance, and more. For these people, it will be easier to get loans with a digital trail to help banks assess credit risk. Vulnerable demographics like women, persons with disability and the elderly will benefit from not having to visit a physical bank for each transaction. Digital payments can also reduce the cost of financial services by as much as 80% to 90%.

UPI – Uplifting payments in India

Unified Payments Interface or UPI is the game changer for the great Indian digital revolution. Indian consumers love the convenience of UPI apps. Now, a kirana store owner, tailor, or maid can get paid in the blink of an eye, even during lockdowns and other restrictions.

In June 2021 alone, the number of UPI transactions hit 290 crore, which is a record high. According to EY report, this is 110% higher than the 143 crore transactions recorded in June 2020. UPI allows one to use our mobile number and smartphone for financial transactions. Earlier, we needed a bank account number, branch, IFSC code, and other information to make a transfer. With UPI, we have near-instant money transfers. There is other factor boosting UPI transactions is the decision by the Centre to eliminate merchant discount rates (MDR) on UPI and RuPay since January 2021. MDR is the fee paid to banks and payment gateways for commercial transactions.

Undoubtedly, banking in India is progressing speedily towards increased digital payments. Sure, the National Payments Corporation of India (NPCI)*99# service is

> At Rs 4,856 crore, India has the highest investment in fintech, more than China's Rs 2,137 crore. Its fintech market is estimated to hit Rs 11.25 – 12 lakh crore by 2025.

still available and Indians can make basic transactions using regular mobile phones by dialing it. But low-cost smartphones will hit the market soon. The 30 crore individuals still on a 2G plan and more will flock towards low-cost smartphones. This demand will give the mobile internet and app-based financial services sector a huge boost.

India is Asia's #1 in fintech investments

At Rs 4,856 crore, India has the highest investment in fintech, according to RBSA Advisors, more than China's Rs 2,137 crore. The Indian fintech market is estimated to hit Rs 11.25 – 12 lakh crore by 2025.

Fintech refers to any new technology designed to improve and automate the delivery and use of financial services (Investopedia) and 67% of the 2,100 fintech companies in India were set up in the last five years. India's most popular digital-only payment gateways are PhonePe, Dhani, BHIM, Axis Pay, PayTM, and Mobikwik. Many other fintech companies are making their mark. They include Cred, RazorPay, PolicyBazaar, Lendingkart, BankBazaar, and more. Even global payment app giants (known as Tech-Fin) like GooglePay, AmazonPay and WhatsappPay, have executed on the UPI stack for India. This proves that the UPI platform is world-class and has robust capability to scale and maintain efficiency (Mozark global study using Aquamark tool). Another landmark in the India digital banking space was the RBI's decision to allow payments-related data to be stored in the cloud.

Way forward to a cashless India

Being first means not competing with other countries. But India's race is against internal hurdles that block the country from reaching every citizen. If infrastructure, mobile internet services, cybersecurity, awareness, and reach across India improve, it can meet the growing demand for digital financial services and spur economic growth.

India needs to step on the accelerator and introduce digital banking and mobile payments to the millions of unserved and underserved Indians. The country also needs to speed up the penetration of mobile banking services to every corner of the country, boost infrastructure, secure payments, and improve Quality of Experience (QoE) for transactions.

Improved infrastructure

The biggest challenge to achieving a cashless India is inadequate and sub-optimal infrastructure. The digital economy can contribute up to 20% or Rs 75 lakh crore of the total economy and create 6.5 crore new jobs. While broadband penetration is critical to India's economic development, only 2.3 crore Indians are wired internet subscribers. Home internet penetration in India is only 7%. In China, it is 92%. Similarly, only 55 out of every 100 people in India have an internet connection. Although India has 4G/LTE technology, there is a lack of towers and infrastructure in many areas, which leads to poor connectivity – especially indoors.

Creating one crore public Wi-Fi hotspots under the government's PM-WANI scheme will offer significant relief to the digital banking sector. These hotspots will be an effective low-cost solution for the common person. And even though the one crore number is a low target for India, it is a good start. Currently, the country has less than 3% of the global average of hotspots per citizen (1 hotspot for every 150 residents). The developed world is at an average of one hotspot per 20 people!

Additionally, satellite communications can play a significant role in remote areas. Last year, central government began permitting private players in space-related activities. This step is a giant leap forward to getting the internet in the hands of every Indian. Liberalized licensing and regulatory-lite policies will boost free-market competition and spread mobile communication across the country.

Ramp up cybersecurity

If we want more Indians to adopt mobile payments, we need to invest in security and trust-building. With more

> If infrastructure, mobile internet services, cybersecurity, awareness, and reach across India improve, it can meet the growing demand for digital financial services and spur economic growth.

digital payments, the number of transaction failures is growing larger. System outages in banks have been unable to keep up with the increase in transactions. Many apps offering payment interfaces to customers are connected to regular bank accounts. So, if banks do not scale up their infrastructure, transaction failures will continue.

Only 58 of 2035 fintech organizations in India have cybersecurity measures. CERT-In reported a 1,000% increase in malicious activity related to digital transactions over the last six months. NITI Aayog continues to stress the importance of protecting India's digital financial system against fraud and security breaches.

To help combat crime in the digital payments space, the RBI issued guidelines in February 2021. The rules include mandates for UPI apps to protect their source code and cybersecurity guidelines against hacks and cyberattacks. Banks and payment apps have six months to comply. However, rigorous testing is required across the vast array of devices and networks across the board, to improve security and gain the confidence of more Indians.

Improve quality of experience

For mobile banking to take off, the digital payment experience must be better than that with cash. Busy individuals in large cities find digital payments convenient due to better Wi-Fi and wired network connections. The same convenience will be appreciated in rural areas. It can stimulate more businesses and entrepreneurs to expand beyond the metros.

But even in a mature market for mobile internet like India, if we cannot measure it, we cannot improve it. Mobile operators should expand and improve the quality of experience on their networks based on what consumers value most. Internet browsing and payment transactions use a significant amount of data on mobile networks. If net banking websites do not load fast, app transactions fail, or OTPs do not arrive in time, it will be hard to persuade others to join the fold.

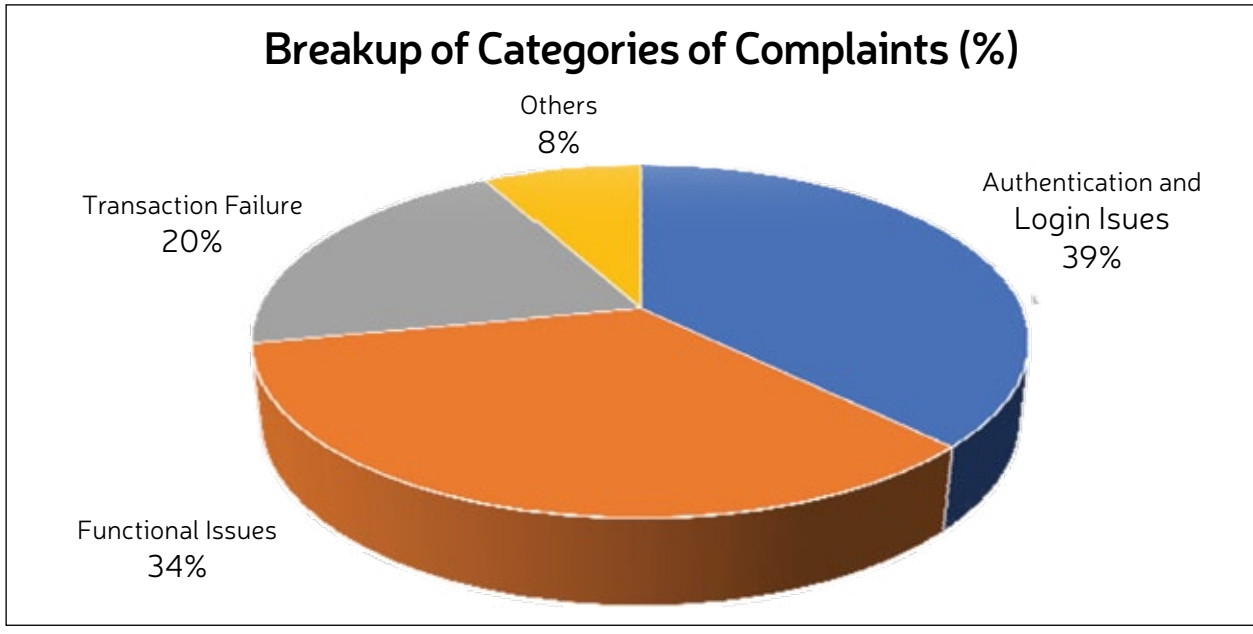
The "best effort" mindset of banks and telcos need to change for India to maintain excellence in quality of experience (QoE). For example, a recent Mozark quantitative study of top banking apps in India found the "time to log in" (after entering user details) was high with over 25% of transactions taking more than five seconds. This number is quite high for the world of apps. There were similar delays and variances in the "time to download a statement". But payment transfers after receiving OTP and entering it, functioned with minimal variance. These results were in line with the percentage of customer complaints that the RBI receives about these payment apps.

Mozark study also showed that the UPI stack did not overload the system. But bank app stacks were not fully tested by changing devices and location. These rigorous tests must be implemented on a wide scale with an ample sample size. We cannot test a few cases and hope for the best. The good news is that tools like Aquamark allow for field tests conducted remotely at a tenth of the cost. Telcos and the banking sector can use these field testing and monitoring tools to raise their quality of service with an attitude of zero-tolerance towards errors and failures. Only then will our economy be world class consistently.

Time for a new banking license regime

Neo-banks are fintech players without physical bank locations. They exist solely in the digital world. They offer a more pleasant experience on the front-end than a standard banking website. Globally, these neo-banks have regulatory licenses and have been successful in attracting customers. Apart from a user-friendly interface, they also offer customized solutions for consumers. Think of a PhonePe or GooglePay portal with friendly icons, navigation, and easier transaction options. These neo-banks can be tremendously advantageous to

> While broadband penetration is critical to India's economic development, only 2.3 crore Indians are wired internet subscribers. Home internet penetration in India is only 7%.



Source: Mozart analysis of RBI data on mobile banking consumer complaints

small businesses and startups who may not qualify for loans in traditional banks.

In India, these digital-only banks cannot function on their own since they are not issued licenses and must partner with traditional banks. Issuing licenses to digital-only banks can help crore of people convert to online banking. Digital banks are more cost-effective to consumers since they do not have high overhead or operating costs.

Let's move to the finish line

The Digital India mission is pivotal to our nation's success. It is a shining testament to Indian ingenuity. Digital financial freedom and inclusion can uplift crore of Indians. Online UPI transactions through mobile banking and app-based payments are at an all-time high and poised to grow even further. But as former US Supreme Court Justice, Oliver Wendell Holmes, Jr. once said, "Greatness is not in where we stand but in what direction we are moving."

Our direction is fine. But it is good to accelerate our efforts to bring mobile banking to the rest of the millions of Indians living without it. Our infrastructure needs urgent improvements. This includes executing PM-WANI targets, liberalized Satcom policies for "network anywhere", stringent cybersecurity protections, and monitoring on-ground quality of experience. Only then can we truly realize the benefits of a cashless India for all.

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Make hay while the sun shines

Can India become the telecom equipment and electronics manufacturing hub of the next decade? Yes, but only if it makes the right moves

BY RAJESH MEHTA & UDDESHYA GOEL

The advent of the pandemic has been a consequential inflection point in the fundamental working of the social system. With the nation being under lockdown from time to time and over 55% people working from home, a lot more time is now spent at home leading to the increased demand for greater comfort and security through smart devices and appliances. While the markets of several sectors got disrupted during the pandemic, the consumer electronics and the telecom market turned out to be resilient, even with the intermittent closure of physical providers across the nation.

But there is a wedge in the Indian market scenario – despite being one of the largest consumer markets, India's share of global electronics manufacturing has been a mere 3.6%, even though domestic manufacturing grew at a CAGR of 23% over the last five years. This has been a consequence of snubbed opportunities in the last decade. When the trade wars began and companies were exiting China, many turned to ASEAN countries, including Vietnam, Taiwan and Indonesia. However, India failed to attract such companies, again. The policies that were incorporated by these South Asian countries in the last decade are finally being introduced in India with an indigenous flavour.

Today, India has another opportunity and it is paramount to not miss it. Small calibrated steps would go a longer way than grand gestures. Digitization in India at a mass level, with the lowest broadband rates in the world, could captivate MNCs and open up millions of manufacturing and services jobs. The PLI scheme launched by the governmentis one such step in this direction.

For the telecom equipment and electronics and market, the PLI schemes are designed to trigger an impulse for scale both for Indian companies and foreign companies who wish to manufacture in India at competitive costs. They are designed to have a domino effect creating pools of ancillary firms and services, and a wealth of jobs.

Call for in-house production

In the electronics manufacturing sector, it is astounding to know that India has virtually no display and semiconductor manufacturing units. Displays and semiconductors are the most expensive parts of phones and televisions and account for anywhere between 25% and 50% of the input cost. Moreover, the global supply chain infrastructure of semiconductors has suffered a significant crack which is driving up the prices; in fact, many estimates suggest that the major microchip buyers (auto and consumer electronics industry) are on the way to lose USD61 billion this year.

In India, domestic requirements are being met only through imports, and mostly from China and Taiwan. This is due to the repercussions of the elemental policies since the 1990s in India. The Indian industry still operates at the lower end of manufacturing and encourages the world to outsource only its non-core activities to India. This is the root cause of a birth of a non-innovative economy and substantiates the fact that India is still an innovation laggard in the global

> One of the factors that is in favour of India becoming a 5G manufacturing powerhouse is the backlash against Chinese telecom gear makers.

> The current PLI scheme for telecom caps R&D investment at only 15%, which will only help companies that don't plan on indigenous product development.

setting, coming at the 48th position behind China (14th) and Vietnam (42nd).

The big need now is to focus on indigenizing the manufacture of parts, rather than just hosting the cheapest high-quality assembly lines. Building domestic manufacturing capability will lower import bills and cost of production and thereby drive demand further. Making these components in-house will also massively improve the country's net value addition to the overall electronics manufacturing process, which India aims to increase to 35-40% by 2025.

Slice of 5G pie, and more

On the telecom front, the next revolution in the tech industry is near and the entire globe is eyeing to be the early adopters of the 5G technology. India stands at the center of the 5G hub and can be considered a unique market for 5G equipment if we play our cards well. One of the factors that will favour us in becoming a 5G manufacturing powerhouse is the backlash against Chinese telecom gear makers. Nearly all the developed and underdeveloped nations are running away from Chinese manufacturers and barring them in their 5G development.

If India wants to become the 5G equipment hub, a fair bit of careful innovation would be required to elevate the manufacturing of next-generation radio access networks, internet of things (IoT) devices, customer premises equipment, routers and switches. Another interesting innovation where India could capitalize on is e-waste. India is the world's third largest e-waste generator, producing over 3.23 million metric tonnes of e-waste per year. This e-waste can be reengineered to make 5G equipment in a cost-effective manner.

Another pivot point can be to avoid the asked 26GHz band in the short term to prevent the pockets of telecom operators from getting burned. Instead, relying on existing airwaves and short Wi-Fi airwaves could be the game-changer for India.

There are immense challenges on account of numerous local hurdles, including inadequate infrastructure, the high cost of finance and logistics, and inverted custom duties. Even if India has the capability to manufacture printed circuit boards, other critical components such as diodes, chips and transistors are not made in the country. This will require building an end-to-end manufacturing system with efficient local supply chains to cater to the soaring demands.

The current PLI scheme for telecom caps R&D investment at only 15%, which will only help companies that don't plan on indigenous product development of telecom equipment, and will only lead to assembly. There is skewness towards contract manufacturers at the cost of companies who are investing top dollars in R&D to develop the products. A quick amendment is required to liberalize the local innovation infrastructure and unleash future sustainable growth. In addition, a push is needed on the annual gross expenditure on R&D from the current 0.65% of GDP to the global average of 1.5-3%.

Direct cash incentives through cheap credit and viability gap funding will be of foremost importance to set up new manufacturing units. Emulating China, India must also aspire to deliver an effective single-window clearance system for all approvals that should be provided in a time-bound manner. Ease of doing business cannot just exist on paper, but also in practice.

Rather than continuing to make products in areas where other countries already have the advantage of economies of scale, India must ride the future trends of increased consumer electronics and 5G components demand. Even though India does not have the first-mover advantage, the demand in India alone offers the opportunity for large-scale production, often a common problem in first world countries. The time is now to hit the burning iron.

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[COMMENTARY]
MAKE IN INDIA

Democratization of space key to Aatmanirbhar Bharat

To achieve self-reliance and to increase India's share in the global economy, private sector investment is critical for the Indian space sector

BY SHIVAJI CHATTERJEE

Science and technology have played an important role in India's rapid growth and development. One of the key pillars of this success story is the incredible progress India has made on the space technology front led by the path-breaking visionary scientist Dr. Vikram Sarabhai. With his far-reaching vision, he paved the way for the development of space technologies and its applications to cater to various national needs.

The Indian Space Research Organisation (ISRO) has also played an important role in the development of India's space sector. Over the past years, it has successfully developed notable indigenous capabilities in space technology. From design, development of launch vehicles to the indigenous development of communications and other satellites and space applications, ISRO has done it all. Yet India, through ISRO, controls only around 3% of the overall share in the global space economy. According to Morgan Stanley, the global space industry is expected to generate revenue of USD1.1 trillion or more in 2040, up from the current USD350 billion.

Given the space policy landscape, the state-owned agency has been solely responsible for all space-related activities and there have been limited opportunities for participation for the private sector. From scientific research projects to deep earth exploration and the launch and development of satellites, to preparing ground infrastructure for various needs, ISRO has juggled with multiple responsibilities and with fairly limited resources. However, the government's push for Digital India supported by other large scale digitization initiatives has created a strong demand for space-based services in the country that far supersedes the capacity that a public funded institution can deliver by itself.

Today India needs to drastically improve on building new propulsion technologies, that can not

> Ubiquitous and high-speed satellite connectivity enabled by high throughput satellites could be the enabler that can help bridge India's long-standing digital divide.

only carry higher payloads to meet enhanced national requirements, but also compete against the likes of commercial ventures like SpaceX, who have advanced capabilities that can carry much higher payloads and also use reusable rocket technology. ISRO can do this, and more, with close collaboration and strategic partnership with the private sector.

There are immense opportunities in the design and development of new satellites that suit the requirements of various agencies as well as foreign customers, where space focused Indian startups could contribute with their talent and skills. Ground stations are yet another important part of the satellite communications ecosystem – one that the private sector would find an attractive proposition. Besides, there are avenues of growth in the development of software solutions specifically required to leverage and make use of the large-scale data inputs from these satellites.

The time to leapfrog

With the focus on building Aatmanirbhar Bharat, the government wants the private sector to be a co-traveler in India's space journey – an idea that mirrors the policy interventions that catapulted the growth of India's telecom sector, opening the doors to the private sector. The opening up of the space economy through the new space policy is expected to unleash a new dynamism that was missing till now. This comes at a time when the space sector globally is attracting significant investment from private sector companies like Amazon, SpaceX, Softbank and OneWeb who are looking to grow the sector and explore opportunities on a global scale.

To achieve self-reliance and to increase India's share in the global economy, private sector investment is critical for the Indian space sector. Opening the sector for private players will have a multiplier effect. To begin with, within a short period of time, simple economic forces will determine and expand the opportunities that the sector can provide. Once that is done, investments will begin flowing in to help meet the demand for space-based applications such as satellite-based remote sensing, weather predictions, data connectivity and many others.

More competition will bring in more investments and lower the cost of services. A key example of this could be in the domain of internet services where Indian satellite data services are currently the costliest in the world. Given that India's mobile data prices are the lowest in the world, it stands to reason similar satellite-based services can be more cost-effective allowing for greater uptake by private and public enterprise and in-time, even individual consumers. VSAT operators in India today compete admirably with terrestrial options despite having a capacity and cost constraints imposed by the regulatory framework. In an ecosystem where the use of automation, artificial intelligence (AI), internet of things (IoT), and big data analysis will only increase, the role of satellite enabled services to make this possible cannot be underestimated.

As per TRAI, the total broadband connections stood at 765.09 million, as of February 2021. There were 742.84 million broadband users through mobile phones and dongles, while 22.26 million were using broadband through wirelines. Despite the mobile teledensity in India touching 87.26%, people across rural areas are still deprived of reliable and high-speed broadband connectivity. Ubiquitous and high-speed satellite connectivity enabled by high throughput satellites could be the enabler that can help bridge India's long-standing digital divide. The recent COVID-19 pandemic further highlighted this divide in terms of access to online education, healthcare or even vaccine distribution and remote access to government systems online.

The new space policy has been announced at a time when India looks to build an open and inclusive space ecosystem. This is bound to pave the path for greater democratization of space technologies. And, with the private sector all set to embrace the opportunity, there is no doubt that the country will emerge stronger in the space and eventually capture a larger slice of the global space economy. However, any further delay in the implementation of the new policy, or slow actions by Indian National Space Promotion and Authorization Center (IN-SPACe) may come with its own bearings – impacting the aspirations of over a billion Indians.

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Handset manufacturers back telcos across spectrum bands

Telcos in India have spectrum from 2G to 4G. By using Dynamic Spectrum Sharing, these bands can find use in deploying 5G NSA and SA, and for faster deployment.

BY HEMANT KASHYAP

Smartphone makers like OnePlus and Realme have announced that they will be launching smartphones in India with relevant 5G band support. The makers said that launching devices with global 5G band support will increase the prices for consumers.

Navnit Nakra, VP and Chief Strategy Officer, OnePlus India, said, "5G bands on 8 and 9 series have been decided based on Indian priority. N78 band is emerging as the priority band in India. The 5G message is very strong. Users will enjoy 5G in India and globally. Our intent for the Indian market is to provide 5G band support across the product line".

He also said that N78 will become one of the most used bands globally; research also shows that the majority of commercial 5G network will rely largely on the mid-band spectrum. This spectrum band balances coverage and speed, therefore forming the base of majority of the networks.

Madhav Sheth, CEO, Realme India, said that the brand will ensure C-band support, including N77 and N78 across its 5G portfolio along with various other 5G bands. "Across various price categories, we have support for multiple 5G bands, starting from our most affordable 5G smartphone. Realme 8 5G supports up to five 5G bands which are already more than what many 5G flagships in this country provide," he said.

The N77 and N78 bands, operating within the mid-band frequency range, will take 5G in India to masses, Realme said. The smartphone maker also said that these bands allow smartphones in the Rs 10,000 price point.

India's 5G spectrum situation

Telcos in India have spectrum from 2G to 4G. By using Dynamic Spectrum Sharing, these bands can find use in deploying 5G NSA and SA, and for faster deployment. Telecom service providers in India want original equipment manufacturers (OEMs) to support all existing bands, along with the new 5G bands. Recently, telcos had urged the Department of Telecommunications (DoT) to bring uniform guidelines to develop 5G ecosystem to ensure that any new 5G smartphone launched in India is able to support all bands, including mmWave spectrum.

Reflecting on the development, Tarun Pathak, Research Director, Counterpoint said, "If they (telcos) launch 5G on these bands, devices should be there to support these bands. The chipsets are already supporting most of these bands and it's up to the OEMs to provide the band support. Adding these bands makes RF more complex and adds to bill of material (BoM)." He also said that adding mmWave band will add more to the BoM. Therefore, smartphone makers should limit band support to premium devices.

As per Counterpoint, India may have an installed base of 30-40 million of 5G smartphones by the time the first commercial network goes live in the country. Pathak said that this is the first time device ecosystem is preceding network development at this big of a gap.

For now, 5G trials are on across the country – while Reliance Jio has a trial network running its own 5G RAN and core, Bharti Airtel and Vodafone Idea are partnering with European vendors Ericsson, Nokia and Korean giant Samsung.

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TRAI unlikely to revise spectrum base price

While the industry has been demanding lower floor price, TRAI's decision to hold its fort may delay the launch of commercial 5G services in India

BY HEMANT KASHYAP

India's dream for an early 5G roll out may be in for some stormy weather with the telecom service providers and the regulator – Telecom Regulatory Authority of India (TRAI) – not seeing eye to eye on the reserve price of spectrum in the mid-band earmarked for the new standard.

According to reports, the regulatory authority is unlikely to change the existing reserve price of spectrum, a decision that may translate again in low turnout at the 5G spectrum auction. It may, however, consider newer bands such as the millimeter wave (mmWave) band with a reasonable price to drive economic benefits.

Reports also indicated that TRAI might put at least 1 GHz of spectrum on sale, allowing telcos to drive countrywide 5G deployment. The sector regulator has already been busy conducting in-house studies to arrive at a suitable base price and quantum for the spectrum.

Telcos led by the Cellular Operators Association (COAI) have been asking the Department of Telecommunications (DoT) to seek reserve prices from TRAI for multiple frequencies. These bands, being used for field 5G trials, including mmWave band, will form the core of the network. Reports indicate that at least the industry's demand of a larger chunk of spectrum may be fulfilled.

The industry has been aiming to offer enterprise solutions around internet of things (IoT), artificial intelligence (AI), virtual reality (VR), and Industry 4.0 applications.

What is there for India's 5G rollout?

Telcos, particularly Bharti Airtel and Vodafone Idea, have been demanding a cut in the base price of 3.3-3.6 GHz band which was set up at Rs 492 crore per MHz by TRAI in 2018. What's more, the DoT had said that the unsold 700 MHz spectrum will once again be on sale in the 5G spectrum auction, along with the earmarked band.

However, in March this year, the coveted 700 MHz spectrum band did not find any buyer. At Rs 6,568 crore per unit, the band still remains a pipe dream for the telcos. In fact, none of the telecom operators bought the band during the spectrum auction in March with Bharti Airtel specifically pointing out that the band did not have any economic case for operators. Even, Reliance Jio and Vodafone Idea remained wary during the sale.

TRAI, however, believes that the price is justified and that the band remained untested. In 2019, it scuttled the DoT move to cut 5G airwaves pricing, and categorically said: "The authority reiterates the spectrum valuation and reserve prices as contained in its recommendations dated 1st August 2018."

Interestingly, DoT has allocated spectrum in not only the mid-band, but the 700 MHz and mmWave band too. The DoT wants the telcos to develop India-relevant use cases for this band. The telcos had also called this a moot point, since there were no guarantees that the government will make these bands available.

The situation remains unclear, though. If the government sticks to its spectrum price, 5G will not just come later to India, but it will also come at a much higher price. Without a proper spectrum portfolio, telcos can't deploy affordable and nationwide 5G.

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Getting ready for esports

With cloud networking, companies can make instant and dedicated connections to public clouds and data centres, to reduce latency during peak hours for gamers

BY AMIT SINGH

Esports and online multi-player games have exploded in popularity in the last decade. This industry is growing particularly fast in emerging markets such as Southeast Asia, India, and Brazil, where internet user growth is much higher than Western countries. In North America, internet users have grown 125% from 2010 to 2020. In contrast, internet users in Asia have grown 305% during the same period. Tournament live streams are also creating massive audiences cheering for their favourite teams.

According to Newzoo, Esports viewers topped 495 million in 2020 and may reach 646 million by 2023. Furthermore, companies are pouring marketing funds into Esports through sponsorships and advertising. The global Esports market valued at USD950 million in 2020 may grow to USD1.6 billion by 2023. During the COVID-19 pandemic, companies are expediting the process to provide high-performance online games and high-quality virtual Esports tournaments across the world.

This massive expansion has created IT challenges that need to be addressed to continue supporting growth. One of them is that multi-player games such as Fortnite, Warzone, and Apex Legends frequently push for mandatory updates. Also, players are required to

> Deploying edge cloud services can significantly improve the experience for gamers. Enterprises can instantly enhance their digital experience by creating a private network on demand.

> Content Delivery Network or Global Intelligent Accelerator can be used to distribute gaming content from one point of origin to servers located near the users.

update their video game before they start playing, unlike smartphone or app updates. This is for several good reasons: sometimes game-breaking bugs are discovered and exploited to give players an unfair advantage. Additionally, new maps, characters, or seasons are introduced to the game with added storylines or weapons, thus forcing players to update before they start playing.

The problem is particularly with data-intensive games where updates can easily reach 100GB. Imagine you come home after a long day of work. And then look forward to a relaxing evening playing video games with your friends, only to discover that your system needs to perform an update that takes six hours to complete! All this creates a negative user experience. Slow updates are also undesirable from the perspective of game developers as they lock out all users when pushing an update. So, the number of players who can play after an update release is limited, which also dependson the download speed of the servers at the developer's end.

It is important to note that most online multi-player games are developed in the US and Asia but are played by users worldwide. Out of the current 10 most popular online games, eight are developed in California and are immensely popular in Asia. For example, the highest-ranked players, based on tournament earnings for League of Legends and StarCraft II are from South Korea. In fact, Esports is so popular in Asia that it will be a part of the multi-sport event of the 2022 Asian Games. As gamers seek fast download speeds to maintain instant access to their favourite platforms, developers cannot just focus on the domestic market. They need to widen their scope to reliably deliver content to emerging markets such as Southeast Asia, South America, the Middle East, and Africa.

Yet another challenge with global live tournaments is delivering content with extra low latency, far below the human cognitive level. Since Esports tournaments are live games, all player actions must occur simultaneously. The initial solution was to host Esports live and have all players travel to this location, thus allowing developers to create a local network with the lowest possible 'ping'. However, the COVID-19 pandemic has disrupted this model since large gatherings are not allowed. As a result, online tournaments are being hosted. Moreover, demand will continue to grow beyond the pandemic since more casual players are signing up to play online tournaments. Thus, low latency is essential for the future of Esports.

Technologies to overcome challenges

On the infrastructure level, a globally distributed, full-mesh, and high-performing network backbone is critical. Even if you are on a public cloud already, you may want to consider a hybrid model to improve network performance and enhance the control of your infrastructure, especially in far-reaching markets such as China, India, Southeast Asia, and South America.

On the platform level, deploying edge cloud services can significantly improve the experience for gamers across borders. Enterprises can instantly enhance the digital experience for their users by creating a private network on demand.

Through cloud networking, companies can make instant and dedicated connections to public clouds and data centres. A reliable network can help reduce latency and jitters during peak hours for gamers. When they try to access content, intelligent routing can direct their request to the nearest server. Companies can also improve the experiences of gamers spread across the globe by using a Content Delivery Network (CDN) or Global Intelligent Accelerator (GIA) to distribute content from one point of origin to servers located near the users.

Another measure that game developers can take is optimising updates for areas with high demand, such as Southeast Asia and South America. This can enable all gamers to have their updates at roughly the same time. This technology also reduces the peak load on main servers, creating a more reliable update delivery network and minimising server downtime issues. Such benefits make edge cloud services like cloud networking, CDN, and GIA the most optimum solutions for Esports as well as online gaming companies with IT challenges that are looking to operate globally.

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End of the router as we know it

The changing nature of internet services and applications are driving manufacturers to develop better and cost-effective router systems

BY HANNES GREDLER

Since its beginning in the 1980s, network routers have evolved significantly. The greatest leap in development was observed when the World Wide Web was introduced. Network providers were suddenly faced with the challenge of having to keep up with the rapid introduction of internet services and the demand for bandwidth-intensive applications. In order to meet the demand, they invested enormous amounts in networks, which they had great difficulty in refinancing. They asked network equipment manufacturers to help them build value-added services, which in the years that followed led to a flood of new features that are now available for almost every router.

Critics argue that by adding new features but not removing obsolete ones, the cost of the routers has risen so much that they are no longer in proportion to the actual benefits. James Hamilton, VP and Distinguished Engineer at Amazon Web Services expressed this observation as follows: "The network is anti-Moore." In this context, here are some functions that have become redundant in the course of the current technical developments.

Hardware-buffer

In their Paper Sizing Router Buffers (2004), researchers at Stanford University describe their observation that buffers with a depth of up to 2000 ms are clearly suitable for services with low bandwidth and data stream diversity. But at speeds of 10 GBit per second and diversity of up to 10 million data streams, the advantages of buffering become extremely doubtful with a typical internet backbone connection.

The benefit is also questioned by the fact that there is no signalling to the Transmission Control Protocol (TCP) layer during "buffering". Most routers, however, still support a buffer depth of over 100 ms for 100 Gbps switching. A simple calculation shows that 1.25 GB DDR4-RAM is required for every 100 GBit/s port in a given router.

Exactly this DDR4 RAM, sometimes the most expensive form of RAM, makes the buffer the biggest cost driver for today's router hardware. Not only is it needed for a function that rarely works with today's internet backbone usage patterns. At the same time, it must be implemented as off-chip memory, which increases the cost of external I/O, power consumption, and cooling.

Hardware-forwarding tables

The second-largest cost factor for a router's data level is the size of its forwarding table. Modern hardware can store approximately two million forwarding entries in its IPv4, IPv6 and MPLS forwarding tables. The design of this forwarding engine is based on two basic ideas.

n One, a single forwarding entry can have a high data consumption. In fact, a single prefix can take up the entire bandwidth of a connection. This is still relevant today as content delivery networks and Web 2.0 companies direct a large part of their Internet traffic to just a few IP prefixes.

n Two, all forwarding entries can carry the full connection bandwidth. This no longer applies today. Traffic per prefix on the internet has increased exponentially, which means that the chip design for data forwarding has to be radically revised. Instead of treating each IP forwarding entry equally, a memory cache hierarchy is much more practical. This is comparable to today's computer designs: a tiered memory hierarchy with different levels of memory, each with different speeds, with adequate costs.

Traffic per prefix on the internet has increased exponentially, which means that the chip design for data forwarding has to be radically revised.

> To ensure that functions can be added and removed smoothly, the code should be structured in a way that it can be put together from individual blocks of code.

Modern IP routers still work at only one storage level, on the assumption that every forwarding entry must be fast. However, if you take a closer look at the analysis of the real backbone traffic data it is no longer the case. In fact, the forwarding tables for contemporary practical use are now 10 times oversized.

The good news is that the hardware can be easily optimized. Customers only need to clearly formulate what is usually required so that the next generation of forwarding hardware can be adapted accordingly. Network software, on the other hand, is a very special kind of problem.

Software features

It is difficult to say which software functions are actually redundant and which are not, since these depend on the individual needs of the telecommunications company. Over time, manufacturers have developed a wide range of features at the request of network operators and inserted them directly into the code. However, this procedure makes it impossible to deactivate certain functions after implementation. This can quickly become a cost factor as network operators have to pay for these features even when they are not being used. At the same time, when a new function is introduced, interference tests must be carried out every time for all existing functions – even for those that are not required.

The background to this is that the software for the router was previously programmed as a monolithic system, whereby new functions were closely linked to the underlying infrastructure. The removal of such functions from the code base can be as complex as their original development. At the same time, the hurdle for a functional expansion increases with each new feature.

In today's highly competitive telecommunications market, however, service providers rely on their systems being agile, easy to maintain, and tailored to their needs and those of their customers. Accordingly, router system manufacturers have to develop a new, more cost-effective approach that enables network operators to flexibly and smoothly manage, update and, if necessary, remove functions.

The solution = Disaggregated Systems + Distributed SDNs + Modular Code

The first step in the right direction is the disaggregation of hardware and software. This allows network operators to choose between different bare metal switches and validated network software for them, and to take advantage of the latest chip generations and thereby strengthen their innovation potential. However, this means that the responsibility for function management lies entirely with the network operators. A distributed software-defined network (SDN) offers the ideal conditions for this. It combines the advantages of an SDN with the advantages of a distributed control level and thus enables smooth management of the software.

To ensure that functions can be added and removed smoothly, the code should be structured in such a way that it can be put together from individual blocks of code. These should be able to be supplemented or taken out again as desired, whereby there should be no interdependencies between the blocks. An "internet-native" approach can help here. Independent micro services are used, which are carried out in containers. If a new function or an update is required, a corresponding container is supplied by the software developer, which updates or adds the respective feature within milliseconds and without interrupting the service. In this way, route processing, updating, and restarting are 20 times faster than with conventional router operating systems. If open interfaces are also available, network operators can even develop and implement their own functions.

Traditional routers and dynamic control systems are challenged by new concepts such as disaggregation and distributed SDNs. These promise significantly faster implementation, automated control, and a shorter time to market. In order for future router designs to meet these challenges, fundamentally new router hardware and software must be developed, and modern software architectures and paradigms introduced.

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"India is transforming into a wireless-first nation"

Juniper Networks is one of the largest networking solutions providers across the world, with over 9,000 employees in 70 countries. Founded in 1996, the company excels in networking hardware and software solutions for enterprises. As Juniper Networks Systems Engineering Director for India and SAARC, ***Pankaj Kitchlu*** *handles the company's telecom service business in the region. A man with rich industry experience – having previously worked with Bharti Airtel and Reliance Communications – he talks with* ***Hemant Kashyap*** *about the recent developments in telecom and networking sector and how it is shaping the future of connectivity. Excerpts:*

We have seen great digital adoption across the board from every kind of industry over the past 2-3 years. What do you think has driven the change?

Digital adoption will only continue to grow as industry players introduce more natural ways for people to interact with technology through sensory inputs such as touch, speech and gestures. This first started with the widespread adoption of touch-based smart devices. Then, it led to an increase in demand for ubiquitous wireless connectivity and need to access applications in the edge and cloud.

This transformative shift has resulted in the staggering need for businesses to stay constantly connected and digitize processes and operations. The pandemic has contributed more conversations around digital transformation strategies in boardrooms. However, it has also brought to light the importance of quality user experiences. Looking ahead, the industry will need to shift its focus towards delivering superior user experiences. User experience should be seen as the single most important metric for measuring a successful IT infrastructure.

The ongoing digital revolution has certainly seen digital adoption at an unprecedented level. Do you see the momentum continuing in the near future?

The digital revolution is here to stay and platforms, which are innovative and create unique experiences, will come out on top. Some of the key factors that will fuel mass digital adoption include the edge cloud, AI and 5G.

These technologies will help fuel digital adoption amongst companies that will heavily rely on real-time analytics and always-on connectivity. In terms of industries that will embrace this change are organizations in healthcare, manufacturing, transportation and other critical industries that will all be at center of this digital revolution.

We will also see more companies introducing application that offer advanced features to provide superior user experiences. For example, now we are seeing the rise of telehealth services giving patients the convenience to seek medical care from the comfort of their own home. Technologies such as augmented reality (AR) and virtual reality (VR) have the potential to transform several industries including retail, e-commerce and civil engineering.

How well has Indian industry coped with the pandemic? Was there anything you would have done differently?

India, in particular its IT services industry, has remained resilient and continues to grow both domestically and globally. This resilience has helped to mitigate the impact of the pandemic. For example, early adopters of digital platforms in India have managed to remain stable and are now experiencing growth.

> This transformative shift has resulted in the staggering need for businesses to stay constantly connected and digitize processes and operations.

The pandemic has also brought the spotlight on the importance of disaster recovery sites to safeguard business continuity, especially with the industry-wide supply chain constraints. In addition, organizations now understand the need to build resilient network architectures that can mitigate disruptions, while provisioning for sudden spikes in network traffic and bandwidth demands.

Furthermore, India is transforming into a wireless first nation with demand for connectivity reaching an all-time high. As such, more investments need to be made into the country's fibre networks to keep up with the demand. With 5G on the horizon, there will be potential to introduce both B2C and B2B use cases; fibre networks will play a significant role in the success of the rollout.

Cloud and Edge Computing is fast becoming the priority of network operators. How important do you think edge computing is to telecom service providers and other network operators?

Edge computing is increasingly viewed by service providers from a quality of experience lens. With latency going down from hundreds of milliseconds to less than ten milliseconds, round-trip delays will be significantly reduced or even eliminated. This will bring the possibilities of the edge cloud even closer for enterprises to execute in the market.

For example, applications that need instant feedback to facilitate quick decision-making will rise in prominence. Use cases include automobile manufacturers introducing autonomous cars, as well as healthcare institutions exploring the use of robotic-assisted surgery tools. Essentially, edge computing offers enterprises the opportunity to introduce cutting-edge services and solutions to stay ahead of the curve.

Another key technology change making this possible is the separation of mobile User Plane Function (UPF), which can now be located now on the edge cloud within the enterprise or on private on-premises edge. Native support for edge computing and flexible UPF placement, introducing Service and Session Continuity (SSC) allows Make-Before-Break connectivity.

Edge cloud on the telco premise would make sense for enhanced broadband use cases like entertainment, gaming, retail and logistics. Another slice of the edge cloud might move into the enterprise space where low latency and real time nature are key priorities for the manufacturing, healthcare and finance sectors. A hybrid edge makes sense when you must balance both mass and low latency in the energy and automotive industry.

In today's landscape of omnipresent threats, security needs to remain top of mind. Enterprises should focus on moving from detection to enforcement without any manual intervention. Real-time cyber attacks are very much a reality today. Therefore, it is crucial that all touchpoints are secure to ensure uninterrupted and seamless operations.

5G is fast becoming the network of choice for many Industry 4.0 applications. What are some of the crucial enterprise-level use cases for 5G?

The adoption of 5G can be seen as the first generation for enterprises, and the fifth generation for consumers. This is because in the past three decades, majority of developments in next-generation networks were focused on consumer use cases. However, this will shift due to the focus on Industry 4.0.

More and more enterprises are becoming open to the adoption of 5G technology. This will result in a wave of innovative and advanced Industry 4.0 use cases pioneered by enterprises. Furthermore, two other factors that will fuel this mass adoption is the shift towards edge cloud computing and AI. Both of these will work in hand in hand with 5G to make the enterprise transformation journey simpler.

We are witnessing early adopters changing their architecture needs based on business model offerings. Furthermore, the readiness of enterprises to adopt 5G to refine their offerings, as well as country level initiatives by

> In the past three decades, majority of developments in next-gen networks were focused on consumer use cases. However, this will shift due to the focus on Industry 4.0.

the government and regulators are factors that will drive 5G investments.

What will remain consistent is the basic need to deliver connectivity for organizations sectors like logistics, sports, entertainment, tourism, retail and other sectors that are driven by consumer demand. Same is the case with manufacturing, robotics, automotive, mining, ports, and verticals that depend on low latency to streamline productivity and efficiency, and sectors like healthcare, Fintech, and other industries that are time sensitive and require precision. Connectivity is also critical for smart cities, utilities, public safety, transport, and mission critical industries.

So far, India has focused on improving existing networks than working on rolling out 5G. Do you believe that is the right call?

India is still focused on getting the 4G experience right, and in the last two years, service providers have been focused on setting quality of experience standards instead of mass network rollouts. That said, data consumption in India has reached an all-time high and continues to grow, which also means that a 5G rollout will be crucial in meeting demands.

The solution to this challenge can be found in planning ahead and having a long-term vision of how 5G work will work and what are its benefits. To achieve this, a significant amount of investment needs to go towards the metro, aggregation & access to upgrade from 10/100G to 400G port connectivity.

What this also means is that a lot of time and resources need to go towards developing this transport layer to be ready for 5G on day one. In this way, service providers can start looking at developing architecture for the network of the next decade to meet the demands of future growth and experience a more seamless transformational journey down the road.

IoT, especially NB-IoT, has been gaining traction for the past few years. With 5G on the horizon, do you see IoT-powered enterprises in the near future?

IoT has always been present, but what will change in the next generation is an ecosystem of smart devices and sensors equipped with edge computing. IoT-powered enterprises regardless of vertical can now grow and developing a services mix, which they can offer more broadly. Furthermore, the cost and strong business use cases of IoT will drive growth of IoT in India.

In addition, with the massive influx of data from sensors and devices, enforcing security policies across every point of connection could be a starting point for enterprises to think about creating smaller cyber attack surfaces. Juniper Connected Security for example unifies all network elements into a threat-aware network.

What does the next generation of connectivity hold for Juniper Networks?

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We are also focusing on 400G inflection, metro and access networking, and automation for a superior service experience. In particular, our Paragon Automation suite provides end users with an assured service experience throughout the life of their service.

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Ajai Chowdhry, Founder, HCL

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Digitisation – a catalyst in transforming society.

Samar Mittal, Nokia

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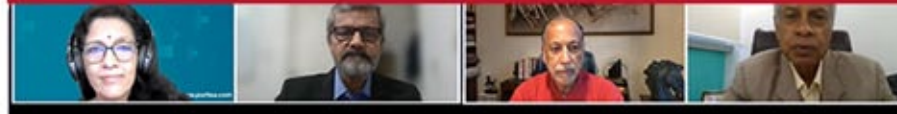

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[COMMENTARY]
SATTELITE BROADBAND

Let us talk about the price point

LEO, MEO, ICO, or GSO satellites? The government needs to take a serious look at how effective any of these could be for India before saying yes

BY BRIJENDRA K SYNGAL

There is so much of print media space being occupied with various satellite companies vying for the burgeoning data hungry market in India knocking away at the doors of Sanchar Bhawan that tall building in the centre of Delhi, and custodians of anything telecommunication. The tagline of all is fast speed broadband, without ever mentioning or defining fast broadband, that moving forward how it will gel with Aatamnirbharta (self-reliance).

These projects some three of them, and of course the ubiquitous, tried and tested old horse of geosynchronous satellites, which barring latency for certain applications is ideally suited in terms of throughputs, capacity and deploy ability. They are being bandied around as the saviour of broadband internet connectivity; anytime and anywhere to watch Netflix inside, say Atal Tunnel in the hills, in the name of low latency that it offers.

What has low latency to do with Netflix, one might ask? This is quite akin to the Pepsi way of hyping their drink. PepsiCo had envisioned marketing Frito-Lay snacks alongside Pepsi-Cola soft drinks. In an interview with Forbes in 1968, PepsiCo CEO Donald Kendall summarized this by noting that "Potato chips make you thirsty; Pepsi satisfies thirst." His plans of jointly promoting the soft drink and snack products were thwarted later that year, when the Federal Trade Commission ruled against it.

So is this a case of creating Netflix addiction to create demand?

Geosynchronous Satellite Orbit (GSO) can carry far more powerful signals than needed for Netflix. As the story unfolds about the real efficacy of these systems, and price points well beyond the pockets of ordinary Indians, it appears much ado about nothing. The past record of these systems has not been that great. At the best they can be described as hobbies of the promoters, like building Meccano sets.

Unless questions like real capacities, audience they can address simultaneously, and the applicability in our environment is asked, the systems are pure simple glitzy, pipe dreams. Let the price points be produced in terms of tariff per bit/byte.

I am not against induction of technology, having lived with cutting edge technology since the early sixties. In the mid-eighties I had my first encounter with Low Erath Satellite (LEO) system christened Iridium on the basis of the atomic number of the metal involving 77 satellites, which subsequently got reduced to 66, but the name stuck on. This US-promoted system raised some billions of dollars, finally going up in smoke and chapter 11, the saviour of all. Each satellite can have four inter-satellite links: one each to neighbours fore and aft in the same

> Project Loon began as a research and development project by X (formerly Google X) in 2011. In January 2021, it was announced that the company would be shut down.

orbital plane, and one each to satellites in neighbouring planes to either side. The total setup cost for the first-generation fleet was approximately USD5 billion.[The first test telephone call was made over the network in 1998 (11 years), and full global coverage was complete by 2002. And even though the system met its technical requirements, it was not a success in the market.

Insufficient market demand existed for the product at the price points on offer from Iridium as set by its parent company Motorola. The company failed to earn revenue sufficient to service the debt associated with building out the constellation and Iridium went bankrupt, one of the largest bankruptcies in the history of United States at the time.

This was followed by 288 satellite system of Teledesic that gained early funding from Microsoft Chairman Bill Gates, McCaw Cellular Communications founder Craig McCaw, and Saudi Prince Alwaleed bin Talal. The system would have used Ka band to send and receive signals from users. Each satellite would have acted as a node in a large-scale packet-switching network. The service was planned to begin in 2002 with a total cost of the project estimated at USD9 billion.

The initial rollout was to include 12 orbit planes with 24 spacecraft in each plane. The antenna footprint for each satellite was to be about 700 km. Teledesic planned 288 satellites in 12 low earth orbits, each at an altitude of 1,315 km, but the project was still born after some USD10 billion was proposed to be spent (1997-2002). This was followed by two Intermediate Circular Orbit (ICO) satellites (1995-2003), and Globalstar. ICO after raising USD6-7 billion dollars died. Globalstar survives. Iridium too survived after chapter 11, when sold for USD66 million. And there were others collapsing at the drawing board level.

Yet another one to collapse was Project Loon of Loon LLC, an Alphabet Inc. subsidiary working on providing internet access to rural and remote areas. The company used high-altitude balloons in the stratosphere at an altitude of 18 km to 25 km to create an aerial wireless network with up to 1 Mbit/s speeds. A reference to the balloons used, Project Loon began as a research and development project by X (formerly Google X) in 2011, but later spun out into a separate company in July 2018. In January 2021, it was announced that the company would be shut down.

India invested some USD700 million – by a consortium led by IL&FS and SBI as the anchor promoter, and USD150 million of VSNL money respectively on these two systems in 1990s. Their ground stations are mothballed at Dighi near Pune and Chattarpur in Delhi. The main reasons for the failure were inordinate delays from concept to commissioning, unrealistic tariffs at USD8 per minute and addressable audience of few million or so. In the meantime the GSM swept the world with Tsunami-like force, further eroding the applications, utility, and viability. The capacities on offer were not much to write home about.

OneWeb, too, has come out of chapter 11, rescued by the Government of the United Kingdom and Sunil Bharti Mittal. Let us come to the central point: are these systems really capable of delivering or are they taking for a ride our gullible system built more on public perception than merits, supported by hard numbers? What more are they promising, except broadband for all and Netflix inside Atal Tunnel?

A quick look at the details of the three companies engaged in satellite-based internet projects reveals that Telesat is the most efficient system in terms of average Gbps/satellite, with more than 4x SpaceX and 10x OneWeb. It is also important to note that the limiting factor for SpaceX is the ground segment, as they need to deploy a very large number of ground stations and gateways to operate at full power. For OneWeb, the space segment will prove to be the limiting factor (user links data-rate).

So what is this tall talk of broadband for all? Either one must revise the broadband definition or ask how they propose to service some millions of Indians, data hungry aspirants. Elon Musk the Starlink promoter has himself admitted that the system is designed to meet 19 million unconnected in US, with such a huge investment. For him this is self-fulfilling, self-promoting venture, but how does he intend to address the market in India and that too at unexpectedly exorbitant price points, to recover his costs?

OneWeb appears no better placed than Starlink. Yet on the horizon is Jeff Bezos promoted Kuiper. Here are some

> The limiting factor for SpaceX is the ground segment, as they need to deploy a very large number of ground stations and gateways to operate at full power.

The Satellite Broadband Stats

	Telesat	OneWeb	SpaceX
No. of satellites	117	720	4,425
Max FWD capacity	2.66Tbps	1.56Tbps	23.7Tbps
Min ground locations	42	71	123
No. of ground antennae for max FWD capacity	221	725	~3,500
Required number of gateways per ground station	5-6	11	30 –
Average data-rate per satellite (real)	22.74Gbps	2.17Gbps	5.36Gbps
Max data-rate per satellite	38.68	9.97	21.36 Gbps
Satellite efficiency	58.80%	21.70%	25.10%
No. of customers per satellite at 50 mbps	5000	450	1100

Source: Massachusetts Institute of Technology for the 69th International Astronautical Congress, Bremen, Germany. 1 October 2018
Note: Approximate umbers. The numbers might increase based on the statistical data of user pattern

conclusions with hard numbers.

- **OneWeb:** 1.56 Tbps with 71 ground stations (720 satellites)
- **Telesat:** 2.66 Tbps with 40 ground stations (117 satellites)
- **SpaceX:** 23.7 Tbps with 123 ground stations (4,425 satellites)

The most effective system in terms of Gbps/satellite is Telesat (22.7 Gbps/sat), thanks to the low number of high capacity satellites, low elevation angles to user links, use of ISL and digital payloads, and use of two active gateway antennas. SpaceX constellation, on the other hand will require an extremely large ground segment with hundreds of ground stations and ~3,500 gateway antennas to operate at maximum throughput. OneWeb's constellation could significantly reduce their ground segment if they had used inter-satellite links (even at moderate data-rates ~5 Gbps).

The western world model is simply based on creating hype, lure into creating a third party interest, seek investments worldwide, and eventually use their technology prowess to benefit and deliver. Where would all these figure in terms of self-reliance, our NDPC 2018 policy of broadband for all and USD100 billion investments? These are tough questions that must be asked and addressed with hard numbers, not whistling in the winds.

Be that as it may, and as foretold above, the questions arise: what actions must the government take or what should it ask these ventures to do before they are allowed to enter the data hungry, price sensitive market in India.

From the above description one does not feel convinced whether they can fulfil their tall talk of internet for all and that too at USD99 a month, and entry fee of USD499.00 (Starlink). It would be the same story as in the cases of Iridium et al. Even if that is given, how many customers realistically would they be able to address. Let us talk numbers, with price points

They must apply for all clearances in the same format as applied for in their backyards, like FCC, OfCom and various other European regulators, and complete transparency in setting up adequate number of gateways with state of the Legal Intercept Mechanism on the basis of CALEA law in US, and European laws, at their expense. Let them not look at any government funding.

The government would be well advised to take all actions for compliance before they generate third party interest a la Twitter, Facebook, and Google, etc. How does all this match with local manufacturing of customer premises equipment, ground stations and satellites?

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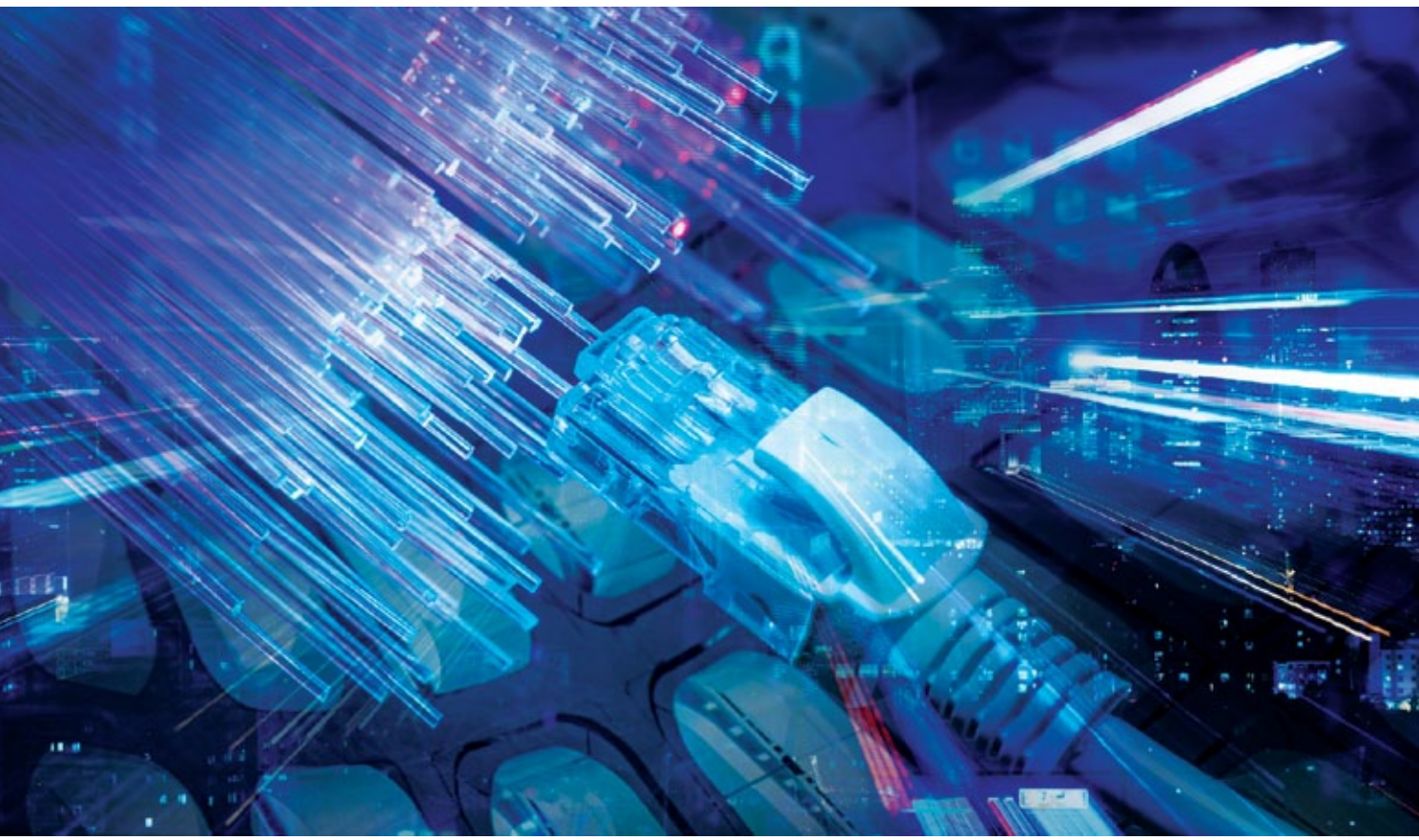
[COMMENTARY]
BROADBAND

Together we can go digital

Despite a massive shift towards everything digital, rural India still remains largely unconnected. It's time for all stakeholders, including the government to act



BY V SRIDHAR

The anniversary of the signing of the first International Telegraph Convention and the creation of the International Telecommunication Union (ITU) on 17 May is celebrated as the World Telecommunication and Information Society Day (WTISD) every year, and the theme for 2021 was "accelerating digital transformation in challenging times". In his message on the day, the ITU Secretary General Houlin Zhao indicated that agency would use the occasion to unite the world in pursuit of digital transformation in every field of business and all

> Telcos, the backbone of digital transformation, have been hit hard due to excessive regulatory burden and intense competition from the internet firms.

> There is a shift of about 35% profit from telcos to internet companies. India continues to fare poorly in terms of regulatory levies and supply of radio spectrum.

aspects of life. He also released an advocacy toolkit for enabling the same.

It is in this context that we need to salute the digital platform startups. These companies have made our daily lives much easier, especially during the pandemic. Today, these start-ups deliver food to our doorsteps, offer home-based teleconsulting to address our health concerns, provide over-the-top (OTT) entertainment to tide over these depressing periods, and deliver digital education to millions when physical schools and colleges are under lockdown. These companies have also enabled us to work from home (WFH), and more, to eventually protect our health and safety.

No wonder then, the year 2021 is most likely to be remembered as the year of start-ups. In fact, the Indian unicorns such as Zomato, Delhivery, Flipkart, Freshworks, InMobi, Nazara, Ola, Paytm and Policybazaar are expected to list their initial public offering (IPO) soon. It has been quite some time since VSS Mani went for IPO of JustDial in the Indian stock exchange and Deep Kalra's MakeMyTrip listed at NASDAQ. Hopefully the financial institutions and retail investors will give the required boost to these IPOs resulting in these start-ups generating enough finance for furthering their investment to scale up their operations and provide the required societal support during the seemingly unstoppable pandemic.

While businesses have been embracing digital transformation to improve their efficiency of operations and provide personalized services, digital adoption of government services, especially in healthcare has seen a strong uptake. Criticisms apart, starting with Aarogya Setu, followed by the CoWIN platform, the government has been able to manage to contain the spread of the pandemic and provide health alerts in a timely manner. It has also helped improve vaccination scheduling and issue digital vaccination certificates.

The unified payment interface (UPI) pioneered by the National Payment Corporation of India (NPCI) has witnessed unprecedented growth in adoption, with staggering 22 billion transactions in 2020-21, valued at around Rs 40 trillion. This is not far behind the transaction volume of 20 billion with a value of about USD one trillion processed by PayPal, which is one of the largest payment services in the US. The Aadhaar authentications have reached a record rate of 47 million on 22 June, indicating the extent of adoption of Aadhaar authenticated services.

While all the above are taking place around us, there are also concerns about these digital initiatives not reaching everyone. In fact, those in rural areas are not able to reap benefit of this digital transformation due to poor internet connectivity. There have also been concerns about the reliability and robustness of these digital services, especially during times of crisis. As per ITU, reliable high-speed internet access that is a necessity for availing any of the digital services still evades more than 65% of rural households around the world. About 3.7 billion people around the world are without internet access. Even with a very weak definition of broadband (512 Kbps downlink speed), more than 300 million mobile subscribers in India do not have one.

Telecom continues to be the backbone of digital transformation. However, telecom companies have been hit hard due to excessive regulatory burden and intense competition from the internet firms. Recent McKinsey report indicates that there is a shift of about 35% profit from global telecom firms to internet companies. India continues to fare poorly in terms of high regulatory levies, inadequate supply of radio spectrum that is essential for providing mobile broadband services, and poor supporting infrastructure such as right-of-way and fibre connectivity.

To reap the benefits of digital transformation, everyone has a role to play – teachers nurturing their students on digital skills, youngsters promoting digital awareness amongst senior citizens, businesses providing user-centric digital services, telecom operators deploying reliable high-speed internet access, and governments implementing a comprehensive digital policy to address the needs of the citizens.

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[COMMENTARY]
COMMUNICATION

C for communication, C for caution

Having ever improving technologies is advantageous but the security risks and the ethical challenges still need to be solved

BY RAJAT SINGHANIA

In 1999, Bill Gates wrote 'Business at the Speed of Thought'. He predicted that the world would be a very fast place, and it would belong to those that have the information and the ability to process the information quickly. Success would become a function of data, information, inference, speed of action and agility to intervene. The pace of information and communication technology (ICT) has already proved his prophecy correct, as we have progressed way beyond the ringing landlines, letters, pagers and post offices.

The modern communication post – box has evolved from emails into instant messaging platforms that can deal with live streaming, videos and pictures – much beyond the mundane text messages. And the speed at which information is getting transmitted around the world is mind-boggling. The challenge at hand is how to process this huge amount of data, keep it safe while also making it accessible.

If we look at what is the expected future of communication, it would seem like a Sci-Fi movie – you think of someone and immediately, the other person gets a buzz that he is required, and sets up the antenna to catch the thoughts. Technology may actually enable us to network directly into someone else's brain, and communicate without a barrier.

We're decades away from such technology, but scientists have already been working on creating brain-computer interfaces that allow people to transmit thoughts directly to a computer. As Futurologist Dr. Ian Pearson, whose job is all about forecasting the future said, "By 2050, we'll be communicating through a form of telepathy from thought recognition technology." However, till then we will have to take care of our data and build safe technology for communication. The tech experts have been talking about Wi-Fi 6 and 5G, designed to deliver faster data-transfer speeds and simultaneously support more devices. While Wi-Fi 6 is a better way to connect to the internet indoors, enabling the gadgets inside the home to communicate with each other, 5G is a better way to connect to cellular networks while on the move.

> The speed at which information is getting transmitted around the world is mind-boggling. The challenge is how to process and keep it safe while making it accessible.

Technology has been called many things – lazy solutions, decreasing face time, losing human touch, addictive – but the reality remains that this will remain the preferred way of communication due to instant, fast, immediately sent reminders, automated programmed mailers etc. As better technology empowers the communication strategy, slowly 'geography is becoming history'. Physical distances are becoming less important. People are even able to partake in social customs and festivities through technologies. In fact, in some way, digital enablers and technology has helped the differently challenged to communicate better.

However, with anything that has such a lot to offer, there comes a downside. Security and ethical challenges will remain an issue with digital communication. Safety of the channel used, and ethics of the service provider along with security of the data need to be addressed first hand. We need users' awareness and communication hygiene to make the best use of the digital onslaught we are going to witness.

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Add a punch to your business communication

In this anywhere, anytime workplace era, collaboration tools and solutions complement email and enhance synergy; allowing to get more work done – at record speed

BY PRAMOD SHARDA

The history of the web has its origin within the efforts to create and interconnect computer networks that transpired from research and development. Now that the internet has completed 25 years of its existence in India it is very difficult to even imagine life without it. The accessibility of the internet has brought in oodles of changes in our daily lifestyle which is almost impossible to be undone. Today technology has transformed drastically from what it was a few years ago owing to the increased access of the internet.

A major gift of the internet has been emails and email solutions also fine-tuned as collaborative solutions. The internet replaced the traditional mode of communication with the onset of emails. The first email was an experiment to see if two computers could exchange a message. The two computers were stationed side by side maintaining a physical connection through the ARPANET, which belongs to one of the first computer networks of the world. As the internet communication developed, basic emailing that began with Hotmail later

> Equipped with free-flowing chat, collaboration solutions allow every member to interact directly, instead of answering one question at a time.

> Team collaboration solutions provide persistence. It helps you connect to every client – be it a desktop client, a mobile client or an online web browser client.

continued on numerous applications. From handwritten letters to sending multiple emails, systems and solutions have metamorphosed the written communication.

Email communication has become the king of business communications lately, leaving behind desk phones and calling between colleagues. With the introduction of email communication, dissemination of information occurs at a better speed and at a considerably convenient time. Email offers a single platform/place wherein one can track all the necessary information pertaining to that very organization, for example, contacts, incoming and outgoing messages, chats, calendar, etc., while keeping everything synced and organized.

Today we have a 360-degree solution which allows us to communicate officially with people via team chat and video calling and also do real-time collaboration editing and book appointments via email calendar and so on. With the progress of technology, people's skill sets are getting increasingly specialized, and collaboration as a practice has become more important today than ever. Collaboration in workplace helps in carrying out teamwork successfully.

The introduction of 'team collaboration solutions' has been a major shift. In today's world numerous collaboration solutions are making waves in the market. Drifting the focus away from email, these team collaboration solutions permit individuals to be more productive, get more work done, and at record speed. Mostly based on the cloud, these solutions keep files intact at a designated destination where one needs them, while also allowing persistence in the messages.

Since the collaborative solutions are here to stay, let us understand how it can be beneficial for an individual and the business.

More than just communication

Team collaboration solutions plan out communication in an efficient way. It focuses majorly on the content rather than the message. Equipped with free-flowing chat, collaboration solutions allow every member to interact directly, instead of answering one question at a time.

The structure of these solutions further allows employees to join in at a convenient time and catch up on everything missed, and pitch in or actively get involved when something significant comes up.

Team collaboration solutions provide persistence, it helps you connect to every client – be it a desktop client, a mobile client or an online web browser client. With its chat and file hosting, one can access any information on the go and get the required work done.

These solutions also help an individual or the organization in staying organized by categorizing their teams and projects into specific rooms or conversations. This in turn cuts down time wasted in looking for files between different emails, thus making one much more productive and proactive.

Organizations often lose out on their data. However, with team collaboration solutions, data never leaves the room. Data is vital to the task at hand, and when shared via collaboration solutions, the file lives directly in the room. This way one can act, react and keep making any necessary changes in the file without losing any crucial data.

Get customized solution

Collaboration solutions are highly customizable as they are tailor-made for an organization keeping in mind the needs and demands. One can fully customize their solutions to withstand a truly unique experience, bridging the gap between tools. Various simple additions like chatbots allow users to keep ongoing task lists right in their collaboration room. Additional features including reminders and easier methods of file sharing make these solutions highly desirable.

With time the workplaces have undergone major changes, from their working to the use of tools. Once the leader of communication, the email has now been replaced to an extent by collaboration tools and solutions. It is appropriate to say that they have brought in a paradigm shift in how businesses operate today. While they may never completely replace email communication, these solutions will certainly work to complement the flow of emails.

Sharda is the CEO India and Middle East, IceWarp

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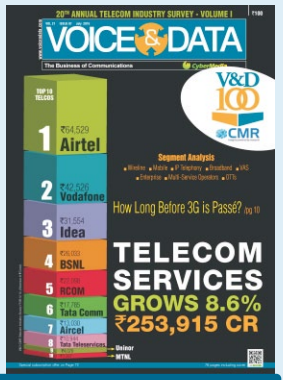

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Angira Agrawal
Chief Operating Officer, Skylo Technologies

"NB-IoT has broadened the future of IoT"

Skylo Technologies has been making headways in providing enterprise-grade internet of things (IoT) solutions. It provides mission-critical use cases to industries such as logistics, farming, fishery and railways. The company has recently announced a partnership with Inmarsat to deliver commercial NB-IoT solutions via satellite. Its Chief Operations Officer ***Angira Agrawal*** *has a vast industry experience across technologies like cloud, IoT, networks, and enterprise software. In an interaction with* ***Hemant Kashyap*** *he talks about IoT, NB-IoT, and what the future holds in store for the industry. Excerpts:*

How has the role of NB-IoT changed in the 21st Century?

Narrowband IoT (NB-IoT) is a wireless communication standard for low power wide area networking (LPWAN) technology. This technology allows for a wide range of new IoT devices and services. Implemented well, NB- IoT creates new connected business models for traditionally 'analog' industries such as fisheries, agriculture and logistics/supply chain with multiplier effects on the Indian economy.

IoT deployment will accelerate the vision of a true Digital India. It will connect millions of sensors and machines so that anyone can gain actionable insights vital to business proliferation. Disruptive IoT solutions have an opportunity to serve the underserved by bringing affordable and easy IoT to the critical machines that run our businesses.

NB-IoT is still being called a developing technology, where do you see NB-IoT in the next decade or so?

NB-IoT has broadened the future of IoT, providing significantly improved communications between machines while lowering device power consumption needs. We provide an end-to-end narrowband IoT solution that connects machines and sensors. It can deliver up-to-the-minute insights from data collected, across a wide range of use cases. Our satellite-based network can bring real time data connectivity anywhere, even in the most remote geographies. Existing networks have been designed to connect people. However, machines require a new kind of network to operate reliably for the ~80% of geographies that are either sparsely populated or, like the ocean, entirely unconnected. We offers 100% connectivity, versus the ~70% (sometimes much less) that businesses typically receive today.

It is easy to say that NB-IoT is the future of device and sensor communication. The industry has made rapid progress over the recent few years. This is even more true in a country like India; where there are large expanses of population living in underserved and remote areas. As such, India offers a huge growth potential.

GSMA reports that there are 136 operators with NB-IoT networks in 64 countries. Do you think the technology has the potential to connect devices across the world?

NB-IoT provides significantly improved communications

> Disruptive IoT solutions have an opportunity to serve the underserved by bringing affordable and easy IoT to the critical machines that run our businesses."

> Connecting the world's machines and sensors needs a new kind of network; especially those in remote and underserved areas like rural farms and those out at sea.

to have complete visibility into the machines we depend on. These solutions also help lowering device power consumption needs, and reducing the cost of network connectivity. This will lead to improved efficiency and also help create new business models for traditionally analog industries such as agriculture, construction, oil and gas, logistics, and many others.

Connecting the world's machines and sensors needs a new kind of network; especially those in remote and underserved areas like rural farms and those out at sea. These require a reliable network that is 100% continuous and always available. This is where satellites can play a major role, but until now, they have been too expensive to consider.

The company recently announced launch of its first commercial NB-IoT network. Do you think Skylo can leverage the NB-IoT market in India? How can NB-IoT help India achieve its digitization goals?

India has been at the cusp of a digital revolution for a few years now. This has largely been led by the Government of India's serious intent on turning the country into an economic powerhouse, and leveraging "Digital India" to achieve this vision. Today, connectivity remains intermittent, often failing, often while still non-existent in remote areas, where a large part of farming happens remote farms operate, at the national borders, at powerline stations across the country's vast hinterlands, at last-mile consumer goods distribution centres, far out to sea, and several other industrial operations.

With the rapid adoption of technology, fuelled further by Industry 4.0, these industries are thirsty for data from their assets. Industries like agriculture, fisheries and logistics that have been largely offline till recently and have begun to transform now, haven't had the opportunity to take full advantage of modern digital technologies like AI, machine learning, IoT, and satellite, regardless of their geography.

The IoT is already playing a pivotal role in India's digitalization story. According to estimates, the IoT investments in India will triple, to touch USD15 billion this year by 2021 across both technology products and services components. There is a continuous effort by the Government of India. This includes several positive policy measures to develop the country's technology infrastructure. However, despite positive tailwinds, India continues to lag. Even today, basic data connectivity remains non-existent in remote areas. There is a need to connect businesses operating in such areas. These businesses play an integral part of India's growth story.

We are working with government customers, small and large enterprise customers, and individuals to deploy solutions across the country. For example, IoT data can transform the way fishermen sell their catch while still at sea. This can help improve their standard of living. It also plays an important role in agriculture, machine rentals, and logistics. Skylo is helping drive productivity by allowing farmers to intelligently sow and harvest crops more predictably through on-farm sensors. It is also radically expanding options for entrepreneurs and industries interested in renting their equipment – from tractors to trucks, and other assets. As an example, construction companies can monitor their equipment location and know fuel levels at all times. They can also check on health of the equipment, benefit from predictive maintenance alerts, get alert when something needs fixing to ensure minimal downtime. Further, it allows companies to keep an eye on assets to ensure renters are taking good care of the equipment.

On the logistics front, we provide drivers and fleet operators the ability to monitor location of fleets, 100% of

> Existing networks have been designed to connect people. However, machines require a new kind of network to operate reliably for the ~80% of geographies.

> IoT data can transform the way fishermen sell their catch while still at sea. It also plays an important role in agriculture, machine rentals, and logistics."

the time, and better understand their equipment – from temperature of refrigerated cargo, operation of digital locks and more. In addition, we have partnered with Omnicomm to monitor fuel consumption data to help cut costs and alleviate theft.

What makes the Skylo Hub different from its competitor NB-IoT devices?

We offer a cost advantage in satellite IoT communications that no one other has been able to match. Before Skylo, connecting with a satellite network required professional installation of a meter-square antenna device costing more than USD5,000. Our Skylo Hub is about 8 inches square and the equivalent of a cellular modem in size, convenience, ease of install, and optimized for self-install. It can connect to 15 sensors through wire, WiFi or Bluetooth low energy (BLE). It can also operate while stationary and in motion, as well as in extreme cold, sweltering heat, heavy rainfall and other harsh conditions.

One of the benefits that we bring in is the low variable cost. Traditional satellite communications are extremely cost-prohibitive, making it impossible for most businesses to afford them. Skylo has partnered with Inmarsat to enable the world's first commercial narrowband IoT-over-satellite solution. Inmarsat's industry-leading L-band network forms the backbone of our satellite network, ensuring unparalleled reliability, uptime and a high-quality user experience for customers at an extremely cost-effective price point.

Skylo's purpose-built network for IoT incorporates proprietary methods of efficiently transmitting sensor and machine data, reducing satellite usage cost and making it possible to provide an end-to-end solution literally anywhere under the sky. Today, this is especially critical in under-networked, rural, and remote areas of India and soon, we will cover the entire world.

We understand that connectivity by itself is only part of the solution. With Skylo, we easily and rapidly integrate external sensors. Skylo cloud receives the sensor data is continuously for easy, ubiquitous availability. The solutions help customers receive continuous coverage to send and receive critical two-way messaging, alerts, and continuously transmit valuable sensor data including location, soil moisture, fuel usage, temperature and much more.

Our satellite IoT connectivity is changing the face of how 'things' are connected, enabling real-time data transmission and greater reliability, particularly where there is inconsistent or no cellular coverage. Skylo's global IoT connectivity fabric makes way for thousands of life-changing applications – from managing vaccine efficacy during delivery, to advancing precision farming, to providing early warnings in the event of natural disasters.

Are you also considering launching own satellites to provide connectivity to the existing NB-IoT solutions?

We recently announced a partnership with Inmarsat. In the near future, we will continue to work with them and other partners.

Indian telcos such as Jio, Airtel and Vodafone Idea have all announced IoT plans for enterprises and individuals alike. How will Skylo compete with these companies?

Connecting people was the aim of all the networks that exist right now. However, machines, devices and sensors operate even in regions with poor population density and hence underwhelming or absent network coverage. Skylo's technology innovations makes it possible to offer ubiquitous and highly reliable connectivity to this hitherto unserved market. Skylo uses satellite communication, a traditionally expensive option, to carry the specific kinds of data these sensors and machines send in a highly efficient and affordable manner.

Being world's first, there is currently no other solution that exists that can offer connectivity at such price points. Every organization we have engaged with has been very excited about the power our solution can unleash for them, driving up business/operational efficiency, customer experience and employee safety.

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Experts warn against using hotel Wi-Fi

Beware of evil twin Wi-Fi. In this scenario, cybercriminals set up fake unprotected Wi-Fi hotspots next to the hotel to trick hotel guests into connecting

V&D BUREAU

With traveling on the rise again, experts have warned about the risks public Wi-Fi in hotels may pose. According to Daniel Markuson, Digital Privacy Expert, NordVPN, 50% of people choose to travel domestically and this puts the data of a lot of travelers in danger.

"As noticed by the FBI, hackers often use hotel Wi-Fi to attack guests during their stay. This is especially important now that travelers are keen to see more familiar places or find hidden gems in the distance of a car ride and stay in the local hotels, which often have poorly secured networks," he explains.

How can hotel Wi-Fi be hacked?

Hackers can connect to hotel Wi-Fi as easily as guests do, snoop on users' online activity and steal their passwords and personal information. They can also install malware on a user's computer or hack into the hotel's database and download the guests' credit card information.

Another threat is hackers positioning themselves as a Wi-Fi hotspot — the so-called evil twin Wi-Fi. In this scenario, cybercriminals set up fake unprotected Wi-Fi hotspots next to the hotel to trick hotel guests into connecting. The network of this kind usually has an unsuspicious name such as "Guest Wi-Fi" or "Free Hotel Wi-Fi". When a victim connects to such a hotspot, all their personal information is sent to the hacker.

"Hotel networks are often built for the guests' convenience, ignoring security practices. This is especially common in smaller hotels, where simple and easy-to-remember passwords are created in favor of the guests. To be in control of their own data, travelers have to be aware of the possible risks and perform some actions for their security," Markuson emphasizes.

How can guests stay protected?

Security begins with oneself and Markuson recommends using mobile data while away from home instead of hotel or any other public Wi-Fi. However, if this is impossible, travelers can take several steps to stay protected.

#1

Connect only to a secured Wi-Fi. Ask the person at the reception desk to give you the exact name and password of the hotel you are staying in. That way, you will avoid connecting to an "evil twin" network.

#2

Disable automatic connections. This will prevent you from connecting to the network you didn't intend to connect to.

#3

Don't make any purchases or reservations using hotel Wi-Fi. Guests like to make reservations for attractions in the town or city they are visiting using hotel Wi-Fi. This is quite convenient but also makes our sensitive information vulnerable. The best way to keep your credentials like passwords, credit card details, etc. safe is to enter them only on a secure network.

#4

Enable your firewall. While a firewall is not that necessary over a secure connection, it is always a good idea to enable it while using public Wi-Fi. This will provide substantial security from hackers.

#5

Use a VPN. As International VPN Day (August 19) is approaching, it is important to remember that the best and most effective way to ensure any user's security over an open Wi-Fi connection is by using a VPN service. It encrypts users' data and doesn't allow third parties to intercept it. So, if you are staying in a hotel for your holiday trip, make sure you have a VPN installed on your device.

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IoT, location technology hot among logistics players in APAC

By combining IoT with location-based services logistics companies can achieve real-time tracking, reduce misplacement of assets, and improve operational efficiency

V&D BUREAU

Over third of logistics companies – 37% – in the Asia Pacific (APAC) region are considering internet of things (IoT) as key investment priorities in the next two years. According to a recently released white paper, the other two hot favourites are warehouse automation (33%) and electric vehicles (32%). Over half of the logistics companies are also leveraging map-based solutions with real-time location data for fleet tracking.

Conducted by from HERE Technologies in partnership with global consulting firm Frost & Sullivan, 'The State of Movement' white paper surveyed 152 logistics companies in six key countries in APAC: Australia, India, Indonesia, Japan, Singapore, and Thailand.

COVID-19 has disrupted, and revealed vulnerabilities in supply chains, putting logistics companies still relying on traditional systems at a disadvantage. With multiple moving parts within the supply chain, these companies are exploring connected systems and vehicles to improve their fleets, asset tracking, and shipment monitoring.

"Digital disruption is taking place in the logistics industry, and traditional approaches will no longer work. Companies in Asia Pacific are welcoming future technologies to help them build resilient and efficient supply chains and drive their business forward," said Janesh Janardhanan, Practice Area Leader – Asia Pacific, Supply Chain and Logistics, Frost & Sullivan.

While GPS (77%), RFID (31%), and QR codes (20%) are commonly used in fleet management, IoT is swiftly gaining popularity with 21% of respondents having adopted it. The research revealed that two out of five

COVID-19 has disrupted, and revealed vulnerabilities in supply chains, putting logistics companies still relying on traditional systems at a disadvantage.

logistics companies will be implementing IoT solutions across all assets over the next two years.

Combining IoT with location data and location-based services can help logistics companies achieve real-time tracking. With this, companies can reduce issues and misplacement of assets while improving operational efficiency. This is especially important for condition-sensitive shipments such as cold chain items and dangerous goods since, according to the study, 36% of logistics companies use IoT to monitor cold chain items, while 33% use it to monitor dangerous goods, and 30% using it to monitor solid/liquid bulk shipments. A fifth (20%) of them also use IoT to monitor courier, express and parcel shipments

Logistics companies are moving beyond traditional methods of route planning as the APAC region continues to feel the effects of COVID-19. Real-time events that happen daily can impact route planning and delivery times. Companies are considering logistics service delivery and asset tracking solutions to tackle these challenges.

According to the white paper 77% of respondents want to achieve better route planning and real-time routing, while 75% indicated that they want the convenience of real-time vehicle tracking and data reporting. They would also like to use these tracking solutions to achieve improved capacity planning, trend visibility and forecasting, the white paper said, adding that 71% of respondents hope to gain improved efficiency in fleet utilization and productivity, with the same proportion aiming to increase customer satisfaction with fleet tracking solutions

"In today's connected world, optimizing your supply chain is critical. Only companies that invest in digital technologies to achieve end-to-end visibility will succeed," said Jason Jameson, SVP and General Manager, APAC, HERE Technologies. "By leveraging map-based solutions with real-time location data, companies will see benefits to their fleet management and shipment monitoring. Coupled with IoT and by using cloud-based solutions to bring everything together, companies will find themselves well-placed to be at the forefront of the logistics industry."

Key takeaways for India

Close to 56% of logistics companies are already using map-based solutions with real-time location data for shipment monitoring.

IoT is gaining momentum in fleet management, with 11% of logistic companies currently using it .

Within the next two years, 38% of companies will be channelling more investments into IoT while 29% and 10% show high interest in warehouse automation and electric vehicles respectively.

The research, however, found that despite wanting to leverage these technologies, logistics companies face challenges in integrating new solutions with their existing infrastructure. To overcome this, companies often turn to the cloud with findings indicating that logistics companies show a strong preference for cloud-based solutions. Half of the respondents are looking to deploy cloud shipment monitoring solutions in the next two years, while 27% are likely to opt for a hybrid setup.

"By utilizing cloud platforms, companies can integrate various solutions with their existing ecosystems. This avoids costly system overhauls and allows companies to pay for the cloud services without having to build and maintain a data center. Cloud-based solutions also offer the flexibility to access data anytime and anywhere," it noted.

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Kaspersky, Bharti join hand to offer mobile internet security

Global cybersecurity company Kaspersky has partnered with Bharti Airtel to provide instant security for internet users in India. The collaboration between the two companies will allow Airtel customers to purchase Kaspersky Total Security solution directly from the Airtel Thanks app, including exclusive deals from Kaspersky.

Pradipt Kapoor, CIO, Bharti Airtel said: "As customer lifestyles become increasingly integrated with digital platforms, it becomes paramount for all of us to secure them with the right solutions. Airtel is working to deliver a secure network experience. We are delighted to partner with Kaspersky and make their solutions easily accessible for Airtel customers."

The alliance is formed with the aim to increase the cybersecurity awareness amongst Indian internet users and encourage them to practice cyber safety in the wake of growing cyberthreats, the company stated in a press release. Cyber threats are constantly evolving and cybercriminals in the past two years have been actively targeting internet users in India.

In the first quarter of 2021 Kaspersky products detected 37,650,472 different Internet-borne cyber threats. "Mobile users are also at risk as cybercriminals are constantly targeting them for financial gains, as well as to obtain important private data. Mobile threats in India have drastically increased since 2019 and are becoming more targeted and sophisticated in nature. India ranked 7th amongst the countries attacked with Mobile Threats in 2020," it said.

Google to fund Slang Labs grow its voice assistant technology

In-app voice assistants company Slang Labs has announced an investment from the Google Assistant Investments program, along with 100x Entrepreneurs, Velu Murugan, Thomas George and their existing investor Endiya Partners. With this announcement, Slang Labs becomes one of the first players in the in-app voice assistant space globally to be backed by Google.

"Through this technology, consumers will be able to do online transactions in their apps through the power of their voice, and in their preferred language," the company said in a press release. "Enabling multilingual voice-based interactions inside the apps of the brands, even if the visual language of the app continues to be in English, is an opportunity for businesses to easily solve these problems and quickly reach the 400+million users in Tier 2 markets and beyond," it stated.

Talking about the funding Kumar Rangarajan, Slang Labs Co-Founder said, "We are glad to be part of the Google Assistant Investments program. This investment by Google emphasizes the importance of voice inside apps and highlights the most significant technology trend for this decade – voice. We have seen an increase

in demand for this technology during the pandemic and will continue innovating for a better consumer interface experience."

The multilingual in-app voice assistant gets natively embedded inside the app as a multimodal overlay, allowing its users to transact with the app by just talking to it or by interacting with the visuals of the app directly. The smart assistant abstracts out all the complex deep tech AI components and provides well researched UI/UX components, that work together to provide a delightful end user experience for the users of the app.

Micron unveils first 176-Layer NAND in mobile solutions

Micron Technology, Inc. has announced volume shipments of the world's first 176-layer NAND Universal Flash Storage (UFS) 3.1 mobile solution. Engineered for high-end and flagship phones, Micron's discrete UFS 3.1 mobile NAND unlocks 5G's potential with up to 75% faster sequential write and random read performance than prior generations, enabling downloads of two-hour 4K movies in as little as 9.6 seconds.

Micron's 176-layer NAND offers a compact design ideal for the high capacity, small form factors required in mobile devices. The launch Micron's volume delivery of PCIe Gen4 solid-state drives with 176-layer NAND that was launched in June, bringing high performance, design flexibility and low power consumption to professional workstations and ultrathin notebooks, the company stated in a press release, adding that the advanced NAND technology and performance enables a more responsive mobile experience with true multitasking across apps.

"5G delivers multigigabit speeds to mobile devices, and a high-performance hardware foundation is critical to powering these lightning-fast mobile experiences," said Raj Talluri, Senior Vice President and General Manager of Micron's Mobile Business Unit. "Our breakthrough 176-layer NAND supercharges smartphones with unparalleled performance, delivering rich multimedia content to consumers' fingertips in a flash," he added.

Netgear launches high-speed Wi-Fi mesh

Netgear has announced the launch of its Orbi RBK852 and Orbi RBK752 Wi-Fi 6 Mesh Router System in the Indian market. The two products are exclusively designed for faster internet speed and for a connected ecosystem for larger homes, or mid-sized offices connecting 30-40 people at a go, the company said in a press release.

The press release also noted that its seamless connectivity across floors and multiple devices connected to the same network enables the device to perform well. The concept of faster and swifter internet will enable the user to connect seamlessly in the new work from home culture and learn from home culture. The Ultimate Performance Whole Home Mesh Wi-Fi System includes a Wi-Fi router and one satellite covering larger homes up to 350sq meters. "A powerful AX Mesh Wi-Fi System helps the router to keep all the device connections strong in every room of the house. Users can simply enjoy the perks of watching 4K/8K UHD streaming and online gaming to multiple screens simultaneously without interruption," it stated.

The router comes with the latest generation of Wi-Fi 6 technology which is faster than ever, with 4X increased capacity compared to a Wi-Fi 5 (802.11ac) system. Seamless and Consistent Mesh Wi-Fi Coverage has been dedicated to quad-stream Wi-Fi 6 backhaul which allows up to four data streams on each band. The company also pointed out that users can easily set up the Wi-Fi management with the Orbi app and create a guest network, by viewing connected devices, and perform speed tests. A LAN port can also be used to connect with more wired devices with 4 Gigabit Ethernet LAN ports on each router and satellite are ideal for home offices or home entertainment areas.

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