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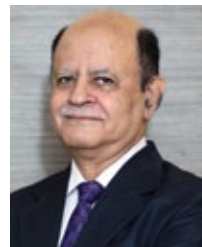
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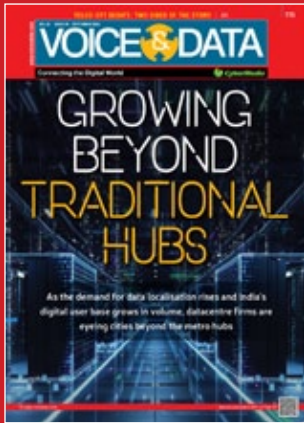
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[OPENING NOTE]

Forging the path to a powerful, more interconnected world

In an era where technology plays a pivotal role in shaping societies, the recent G20 meeting held in New Delhi underscored the importance of digital public infrastructure (DPI) as a catalyst for inclusive, sustainable development. The declaration made during the meeting resonated deeply with the global community, highlighting the significance of a safe, secure, and inclusive DPI that respects human rights, personal data, and privacy.

India, a front-runner in leveraging technology for societal welfare, has been at the forefront of this digital revolution. Initiatives like Aadhaar, Aarogya Setu, Unified Payments Interface (UPI), Aadhar Payment Bridge System, and Aadhar-Enabled Payments System have not only streamlined governance but also ensured the direct transfer of subsidies to the needy.

However, this transformative journey could not have been possible without India's robust telecommunication infrastructure, especially the widespread adoption of mobile data services that became prevalent in the country after the launch of 4G connectivity. It was further driven by the need for connectivity during the COVID-19 pandemic, and the ensuing wave of digital transformation.

The G20 Leaders' Declaration recognised the crucial role of open standards, open-source software, and cross-border data flows in enabling societal-scale services. The emphasis on 'data free flow with trust' and the commitment to respecting legal frameworks were notable aspects of the declaration, fostering trust and accountability in the digital landscape.

Furthermore, the G20 leaders endorsed India's ambitious plan to establish the Global Digital Public Infrastructure Repository (GDPIR), a virtual treasure trove of DPI shared voluntarily by G20 nations and beyond. This collaborative effort emphasises the spirit of global cooperation and mutual assistance, paving the way for a more connected world.

One key initiative that garnered attention was the One Future Alliance (OFA), a voluntary effort aimed at enhancing DPI implementation in low- and middle-income countries. With support from UNDP and its knowledge partners, the OFA initiative seeks to unite governments, private sectors, academic institutions, and civil society organisations. This collaborative synergy will not only amplify existing efforts but also drive innovation and sustainable practices in the DPI ecosystem.

India, with its proven track record in technology-driven governance, stands poised to play a central role in the implementation of these global initiatives. The country's expertise in fostering inclusive digital ecosystems, exemplified by projects like UPI and Aadhaar, positions it as a valuable ally in the global pursuit of a secure, accountable, and human-centric digital future.

As the world moves forward, India's leadership in DPI development serves as a beacon of inspiration for nations worldwide. By embracing the principles outlined in the G20 declaration and actively participating in collaborative efforts like the GDPIR and OFA, India can continue to drive positive change, bridging the digital divide and ensuring a brighter, more inclusive future for all. In this digital age, India's journey is not just its own; it is a shared voyage toward a technologically empowered, interconnected world.

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Welcome to the new data protection regime

Amid the rising incidence of data breaches comes the new data protection law. Here's what you need to know about the changes in the data security domain



BY RUSTOM HIRAMANECK

India is set to break old patterns and form new ones for its data management regime thanks to its recent data protection law. As the country weaves the infrastructure for a USD 1 trillion digital economy, the need for safeguarding the personal data of users in the borderless digital realm and for organisations, the data fiduciaries, to invest in integrated data management and cybersecurity practices becomes all the more crucial.

The average cost of a data breach in India touched USD 2 million (Rs 17.9 crore) in 2023, reflecting a 28% increase since 2020, according to IBM Security's Cost of a Data Breach Report. Meanwhile, Acronis' Mid-Year Cyberthreats Report 2023 revealed key insights about the existing threat landscape: ransomware continued to be the major threat to large and medium-sized businesses, including government, healthcare and other critical organisations.

Ransomware continued to be a major threat to large and medium-sized businesses, including government, healthcare and other critical organisations.

The new law imposes high standards on the data fiduciary to ensure that personal data processed by it or on its behalf is 'complete,' 'accurate' and 'consistent'.

Data stealers were the second most prevalent threat, leading to most data breaches along with traditional usage of stolen credentials. Also, with the exponential rise of applications using ChatGPT and similar generative AI systems, the report discovered that they were being used to commence cyberattacks and create malicious content.

India's new data protection law has been lauded for being business-friendly, not as compliance-heavy as the EU's GDPR and not over-prescriptive in dictating how businesses should protect user data from the above-stated threats. The law is yet to go into effect, but companies will have to start making major pivots in their data management processes as the government has indicated that it expects the law to be fully implemented in less than a year.

However, its principle-based rather than prescriptive-based approach could potentially burden data fiduciaries operating in India.

TRICKY TERRAIN FOR FIDUCIARIES

The protracted timeline of the Data Protection Law (called 'The Digital Personal Data Protection Act, 2023') saw many draft versions with varying sentiments on how to best safeguard user data. The current law imposes high standards on the data fiduciary to ensure that personal data processed by it or on its behalf is 'complete,' 'accurate' and 'consistent'. The standard practice under the law is to now "ensure" that 'reasonable efforts' are taken to safeguard data. Since it is a principles-based law, instead of a prescriptive law; the chances of guidelines being issued later to help organisations understand their responsibilities and obligations regarding data protection and cybersecurity appear slim.

The government has decided to let data fiduciaries handle the interpretation of 'reasonable measures' and to translate that into instilling a holistic cybersecurity system to safeguard the data principal's (end-user) data.

THE NECK ON THE BLOCK

Unlike its preceding versions, the current law does not hold data processors responsible for data breaches. The data fiduciary bears the sole responsibility for complying with the provisions of the new law and of reporting any person-

al data breaches to the concerned authority, i.e., the Data Protection Board and to affected data principals.

With a penalty of approximately USD 30 million (Rs 250 crore) awaiting data fiduciaries for any data breach, the Indian market is making it crucial for data fiduciaries to onboard data storage and cybersecurity partners who could provide holistic protection. With the new law easing up on cross-border data flows, security measures must be met at all five stages: prevention, detection, response, recovery and forensics. This must be across virtual, physical, cloud and mobile platforms, regardless of size or location, through a single comprehensive solution to instil trust with the end user.

IT'S TIME FOR FORTIFIED DATACENTRES

While the new law eases cross-border data flow for global and Indian firms, sectoral regulators like the Reserve Bank of India will still get the upper hand in setting data localisation norms for banks, fintechs and financial institutions. This would mean that depending on the sectoral guidelines, data fiduciaries will have to scout for cloud datacentre facilities possessing a full range of security measures upon which they can build new services while delivering faster access, constant data availability and data sovereignty to their end users.

The need of the hour is to have partners who could offer integration of backup, disaster recovery, next-gen antimalware, cybersecurity and endpoint management tools, thus creating fortified guardrails at these datacentres against any kind of security threats. Chasing a global datacentre network means your data can be stored where required, provided regulatory compliance and connectivity requirements are met.

INVESTMENTS IN ACTIVE PROTECTION TO GO UP

In India, 28% of data breaches studied resulted in loss of data spanning multiple types of environments – public cloud, private cloud – indicating that attackers were able to compromise multiple environments while avoiding detection. When breached data was stored across multiple environments, it also had the highest associated breach costs at USD 2 million and took the longest 327 days to identify and contain.



PRIVACY ESSENTIALS

- Data breaches in India have become costlier, averaging USD 2 million in 2023, a 28% increase since 2020. Ransomware and data stealers pose significant threats, demanding robust cybersecurity measures.
- India's law is principle-based, allowing flexibility but potentially burdening data fiduciaries. The law emphasises data fiduciaries' responsibility, making them solely accountable for compliance and reporting breaches.
- Data fiduciaries face hefty penalties for breaches. To comply, they must invest in comprehensive cybersecurity, spanning prevention, detection, response, recovery, and forensics. Fortified datacentres are essential, aligning with sector-specific guidelines.
- Investments in active protection systems are vital, incorporating pattern detection, allow lists, and self-defence features. Endpoint detection and response solutions are crucial, ensuring real-time monitoring and automated response to evolving security threats.
- Organisations need agile risk management strategies to navigate evolving threats. Leveraging cyber protection experts and external support infrastructure is essential, enabling compliance with the new data law while minimising expenses and risks associated with in-house solutions.

India is at a pivotal juncture where organisations would need an agile risk management strategy to deal with evolving data security threats.

India's data protection law nudges investments in active protection systems for user data that should incorporate measures such as pattern detection, maintaining an Allow List and self-defence of backup files. The pattern detection feature would constantly observe patterns in how data files are being changed on a system and would compare them against malicious behaviour patterns.

Maintaining an allow list would mark programs that are allowed and expected to perform certain actions, to prevent authorised activities from being falsely tagged as unauthorised. Also, as criminals could choose to compromise files by attacking the backup software itself to corrupt the backup files it creates, fiduciaries should get a self-defence feature for backup files.

Being proactive in monitoring threats becomes easy with endpoint detection and response (EDR) solutions. EDR enables real-time monitoring, endpoint data collection, and rule-based automated response and analysis to secure a system against potential security incidents. They are, however, also complex with multiple point products, expensive and could disrupt business continuity. Hence, IT teams need to pay attention to EDR solutions that offer integrated backup and recovery capabilities, providing unmatched business continuity where point-security solutions fail.

India is at a pivotal juncture where organisations would need an agile risk management strategy to deal with evolving data security threats. To be able to deal with the humongous change that is coming with the new data law, data fiduciaries must leverage cyber protection experts and gain access to an advanced external support infrastructure which can eliminate the expense and risk of building in-house solutions. 🧑‍💻

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Decoding a key piece of India's growth jigsaw

eSIMs are a vital piece of networking infrastructure that will soon be found in pretty much everything. This makes it a sub-sector worth tracking.



BY VERNIKA AWAL

In 2016, Samsung launched a smartwatch called the Gear S2 Classic. While this was just another smartwatch in the overall consumer electronics scheme of things, this gadget became the first in the world to come with an eSIM, a little chip that simulates what a physical SIM card has historically done. This, though, wasn't an overnight incident, for talks about creating and adopting eSIMs, in both consumer and enterprise industries, have been happening since the start of the decade.

Today, seven years since the very first consumer gadget with an eSIM, the world stands at a point where eSIM adoption is set to become ubiquitous across nearly every industry.

WHAT IS AN ESIM, AND WHY UBIQUITY?

A SIM card, as is well known, is a small physical chip that comes with hard-coded network information on it. This information is unique globally and becomes the identifi-

Juniper Research estimates the global eSIM market to grow nearly 3.5x in value in four years – up to USD 16.3 billion by 2027, from USD 4.7 billion today.



IN BRIEF

- **The Evolution:** eSIM, a reprogrammable embedded chip, revolutionises connectivity in devices ranging from smartphones to cars and enterprise infrastructure, enabling seamless network switching without physical replacements.
- **India's Digital Push:** India's rapid digital transformation demands extensive eSIM integration, especially in connected cars and commercial vehicles, driving a surge in demand. The country's significant smartphone and wearable market amplifies this growth.
- **Market Potential:** Globally, the eSIM market value is set to grow 3.5x to USD 16.3 billion by 2027. India's substantial market share and increasing tech-driven vehicle sales position it as a significant contributor to this expansion.
- **Telecom Challenges:** Despite consumer benefits, telecom operators are hesitant due to high infrastructure upgrade costs. Striking a balance between value addition and expenditure remains a challenge for widespread eSIM adoption in the industry.
- **Ubiquitous Future:** Despite challenges, eSIMs are poised to become ubiquitous, powering various devices and technologies, promising a connected future where seamless network integration is the norm.

Tech-laden cars in the country are likely to drive the demand for an additional three million eSIMs in India, within 12 to 18 months.

cation that lets any person, anywhere in the world, be able to reach a mobile phone, as long as the network connectivity allows it.

An eSIM essentially serves the same purpose but with key differences. While a SIM is a physical chip that is generally removable from devices, an eSIM is an embedded chip. This chip comes in two variants: one that, like a conventional physical SIM, is hard-coded to a single network, and two, the one that can be reprogrammed as necessary.

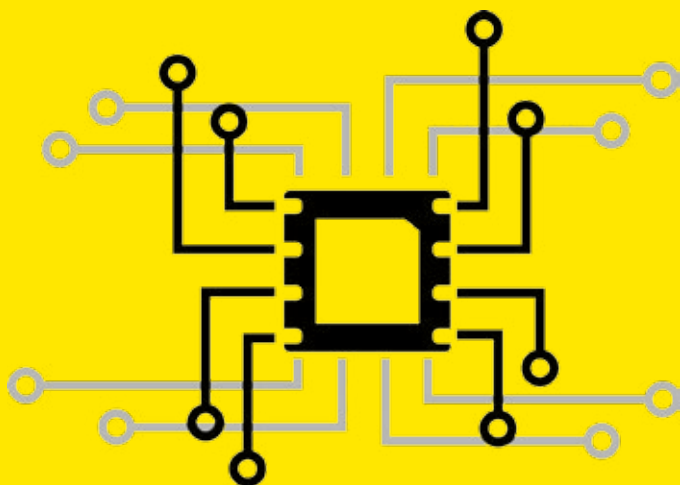
This is where the biggest benefit and flexibility of eSIMs lies. For instance, in consumer devices such as smartphones and smartwatches, the eSIM can sync with any eligible network that supports the technology without the need to get new physical SIMs when swapping networks.

An eSIM is also less prone to physical damages, and due to its reprogrammable nature, becomes a vital part of connected enterprise infrastructure today. Take connected cars and smart appliances at home, and power grids and oil pipelines in enterprises. Every infrastructure today requires eSIMs to be able to maintain consistent and constant network connectivity. While the adoption of captive 5G networks and digitisation sagas of operational technology (OT) frameworks get all the limelight, it is the humble eSIM that powers it all.

POTENTIAL FOR STEEP MARKET GROWTH

India, especially since the beginning of this decade, has been on an expedited path of digital transformation. This journey, interestingly enough, involves upgrading or connecting a lot of old public infrastructure in companies and public services. Doing this requires eSIMs to be embedded and programmed into networks, to realise the true potential of real-time connectivity, big data, and analytics.

This impact is even bigger in connected cars. According to a recent media report, an increasing number of tech-laden cars in the country is likely to drive the demand for an additional three million eSIMs in India, within the next 12 to 18 months. This has already



TELCOS' DILEMMA

- **Infrastructure upgrade:** Adopting eSIM necessitates substantial upgrades in the telcos' networking infrastructure, involving significant capital expenditure.
- **Operational integration:** Integrating eSIMs into existing operational frameworks requires meticulous planning and adjustments, impacting regular business processes.
- **Security concerns:** Ensuring robust security measures to protect sensitive user data stored in eSIMs is crucial. Addressing potential cybersecurity threats and vulnerabilities is a significant challenge.
- **Customer education:** Educating customers about the benefits and usage of eSIMs is essential. Many users may not be familiar with the concept, requiring effective communication to encourage adoption.
- **Interoperability:** Ensuring that eSIMs work seamlessly across different devices and networks poses a challenge. Interoperability issues need to be resolved to provide a consistent user experience.
- **Regulatory compliance:** Adhering to local and international regulations related to data privacy, consumer rights, and telecommunications standards is vital.
- **Partnerships and alliances:** Establishing collaborations with device manufacturers, app developers, and other stakeholders is necessary for expanding eSIM availability.

started happening, with advanced connectivity and smart car features coming to consumer vehicles that are increasingly in the affordable ranges.

Commercial vehicles are also a key benefactor of the spread of eSIMs. Since fleet management systems require trucks and buses to be equipped with new-generation telematics, eSIMs can serve as the key foundation to power connectivity in commercial vehicle fleets.

Finally, there will also be uniform adoption of eSIMs in consumer devices such as smartphones and smartwatches, which will yet again represent a massive market opportunity for eSIMs around the world. A report by Juniper Research pegged the global eSIM market to grow nearly 3.5x in value in the next four years, up from the present-day USD 4.7 billion market to USD 16.3 billion by 2027.

India, in this regard, can serve as a key contributor, having accounted for nearly 12% of all smartphone shipments last year. Smartwatches and wearables are growing exponentially too, all of which will push up the demand for eSIMs. It is this that leaves the industry primed for growth.

THE ONE KEY CHALLENGE

While consumers stand to significantly benefit, telecom operators have not been proactive in consumer eSIM adoption, thereby stalling growth. A key reason for this is that adopting eSIMs requires an upgrade in the overall networking architecture stack from the telcos' end, which in turn is a sizeable capital expenditure. Telcos have so far shied away from making such expenditures at scale.

With the Indian market already operating at wafer-thin per-user revenue and margins, it remains to be seen if eSIM adoption brings additional value for telcos. While there will be a natural course of adoption and progression of technology, eSIMs will continue to play a key role in it, heading towards ubiquity across all appliances, modalities and technologies by the end of this decade. 🌐

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Secure communications in the Quantum age

In an era of rising cyber threats, Quantum Communications has emerged as a crucial necessity, not just a luxury or science fiction



BY VERNIKA AWAL

On 19 April, the Union Information and Broadcasting (I&B) Minister Anurag Singh Thakur, and Union Minister of State for Science and Space Jitendra Singh, took the wraps off the Rs 6,000-crore National Quantum Mission. The latter, which set goals to develop one of the most frontier technologies in the world right now, was a signal from the Centre to India's industry, academia and public-sector stakeholders to take quantum computing, technologies and applications with increasing importance.

At the heart of this importance lies quantum communications – using quantum computing to ensure that encrypted, secure communications channels are maintained in terms of their sanctity.

WHY THE ALARMISM?

Picture this – today, communications are encrypted as per a 128-bit encrypted standard. The most sophisticated government encryption standards, used for India's deepest, most sensitive information, are quite good.

Researchers at IIT Delhi have achieved a QKD data transfer over 380 km, using standard fibre optical cables with a “very low” quantum bit error rate.

In India, efforts are on to test quantum networks over already-available fibre cables in Delhi and QKD over satellite communications.



IN BRIEF

- Quantum Communications utilises quantum key distribution to offer a solution by ensuring secure data transfers safe from quantum breaches.
- India's National Quantum Mission aims to develop 50-qubit to 1,000-qubit quantum computers and establish a 2,000-km quantum communications network.
- Testing QKD over fibre and satellites represents initial progress in building India's quantum communications network.
- India's proactive efforts in quantum technology align with global advancements, ensuring national security and technological growth.
- Industries like BFSI and manufacturing are exploring quantum solutions, creating new business opportunities.
- Public-private partnerships, similar to India's successful space sector collaborations, are vital for driving quantum technology initiatives.

Speaking at industry body ASSOCHAM's Quantum Technology Conclave in Delhi on 5 October, Dr Ajay Kumar Sood, Principal Scientific Advisor, Government of India, underlined that for any supercomputer available in the world today – the best encryption methods will take thousands of years to be broken.

But, once quantum computing is stabilised, an early-stage quantum computer with single or low-double-digit qubits will be able to crack such encryption in a matter of hours, or even minutes.

This, therefore, is not alarmism – it makes quantum computing a vital field to focus on.

WHAT WILL QUANTUM COMMUNICATIONS OFFER?

India's National Quantum Mission lays down key objectives – two of which include the development of 50-qubit to 1,000-qubit quantum computers, and the establishment of a 2,000-kilometre quantum communications network.

Put simply, a quantum communications network will use a technology called Quantum Key Distribution (QKD) to encrypt a message using the principles of quantum theory. This, in even simpler terms, will give us a new technology that will help make our data transfers and communications safe from being breached by quantum computers as well.

This is presently manifesting in various ways. For one, terrestrial networks are being tested by various centre-affiliated bodies such as the Centre for Development of Advanced Computing (C-DAC) and academic institutions such as the IIT Madras, over spans of tens of kilometres. Work is also being done to test quantum networks over already-available fibre cables in Delhi while testing QKD over satellite communications is also being conducted at the moment.

For instance, on 6 October, IIT Delhi announced via a blog post that researchers at the institute could successfully trial a QKD data transfer over 380 kilometres, using standard fibre optical cables and achieving a "very low" quantum bit error rate or QBER.

India's National Quantum Mission has laid down key objectives, including the development of 50-qubit to 1,000-qubit quantum computers.

In simpler terms, this is one of the first instances of establishing long-range quantum communications networks in India – with the QKD in question being the crucial piece to quantum encryption. But error rate, too, will eventually determine how many file and data transfers over a quantum network become successful – a high error rate, which is a prevalent issue in quantum computing today, will lead to failed data transfers.

C-DAC's product showcase at the ASSOCHAM conclave also showcased similar attributes – speaking about acceptably low error rates in a QKD-based data transfer over a quantum communications network.

In a statement on the matter, Bhaskar Kanseri, lead researcher of the project said, "This realisation using state-of-the-art technology would not only help in reducing the need for trusted nodes for intercity or long-distance quantum key exchange, increasing the security of the cryptography scheme, but would also prove to be a crucial step towards the commercial production of long-distance secure practical QKD devices."

All of these are just the first few steps towards establishing India's own quantum communications network – which will be crucial going forward.

INDIA VS. THE WORLD

At a quantum technology conference in Moscow this July, Roscongress, a private, government-affiliated entity working on technologies in Russia, underlined the development of a 35-qubit quantum computer. This quantum computer is the first step for Russia to not only establish its quantum computing network but also its own quantum communications protocol.

China, India's geopolitical neighbour, has also already conducted QKD data transfer tests in terrestrial and satellite networks, showcasing that work on establishing quantum communications has advanced across geographies. It is this that makes it imperative for India to expand its own quantum communications network, and at scale – for it is this scale that will enable us, at a central level, to upgrade the national communications network stack going forward.

WHERE DOES THE INDUSTRY STAND?

In an interview with a business newspaper, K Ananth Krishnan, Chief Technology Officer, Tata Consultancy Services, highlighted that business use cases are already developing in quantum technologies – and it is no longer just a research field.

Explaining some of the key areas of interest, Krishnan said, "In BFSI, portfolio optimisation, forecasting and wealth management in the capital markets are key use cases. We have good simulation techniques and algorithms for maximising returns on portfolios, and minimising and maximising risks as part of quantum applications."

"Post-quantum cryptography is an area of interest. BFSI clients are talking to us about these applications to understand how much time they had before they were to act and improve their infrastructure. In manufacturing, aerospace and applications, such as material chemistry and material design, are being explored. Achieving quantum supremacy will help revolutionise basic materials research, which will be crucial for manufacturers, aerospace and battery makers," he further added.

It is this that MoS Space, Singh, also highlighted at ASSOCHAM's conclave, adding that the development of private sector interest in quantum technologies can take cues from the growth of India's private space sector.

"India, in the space sector, is no longer looked upon as a follower – major developed economies are looking to partner alongside India for space technologies and initiatives, driven by the success of the likes of the Chandrayaan-3 lunar mission, the Aditya-L1 solar mission, and the upcoming Gaganyaan manned space mission, trials for which may begin as early as next month. All of this cannot be solely driven by the government, and public-private partnerships are key," he said.

It is this that stakeholders across public and private entities need to cash in on, as the NQM's final framework and implementation nears its official commencement in the coming months. 🍀

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TV RAMACHANDRAN



PATH AHEAD FOR BHARATNET CAN BENEFIT FROM PAST LESSONS

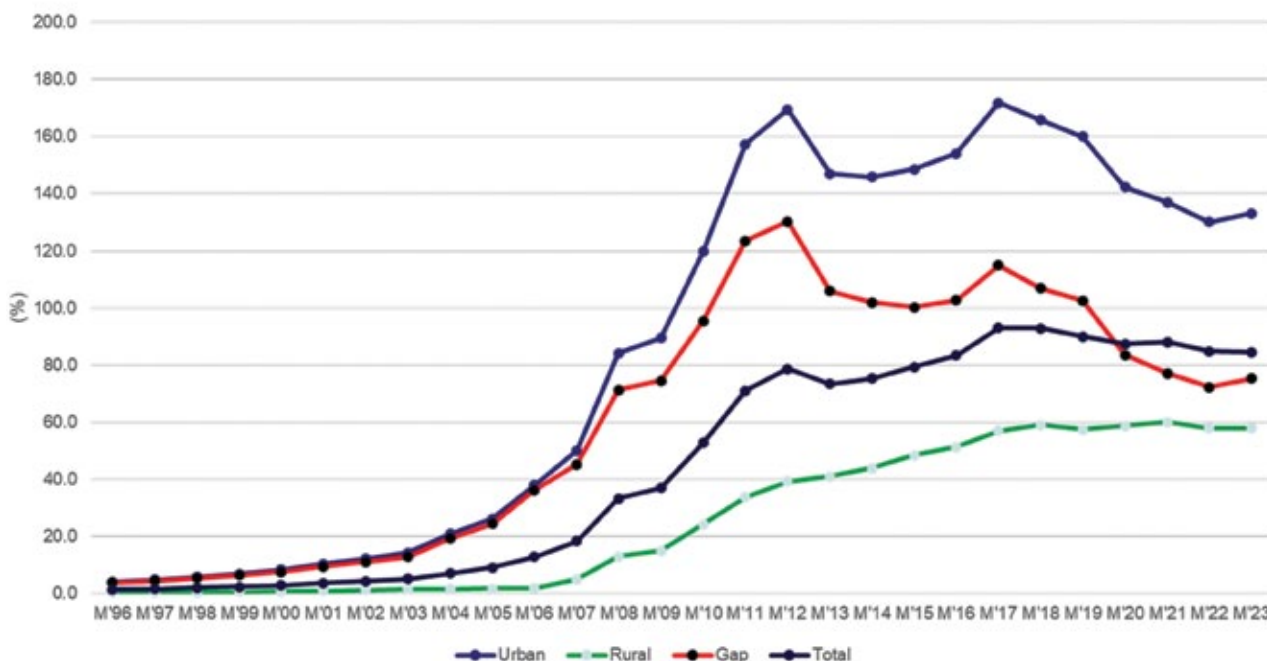
As the project to digitally connect every village receives a financial boost, the watchwords must be self-reliance, security, and empowerment

Undisputably, mobile phone penetration in India is very impressive. There is a general perception that the urban-rural digital divide is improving steadily. But if one looks deeper, one notes that though the teledensity penetration gap between urban and rural has reduced sharply since 2017, from about 115% to 75%, this is actually due to a sharp fall in urban teledensity from about 170% (due to multiple SIM ownership) down about 130%. During this entire period, the rural teledensity has been flat at 60% (see Chart: Teledensity Trends).

Probing further, if we consider internet penetration, which is of paramount importance to the general public today, while Internet access available in urban areas is 107%, average of more than one connection per subscriber, it is a paltry 40% in rural areas. There is, therefore, an urgent need to improve our rural internet and overall connectivity.

The government has put in maximum efforts for over 10 years now to connect the unconnected villages first

Teledensity Trends



Note: The green line above depicts the static rural telecom penetration.

“ Drawing insights from the past, we must ensure that the upcoming model for BharatNet is robust, efficient and future-ready.

through the National Optical Fibre Network (NOFN) project which was upgraded to BharatNet subsequently. Despite the huge efforts, about 45,180 villages remain unconnected and underserved, and, thus, the residents of all these villages are unable to participate in the journey of socioeconomic development. The vision of ‘Sabka Saath, Sabka Vikas’ is getting adversely impacted.

In this context, a giant stride was taken by the government towards transforming India’s rural digital landscape with the cabinet approval, in August 2023, of a huge allocation of Rs. 1.39 lakh crore to reach 6.4 lakh villages within the next two years from the current 1.94 lakh connected villages under the BharatNet project by laying the last-mile fibre. This initiative, one of the world’s largest government-funded digital connectivity projects, marks a commendable move towards achieving comprehensive broadband coverage, particularly in rural areas. While appreciating the initiative, it is necessary to also chart a robust course forward that embodies India’s core principles of self-reliance, security and empowerment.

The impact of BharatNet on rural India’s economy can be potentially quite dramatic. The project’s intrinsic value to India is even more than its well-established impact on GDP. Broadband connectivity will give farmers much-needed access to technology that provides real-time information on weather, crop patterns and market trends. It will help children in rural areas gain access to online educational resources, and it will enable wider, remote access to telemedicine, among other things.

Overall, the project’s success will greatly improve the quality of life for over 600 million Indians. We would also expect a huge impact of this flagship project on Indian MSMEs’ technological upgradation and increased competitiveness; and on Indian startups’ successful ventures, many of which are doing extraordinary work even at the grassroots level.

The digital path ahead, which is critically dependent on optical fibre rollout to the target locations is, however, not

strewn with roses all the way. Even with the latest large funding, there are challenges to be addressed to derive the optimum results. Drawing insights from the past, we must ensure that the upcoming model for BharatNet is robust, efficient and future-ready.

Embracing the principles of quality, ‘Atmanirbharata’ (self-reliance), and ‘Surakshit’ (secure) will be the key to shaping a successful and enduring broadband network that truly serves the people of the nation. There are some crucial success factors for the BharatNet Saturation project that every player involved needs to keep in mind.

All the countries, while launching government-funded mega national projects, ensure that local industries get an opportunity to participate, build local capabilities, generate employment and bring economic prosperity through executing such projects. The journey towards self-reliance necessitates the localisation of manufacturing and production processes.

By prioritising domestic manufacturing and indigenous technology, we can reduce dependency on imports and fortify our national capabilities. Currently, there is a PPP-MII policy to promote domestic manufacturing for government-funded projects. However, there is a need to amend the policy to make it more aligned towards its ultimate goal to promote local manufacturing.

Ensuring the future readiness and security of BharatNet is of paramount importance. As our country is witnessing exponential data growth, it is important to build a robust quality network, which is capable of handling future data demand and complying with international and domestic best practices. Building a future-ready digital infrastructure requires the adoption of international standards and best practices, like upgraded bend-insensitive ITU-T 657. Fibre has much higher efficiency and longer life. Governments, in collaboration with industry experts and stakeholders, play a pivotal role in shaping the digital landscape of the nation. When we talk about quality, we should also ensure strict compliance.

By prioritising domestic manufacturing and indigenous technology, we can reduce dependency on imports and fortify our national capabilities.



IN BRIEF

- Despite reduced teledensity gaps, rural areas lag with only 60% Internet penetration, highlighting the need for improved rural connectivity in India.
- The BharatNet project aims to connect 6.4 lakh villages, making it one of the world's largest government-funded digital connectivity efforts.
- While funding is substantial, challenges in infrastructure readiness, local manufacturing, and future-proofing the network need attention.
- Stringent testing and certification procedures, especially for optical fibre equipment, are crucial to ensure reliability and security.
- Policy amendments to promote local manufacturing and stricter enforcement of testing certifications are essential for building a robust digital infrastructure.
- Successful implementation of BharatNet relies on effective utilisation models.

The development and deployment of digital infrastructure demands a firm commitment to testing and certification of telecom equipment before the same is put into use, as tested, and verified products reduce the likelihood of technical glitches, vulnerabilities and operational failures.

Understandably, the government is investing 100% of the capital in this EPC or HAM project and thus to ensure its reliability, security and performance, it is imperative to undergo rigorous testing and certification procedures throughout the development and deployment of this critical infrastructure. The implementation of mandatory testing certification on telecom equipment (MTCTE) is a proactive measure that ensures that only tested, verified and certified products are used to build digital infrastructure.

The government should, however, delink the case of Optical Fibre and Optical Fibre Cables from other elements of the network and immediately implement Phase III and IV of MTCTE for these, with possibly even a strong direction to the industry, outlining the consequences of non-compliance.

Finally, we expect the utilisation model that was successfully tested under a pilot project would be effectively implemented to ensure that such a huge investment in making this mega digital infrastructure impacts every Indian and transforms their lives through high-quality broadband connectivity.

Undoubtedly, the cabinet's approval of a large allocation for BharatNet marks a great moment in India's digital journey. This landmark initiative holds the potential to revolutionise the rural economy, uplift millions, and pave the way for a truly inclusive and empowered nation. As we tread this path, the lessons from our past guide us to craft an enduring model that embodies the principles of self-reliance, security and empowerment. By weaving these principles into the fabric of BharatNet, we can make a new chapter in India's digital story. 🌟

The author is the President of Broadband India Forum.

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“HELLO SPACE, EARTH HERE!”



India's space missions have opened tantalising vistas of satellite telephony and the Internet. Reaping their great potential will need addressing a slew of riddles

BY PRATIMA HARIGUNANI

Ready-to-eat food, Nike trainers, baby formula, crash helmets, joysticks, water purifiers, golf balls, home insulators, dust-busters, memory foam and even camera phones! We owe these everyday marvels to space. Yes, whenever something, or someone, goes towards the dark blue sky, a by-product is tossed in the laps of everyday grey humanity on Earth.

Now that our satellites and rovers are waltzing in full glory up there, would India have a by-product in the form of satellite telephony and the Internet? After all, we 'really' need it now more than ever.

HOW NEW? HOW RARE?

So what is it? Satellite connectivity helps to connect devices to low-orbit or higher satellites by establishing a radio link between them, instead of using terrestrial cell sites. No points for guessing. The big advantage here is

location independence and quick reach to remote areas, far better than traditional on-ground infrastructure like DSL or fibre. So far, its usage has been limited to texting and SOS messages but it seems a lot is changing with satellite calls and broadband coming in the radar.

Examples from the recent industry action corroborate this promise. HughesNet Fusion has come up with a new home Internet offering that puts together satellite and wireless technologies to fix the latency problem (which was an issue with GEO-based Internet due to the vast distances that traffic must travel there – 23,000 miles from Earth to a satellite and back). It is a hybrid solution that satellite capacity with wireless capacity to wipe away initial latency. With two GEO satellites, Jupiter 1 and Jupiter 2, Hughes is betting seriously on this and it is no coincidence that it is already working hard in the software-defined wide area networking (SD-WAN) using its GEO satellite connectivity.

The number of satellite IoT subscribers can rise at a compound annual growth rate (CAGR) of 39.6% to reach 23.9 million units in 2027.



“Success hinges on continuous efforts in these areas to swiftly and robustly deliver satellite-based telephony and Internet services.”

Vikas Sharma
Founder and Director, HCIN Networks



THE MARKETS PROPELLERS

- More satellites up there cut production costs with the redesigning of terminals
- Rise in investments by government and private space-tech
- Large population unserved by terrestrial services
- High-scale government initiatives
- Strong smartphone penetration
- The ability to reach rural and remote areas
- New Indian Space Policy 2023 with greater clarity on the regulatory framework
- Better certainty on foreign ownership restrictions for operators of LEO and MEO satellite constellations
- India's potentially vast subscriber base that can offer economies of scale

Source: Compiled based on industry reports and inputs from the experts

We have also seen Google, Apple (partnering with satellite communications company Globalstar for emergency messages), Qualcomm (joining satellite service provider Iridium) and T-Mobile (tapping SpaceX's Starlink) offering satellite connectivity on their smartphones. At the time of writing, Huawei had just come out with a new smartphone flagship Mate lineup, one of which offers satellite calling (it also uses PA chips inside to amplify the signal and manage power consumption, as per media reports).

John Strand, CEO of Strand Consult, quips, “I'm so old that I remember when Motorola launched Iridium in November 1998, a wild story that shows what cost can do to a business case. With the introduction of the KA satellite and the introduction of standard components in the satellite industry, the cost of producing a satellite has also decreased.”

While global players like Starlink, OneWeb, Telesat and Hughes Communications are already active in this fast-evolving space, Indian players are also jumping in the pool; as seen with Jio Space Technology, Bharti Airtel, Tata's Nelco, ISRO, Hughes Communications India and Bharat Broadband Network Limited (BBNL).

Moreover, collaborations are underway too, such as SES with Jio Space Technology, Hughes Communications' Indian arm with ISRO, OneWeb with Bharti Airtel and ISRO, and Telesat with Tata's Nelco. It is not hard to guess why.

The satellite Internet market in India could be huge very soon. More so, as 40% of our population does not have Internet access, and rural areas make up most of these cases. Also, the demand for instant communication, increased smartphone penetration and the ability to reach rural and remote areas will boost the adoption of satellite broadband services across India. With approximately 63% of the global population having Internet access, there is a ginormous untapped terrain to bridge the digital



“Only about 10% of the Earth’s surface has access to terrestrial connectivity services which leaves a massive opportunity for satellite IoT communications.”

Johan Fagerberg
Principal Analyst, Berg Insight

divide for the remaining population, as pointed out in the June 2023 EY-Parthenon report. Estimates mentioned in the report peg the overall satellite Internet market to be more than USD 17 billion by 2030, and the global space-based broadband Internet market to surpass USD 50 billion by 2031.

As for India, things are heating up, both in terms of business interest and policy momentum.

Sourav Gupta, Telecom Analyst, Omdia, observes that in India, satellite Internet is at a nascent stage, with Jio and Airtel being the ones that have received Department of Telecommunications (DoT) approval to deliver broadband services via satellites. “But the potential use cases will be providing Internet connectivity in remote and rural areas where traditional broadband infrastructure is limited or unavailable. Also, providing reliable and secure communication during natural disasters and other emergencies, when terrestrial networks may be disrupted, would be strong uses.”

At present, Bharti-backed OneWeb and Reliance Jio along with Luxembourg’s SES have obtained a Global Mobile Personal Communication by Satellite (GMPCS) licence for LEO, and MEO and GEO satellite service, respectively. Inmarsat and BSNL have an inflight and maritime communications licence, Gupta points out. The EY report observes how the Indian government is also entering the satellite Internet space with Bharat Broadband Network Limited (BBNL), in charge of

implementing the BharatNet project. BBNL aims to connect some 7,000 gram panchayats across the country through satellite Internet.

Gupta also notes how some of the global major satellite Internet service providers are planning to enter the Indian market through partnerships with the existing service providers as the government of India recently approved the Indian Space Policy 2023 which seeks to regulate and enhance the private sector participation in the space sector. The policy is expected to clarify the foreign ownership restrictions for operators of satellite constellations in low-earth orbit (LEO) and medium-earth orbit (MEO). “It may also help in providing greater clarity on the regulatory framework, addressing some of the previous hurdles around commercial satellite broadband services in India,” he says.

But the big question is whether customers are willing to pay extra to be able to use a satellite connection on their mobile phone, cautions Strand. Now, that’s a tough landing to make. Here’s why.

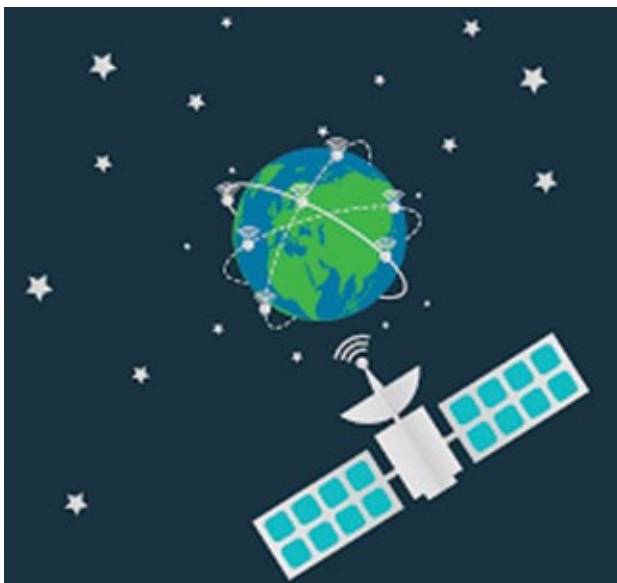
HOW EXPENSIVE?

“The question is also how much a mobile operator is willing to pay for their customers to get access to an additional network. I don’t believe that the willingness to pay is high; you compete with better and better mobile coverage and Wi-Fi in a lot of places.” Strand puts it clearly and boldly on the table.



“The potential use cases will be providing Internet connectivity in remote and rural areas where traditional broadband infrastructure is limited or unavailable.”

Sourav Gupta
Telecom Analyst, Omdia



THE BOOSTERS

- Need for consolidation.
- Better financial models are needed, as these are fixed and high-cost industries.
- Room for innovations in hardware for connectivity.
- Matching low-cost pricing of traditional operators.
- Initial supply-excess vis-a-vis demand.
- Low ARPU models that are deterring monetisation.
- Licence approvals, high service costs.
- Need for harmonisation of space-based spectrum.
- Fragmentation ruins spectrum management efficiency, leaving underutilised portions.
- Exclusive assignment through auctions leads to a fragmented spectrum.
- Fragmented spectrum leads to lower data rates and inefficient use.
- Need to fix high costs for users: Satellite services are, often, 10X the cost of broadband services.

Source: Compiled based on industry reports and inputs from the experts

Satellite communication and the Internet hold immense promise in India due to their wide coverage, bridging the connectivity gaps in remote areas, and fostering digital inclusion, reasons Vikas Sharma, Founder and Director, HCIN Networks Private Limited. However, affordability and a clear regulatory framework are critical factors that will determine their success, he adds, echoing the concern that Strand puts forth.

If we look at the Barclays report on the annual Euroconsult Satellite C conference, the satellite services segment has experienced muted growth in the past years as pricing declines have offset the volume growth.

Strand does not believe that satellite players can disrupt the mobile market. "I believe that they will sell their capacity to a wide range of niche segments where carriers are just one player of many." In his assessment, there is a great risk that some of the satellite players will have the same fate as Iridium. There will be consolidation in that industry, and there are investors who must recognise that the hardware they have sent into space cannot generate the revenue that they dreamed of.

Moreover, there is the question of how the spectrum game will work out here. The Indian Council for Research on International Economic Relations (ICRIER) also launched a working paper recently, supported by the Broadband India Forum (BIF), wherein the authors emphasised that satellite spectrum is a shared resource, and existing empirical and practical models of assignment through auctions are scant. They advocated instead for an administrative assignment of space-based communication spectrum on a shared basis, in line with international best practices.

HOW SOON?

With all these drivers and bumps dotting this trajectory, satellite connectivity is moving at a new pace now.

As viewed by Yerramreddy Nivesh Reddy, Founder and CEO, and Peddineni Raghavendra, Co-Founder and CTO, Mydhili Aerospace, the satellite and aerial connectivity space is poised for significant evolution. "With players like Starlink, Hughes, OneWeb, Google-Garmin, and Facebook entering the market, we can expect increased global connectivity options."

According to the Barclays report, LEO constellations continue to make progress; with Starlink successfully expanding to new verticals with an evolving 'go to market' strategy, embracing partnerships and third-party



“The question is also how much a mobile operator is willing to pay for their customers to get access to an additional network.”

John Strand
CEO, Strand Consult

distribution. Kuiper could also tread well here with the launch of two prototype satellites in October 2023 and plans to deploy the constellation in 2024. Telesat has also got the financing for its LEO constellation and could begin operations in 2027. What's fully deployed is the OneWeb constellation. So, supply is well on track to continue to increase dramatically in the industry (Barclays experts expect x15 between 2020 and 2025).

Gupta notes that, at the moment, consumer smartphones in India do not support satellite connectivity, and the feature is limited to 'satphones', which are used in maritime applications, trekking operations and more. “According to a spokesperson of Google, the company is designing phones for satellites and the feature could be available in the next Android version.”

Reddy warns how GEO-based Internet offers widespread coverage but can have latency issues. “LEO Internet, with its lower orbit, reduces latency but may require more infrastructure. Hybrid solutions, combining satellite and Fixed Wireless Access (FWA) offer versatility. The choice depends on specific use cases and requirements, with technology continuously improving.”

Geo-based Internet, like traditional satellite systems, offers wide coverage but suffers from latency issues due to its high orbit, observes Sharma. “In contrast, LEO-based Internet, with lower orbits, promises lower latency but requires more satellites for global coverage. Therefore, a hybrid approach, combining LEO and FWA, could prove to be a viable solution, offering low latency in populated areas and global reach through satellites.”

HOW UNDISPUTED?

Let's not forget that there are more untapped orbits that can be unexpected and unprecedented, by-products of the current big satellite impetus. IoT Communications and D2D (Direct to Device), for example.

Johan Fagerberg, Principal Analyst, specialist IoT analyst firm Berg Insight, cites a new research report which states that the global satellite IoT communications market is growing at a steady pace. The global satellite IoT subscriber base grew to surpass 4.5 million in 2022. The number of satellite IoT subscribers can rise at a compound annual growth rate (CAGR) of 39.6% to reach 23.9 million units in 2027. Only about 10% of the Earth's surface has access to terrestrial connectivity services which leaves a massive opportunity for satellite IoT communications. As of now, Iridium, Orbcomm, Inmarsat and Globalstar are the largest satellite IoT network operators.

Direct to Device (D2D) is another big, and emerging, disruption. It is now seen as potentially the largest revenue opportunity for the industry – even if not in the immediate future. As per some industry players, this segment could reach USD 1 billion within five years, and others believe it could take as long as 10 years. Euroconsult estimates that the addressable market could touch USD 100 billion. The point to note here is that, as of now, the satellite services industry represents USD 12 billion in annual revenues. Satellite connectivity is turning into a 'must have' with satellite attributes (reliability, redundancy, security) and prospects for verticals such as Aero and Consumer broadband are quite robust. But the largest revenue opportunity lies in other segments, such

HughesNet Fusion has come up with a new home Internet offering that puts together satellite and wireless technologies to fix the latency problem.



The overall satellite Internet market is estimated to be more than USD 17 billion by 2030 while the space-based broadband Internet market is likely to surpass USD 50 billion by 2031.

as the Direct to Device segment – as pointed out in the Barclays report too.

GETTING READY FOR THE COUNTDOWN

All these cascading markets of satellites have good take-off prospects for sure. But not until some issues are fixed before the countdown.

An ICRIER paper noted: “While exclusive auctions have their merits, the interplay of flexibility, innovation, and equitable public access inherent to shared assignments can substantially contribute to a more inclusive and harmonious spectrum landscape.” The paper advocated for a departure from these conventional methods and suggested the adoption of prioritisation and coordination mechanisms for spectrum sharing within the framework of ITU Radio Regulations, but adapted to the domestic context.

At the end of the day, the big question, as Strand underlines, is what the satellite and mobile business case looks like and how ARPU should be shared between the different players. This is the ‘1 billion dollar’ question. As a broadband connection satellite-based broadband can become a commercial product for special customer segments; such as corporate customers, high-income customers and schools. It will not be a mass-market product for low-income Indian people, Strand believes.

As India shines globally in space technology, the timeline and strength of translating this progress into satellite telephony and Internet services depend on technological readiness, infrastructure development,

regulations and market demand, dissects Sharma. “ISRO’s communication satellites like GSAT-19, GSAT-11 and GSAT-30 offer promise, but we must focus on bandwidth capacity, policy formulation, affordability and accessibility. Success hinges on continuous efforts in these areas to swiftly and robustly deliver satellite-based telephony and Internet services, ensuring India’s connectivity evolution matches its space prowess.”

The Barclays report combs through some market trends and concludes that there is a rising demand from B2B customers to connect to the cloud as satellite is now seen as a key component of telecom networks, bringing reliable and secure redundancy. Telecom companies that wholesale satellite capacity and resell to B2B and B2C customers have witnessed a change in demand, with satellite capacity now seen as a key backup for B2B clients that want redundancy and security. There are also new hot pockets like demand for integrated multi-orbit capacity (i.e., LEO, MEO, GEO), as orbital positions have different attributes that are valuable (latency, capacity, low cost of equipment). Telecom operators also see satellites as a good alternative to further expanding their terrestrial infrastructure (towers, FTTH) as this is far better economics in remote parts of the world. But for now, satellite capacity is more of a complement to the operators that they can bundle in their offers, not a substitute.

As hot as they look, these satellite offshoots are not exactly ‘ready to eat’. Not right away. 🍌

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RANKING OF TOP 100 ENGINEERING COLLEGES IN INDIA ON “DIGITAL INDEX”

December 2023 edition



This December, Dataquest is coming up with the market analysis of the higher education sector primarily engineering colleges in India on basis of Digital Index”. Digital indexing will evaluate the overall “**DIGITAL INFRASTRUCTURE, DIGITAL TEACHING & LEARNING PRACTICES, ADOPTING NEW TECHNOLOGIES, NEW AGE SKILL DEVELOPMENT & SUPPORT, ATTRIBUTING NEW DIGITAL CULTURES** among students & teachers.

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Navigating the ambiguity: Cloud services regulation in India

With the latest episode in the TRAI-DoT debate over cloud services regulation, clarity remains elusive, but self-regulation can resolve the matter



BY JAIDEEP GHOSH

The debate between the Telecom Authority of India (TRAI) and the Department of Telecommunications (DoT) regarding the regulation of cloud services has resurfaced recently, creating an ambiguous situation.

In May 2023, the DoT expressed its opinion that cloud services are in the domain of the Ministry of Electronics

and Information Technology (MeitY) and any further regulation under the telecom framework might impede the sector's growth. However, TRAI, in August 2023, stood by its view that cloud services are within its domain and a "light touch" regulation is essential.

HISTORICAL CONTEXT

The TRAI initially submitted its recommendations on the

Harmonising legal frameworks, fostering self-regulation and ensuring global alignment are pivotal for unleashing the full potential of cloud services.

While a federal cloud services law is yet to be established in the US, laws like the Cloud Act (2018) allow access to data stored abroad.



IN BRIEF

- TRAI and the DoT are at odds over cloud service regulation, leading to uncertainty in the sector's future regulation and growth.
- Several countries have implemented or are developing cloud service regulations, emphasising data protection, state control, and sectoral regulations.
- Technological advancements have blurred industry boundaries, requiring flexible regulations.
- Cloud services, diversifying into fintech and more, demand a multi-disciplinary, globally aligned regulatory framework to balance innovation and compliance.
- India faces the challenge of segregating telecom and IT infrastructure in cloud service regulation.
- A balanced, light-touch approach emphasising self-regulation by cloud service providers, based on core principles like data security and privacy, offers a potential solution.vital for a comprehensive digital strategy.

regulatory framework for cloud services in 2017. Further, based on additional terms of reference provided by the DoT, the TRAI issued a consultation paper in 2019 and sought views from stakeholders.

The industry opposed fresh regulations stating that cloud service providers (CSPs) are already regulated by a set of IT and privacy regulations. Besides, they stated that cloud computing is not a telecom service, hence beyond the direct jurisdiction of the TRAI.

Despite the industry opposition, the TRAI recommended a light-touch regulatory regime (in 2020), including the establishment of non-profit industry-led bodies in conjunction with DoT/TRAI. However, DoT declined these recommendations, leading to the existing standoff. This disagreement has persisted since then.

GROWTH OF CLOUD SERVICES MARKET

Cloud computing has transformed data management globally and is witnessing rapid growth in India. The cloud services market in India is forecast to grow at a CAGR of more than 23% to reach around USD 17 billion by 2027, as per research reports.

The global cloud services market reached USD 454 billion in 2022 and is projected to reach USD 2.2 trillion by 2032. This enormous growth potential has turned cloud services into a battleground for technological and geopolitical dominance, with companies such as Amazon, Microsoft, Google, Alibaba, Tencent and Baidu vying for supremacy.

CLOUD SERVICES REGULATIONS WORLDWIDE

Many countries are grappling with the question of cloud service regulation. Australia is developing a regulatory framework for CSPs. The European Union implemented the General Data Protection Regulation (GDPR) in 2018, emphasising data protection while ensuring global data flows. The UK follows the EU regulations and is working on its cloud computing regulations.

While a federal cloud services law is yet to be established in the US, laws like the Cloud Act (2018) allow access to data stored abroad. Besides there are sectoral regulations around health, financial services, etc.

The cloud services market in India is forecast to grow at a CAGR of more than 23% to reach around USD 17 billion by 2027, as per research reports.

Chinese CSPs are subject to greater state control. An important regulation is the Cybersecurity Law of 2017, requiring CSPs to store data within China. CSPs are required to obtain government approvals and licences, making it practically difficult for foreign CSPs to operate in China. Cloud computing regulation is still evolving worldwide and we will likely see more cloud computing regulations being developed in the coming years.

REGULATIONS AMIDST BLURRING INDUSTRY BOUNDARIES

Technological advancements have blurred traditional industry boundaries, requiring a new regulatory vision. Companies like Alibaba and Amazon started as online shopping providers but have diversified into fintech, logistics, cloud services and so on, necessitating flexible regulations without compromising growth and compliance. A well-designed, multi-disciplinary and globally aligned regulatory framework is essential for emerging technologies like cloud services.

PROPOSED REGULATORY FRAMEWORK FOR CSPs IN INDIA

India is in the process of establishing or updating several technology-related regulations, including the Digital Personal Data Privacy Act, the Digital India Act and the Telecommunications Bill.

In the context of the TRAI and DoT's differing views, segregating telecom and IT infrastructure is challenging. However, while telecom operators adhere to strict regulations, cloud services lack similar oversight.

A balanced view needs to be taken to regulate high-growth technology services, such as cloud services.

Cloud services are a rapidly evolving technology, and it is important to avoid over-regulation that could stifle innovation. Further, cloud services are already

subject to certain information technology and privacy regulations, such as the Information Technology Act, 2000 and the GDPR.

Self-regulation, akin to fintech businesses, by CSPs can be an effective way to ensure compliance with these regulations. This could be termed as "light-touch" regulation, but significantly relying on participants voluntarily complying with various regulations, thereby simplifying regulatory efforts.

This approach could involve the following:

- Establishing a set of core principles for the regulation of cloud services, such as data security, privacy, and transparency.
- Allowing CSPs to self-regulate per these principles through an industry-led body to oversee compliance with the principles.
- Requiring CSPs to report to the government on their compliance with the principles. This would allow the government to monitor the cloud services market and identify any areas where further regulation may be needed.

Harmonising legal frameworks, fostering self-regulation and ensuring global alignment are pivotal for unleashing the full potential of cloud services in the country.

In conclusion, India's cloud services sector stands at a crossroads. Early resolution of the TRAI-DoT impasse is essential to shaping India's digital future. 🌟

The author is the former COO of Shardul Amarchand Mangaldas & Co.

Views are personal.

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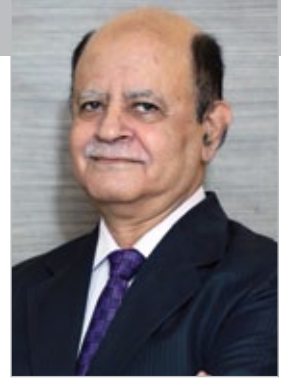
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LT GEN DR S P KOCHHAR



GREEN TELECOM: KEY TO A SUSTAINABLE DIGITAL FUTURE

An array of options is available to the sector to meet its energy demand in an eco-friendly way. An industry veteran compares them and points to the future

The telecommunications industry has become an indispensable part of our lives, connecting billions of people around the world. But as in every other sector, the growing environmental concerns necessitate the adoption of more sustainable and eco-friendly practices. The emergence of green telecom networks, which prioritise energy efficiency, reduced carbon emissions and overall long-term sustainability, would play a decisive role in this endeavour for the future of the sector.

THE NEED FOR GREEN TELECOM

It is vital to understand the pressing need for green telecom networks. Within the ICT sector, telcos are responsible for 1.6% of total global CO2 emissions, which contribute to climate change. As the demand for telecom services is expected to grow exponentially with the upcoming 5G and 6G technologies and their use cases, this figure is expected to rise further. This makes it imperative to transition towards more sustainable and eco-friendly operations.

Advancements in telecom technologies have led to practices which optimise power consumption and lead to more efficient use. Some of these are:

ENERGY-EFFICIENT EQUIPMENT

Modern routers, switches and low-energy base stations

have transformed the telecom industry through significant advancements in energy efficiency. These devices now incorporate advanced power management systems and energy-efficient components. Cutting-edge semiconductors and processors are designed to consume less power while maintaining high performance. This not only reduces energy consumption but also leads to substantial cost savings for telecom operators. Moreover, new base station designs with intelligent systems can dynamically adjust power consumption based on network traffic patterns, further enhancing energy efficiency during off-peak hours.

INITIATIVES AND STRATEGIES

Advanced algorithms play a pivotal role in optimising network operations for energy efficiency. By intelligently routing data to minimise transmission distances, these algorithms reduce energy consumption. For instance, data can be routed through paths with lower energy requirements, thereby conserving power.

Dynamic spectrum access allows networks to adapt and allocate frequencies as needed, reducing the energy expended on idle or underutilised spectrum. Further, IoT-enabled optimisations like the utilisation of sensors to optimise cooling, smart metering and fuel monitoring can help in making the network more efficient.



Embracing sustainable energy solutions is not only an opportunity to reduce operational costs but also a vital contribution to global sustainability goals.

Advancements in telecom technologies have led to practices which optimise power consumption and lead to more efficient use.

Submerged datacentres: Submerged datacentres offer an innovative approach to cooling and power consumption. These datacentres are placed underwater, leveraging the natural cooling properties of water to maintain optimal temperatures for the servers. Liquid and Free Cooling are other promising cooling techniques to enhance energy efficiency to reduce the energy footprint for telecom network operations.

Waste management protocols: This involves responsible disposal and recycling of electronic waste arising from outdated equipment. Sustainable e-waste management not only curbs environmental impact but also ensures adherence to regulatory mandates. In tandem, material recycling represents another crucial facet of telecom sustainability.

Renewable energy integration: The integration of solar panels into telecom infrastructure has become a game-changer. Photovoltaic cells capture sunlight and convert it directly into electricity. This renewable energy source is particularly effective in regions with abundant sunshine. Telecom operators are increasingly adopting solar panels to reduce their reliance on conventional power sources. For locations with consistent wind patterns, wind turbines can be utilised to generate clean electricity. This approach is better suited for remote areas with limited access to the grid.

An emerging and innovative approach to renewable energy integration in green telecom networks is the use of energy kites. Energy kites, also known as airborne wind energy systems, are a groundbreaking technology that harnesses wind energy at higher altitudes using tethered kites. The key advantages of this technology include the utilisation of stronger and more consistent winds for reliable energy generation, higher portability, lower installation and maintenance costs, 24/7 operation and a minimal physical footprint.

POTENTIAL OF FUEL CELLS IN TELECOM OPERATIONS

In the ever-evolving world of telecommunications, ensuring uninterrupted network connectivity is paramount. However, the challenge of power cuts and inconsistent power supplies adds significant operational

costs to the equation. Currently, diesel generators serve as the go-to backup power source to maintain continuous operation in the case of electricity disruptions. But as we confront the environmental impact of diesel generators and the growing demand for sustainable solutions, the telecom industry is shifting its focus towards the adoption of fuel cells. These innovative energy systems offer a reliable and eco-friendly alternative, making them ideal for standalone operations and supplementing the quest for uninterrupted connectivity.

Fuel cells: Fuel cells are electrochemical devices that efficiently convert chemical energy from fuel and oxygen into electricity. Unlike batteries, fuel cells require a continuous source of fuel and oxygen to operate, but produce minimal emissions in the process. Some examples of fuel cells are Proton Exchange Membranes (PEMFC), Solid Oxide Fuel Cells (SOFC) and Direct Methanol Fuel Cells (DMFC).

Fuel cells are renowned for their longevity. They have a significantly longer operational life compared to traditional batteries, reducing the frequency of replacements and associated waste. Another compelling advantage of fuel cells is their eco-friendliness and high reliability. These devices produce minimal emissions, significantly reducing the carbon footprint of telecom operations.

In the context of backup power sources for telecom networks, fuel cells outperform traditional batteries and diesel generators. They continuously generate electricity as long as fuel is supplied, making them ideal for networks with varying power needs. Additionally, they have longer life spans, reducing the need for frequent replacements and waste. Compared to diesel generators, fuel cells are quieter and require less maintenance.

HYDROGEN CELLS FOR BTS: A DEEP DIVE

Hydrogen fuel cells use hydrogen as a fuel source and oxygen, usually sourced from the air, as an oxidant. The only byproduct of this electrochemical reaction is water, ensuring zero emissions and making it an exceptionally clean and environment-friendly energy source.

Government initiatives: The Indian government has been taking significant steps towards promoting green

An emerging and innovative approach to renewable energy integration in green telecom networks is the use of energy kites (aka airborne wind energy systems).



WHY HYDROGEN CELLS FOR BTS?

- **High energy density:** Hydrogen boasts an impressive energy-to-weight ratio, making it highly efficient for powering Base Transceiver Stations (BTS). These stations require a reliable and consistent source of energy, and hydrogen cells offer an energy-dense solution that aligns perfectly with their needs.
- **Clean energy:** As water is the only byproduct of the hydrogen-oxygen reaction, hydrogen cells are an ideal choice for reducing the carbon footprint of BTS.
- **Scalability:** Highly scalable, hydrogen fuel cells can be easily adjusted to match the energy requirements of BTS, providing flexibility in network infrastructure planning and deployment.
- **Storage:** Hydrogen can be stored in various forms, depending on the specific requirements of BTS operations. It can be stored as a compressed gas, a liquid, or even in chemical compounds. This versatility ensures that hydrogen can be tailored to suit the needs of different telecom installations.

technology initiatives and has set ambitious targets to achieve net-zero emissions by 2070. India has already implemented several policy measures to accelerate the shift to cleaner and more efficient technologies, such as subsidies for electric vehicles and the removal of subsidies for petrol and diesel.

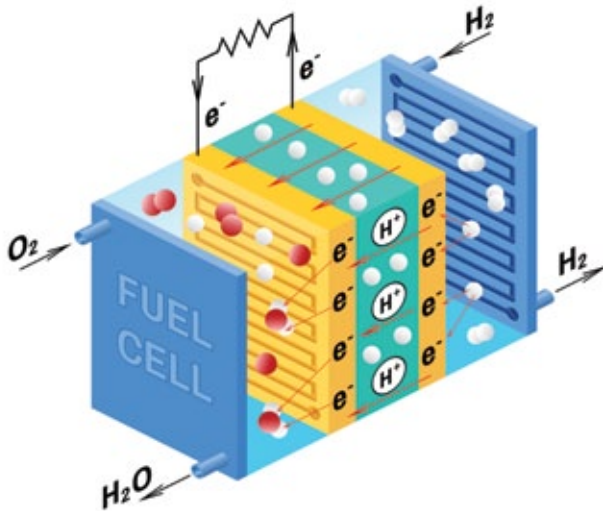
The government has approved the National Green Hydrogen Mission, which aims to make India a leading producer and supplier of green hydrogen in the world. The mission has an initial outlay of Rs. 19,744 crore and aims to achieve a green hydrogen production capacity of at least 5 million metric tonnes per annum with an associated renewable energy capacity addition of about 125 GW in the country.

It has also introduced the Green Credits Programme to incentivise voluntary environmental actions undertaken by individuals, private sectors, small-scale industries, cooperatives, forestry enterprises and farmer-produce organisations for their environmental actions. Significant steps have been taken to promote green technology initiatives, and these initiatives could help India emerge as a key base for hydrogen electrolyser production with 8GW capacity by 2025.

ROLE OF PUBLIC-PRIVATE PARTNERSHIPS

Driving the shift to green telecom solutions necessitates a synergistic approach, and collaborations between governments and private telecom operators have proven instrumental in this regard. Governments can play a pivotal role by providing fiscal incentives and tax breaks, which considerably reduce the financial burden on private entities keen on transitioning to green solutions. Moreover, pooling resources from both public and private sectors can expedite joint research and development initiatives, thereby fast-tracking technological advancements. Beyond the technical and financial facets, these collaborations hold the potential to spearhead public awareness campaigns, educating the masses on the environmental implications of telecom operations and elucidating the imperative transition towards greener solutions.

Simplified mechanics of a hydrogen fuel cell



Source: Mechanics of a hydrogen fuel cell made simple. Andretti Group; 2021. <https://andretti1.com/mechanics-hydrogen-fuel-cell>.

Qualitative comparison of backup power technologies

	Fuel Cell	Diesel	Battery
Reliability	Excellent	Poor	Good
Capital cost (\$/kW)	Good	Poor	Excellent
Extended run time	Good	Excellent	Poor
Emissions	Excellent	Poor	Good
Noise	Excellent	Poor	Good
Weight	Excellent	Poor	Good
Efficiency	Good	Poor	Excellent
Annual fuel cost	Good	Poor	Excellent
Annual maintenance cost	Good	Poor	Excellent
Maintenance frequency	Good	Excellent	Unknown
Refurbishment	Good	Excellent	Poor
Remote conditioning and check	Good	Poor	Unknown
Operation lifetime	Good	Excellent	Poor

Excellent
Good
Unknown
Poor
Very Poor

Source: Hydrogen fuel cell performance as telecommunications backup power in the United States. National Renewable Energy Laboratory; 2015. <https://www.energy.gov/eere/fuelcells/articles/hydrogen-fuel-cell-performance-telecommunications-backup-power-united>.

GREEN TELECOM ROADBLOCKS

The transition towards green telecom solutions, while essential, comes with its set of challenges that the industry grapples with. High upfront investment is often necessary, especially when considering the shift to promising technologies such as hydrogen fuel cells. Many operators find this initial capital requirement daunting.

Furthermore, there's the intricate task of retrofitting and altering existing network infrastructures to accommodate these new energy sources, presenting both logistical and financial hurdles. Even as hydrogen emerges as a beacon of hope for green energy, consistent availability, especially of green hydrogen, remains a concern, underscoring supply chain issues. Additionally, on the path to full adoption, the industry still has technical speed bumps that need addressing, underscoring the need for ongoing innovation and problem-solving.

On-ground support is also required for the implementation of progressive policy measures like the Green Energy Open Access enabled by the Ministry of Power, which the states and discoms need to adopt swiftly to help enhance green energy use in telecom.

THE ROAD AHEAD

The integration of fuel cells, especially hydrogen cells, into telecom operations is not merely a passing trend but a necessity. As the telecommunications industry continues to expand to meet the growing demand for connectivity, so does its energy consumption. Embracing sustainable energy solutions is not only an opportunity to reduce operational costs but also a vital contribution to global sustainability goals.

Green telecom networks represent a promising future for both the telecom industry and the planet. By embracing these innovative technologies and practices, telecom operators can lead the way in creating a greener, more sustainable world. It's a journey that aligns with global and national sustainability objectives and promises to make telecom an even more responsible and environment-friendly industry. 🌱

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Pawan Kumar Chandana
Co-Founder and Chief Executive Officer,
Skyroot Aerospace

“We are on a mission to build futuristic space launch vehicles”

As one of the private companies in rocket-building and launching, and that too in a short period and successfully at the first attempt, Skyroot Aerospace has a very interesting trajectory mapped out – not just for itself but for the satellite industry as a whole and its propellers for other sectors. Its Co-Founder and Chief Executive Officer Pawan Kumar Chandana gives a view from this exciting cockpit in a chat with Pratima Harigunani. The apogee of affordable and on-demand space technology is coming, but how and where, let's climb in and find out.

What triggered this huge ambition? If you can look back and pick one turning point that made this journey explosive, what would that be?

The trigger was the dire need for India to have a globally competitive private enterprise space to have a larger share of the USD 400-billion global market. We sensed tremendous opportunity there, considering we are the most cost-efficient space-faring nation in the world. The leap of faith that I took with Bharath, my co-founder, was the turning point; a leap which was a do-or-die at a time when the private space sector wasn't yet created by the government and there was no space policy in place.

Tell us more about the collaboration with ISRO and plans for a satellite constellation with a French enterprise. What exactly are both sides bringing to the table?

We work alongside ISRO at various levels, especially about the testing of our hardware at their state-of-the-art facilities and utilising their spaceport services for our launches. Our recent collaboration with Promethee, the French new-space operator of nanosatellite constellations, is to jointly explore the prospects of

launching a part of their Japetus earth observation constellation with our Vikram series of launch vehicles. This is an example of how space sector alliances happen, which essentially looks at the most favourable partners in terms of reliability, consistency and cost.

What about the challenges and the way ahead for Skyroot Aerospace? What is the impact of players such as Starlink, Hughes, OneWeb, Google-Garmin and Facebook on this space?

The challenge is inherent at every step of the way for a long-haul activity like a space launch. We have been one of the fastest private companies to build and launch a rocket, and that too successfully at the first attempt. We are not a satellite company, and we do not compete against these players. We are a space launch vehicle builder and launch provider who is on a mission to build futuristic launch vehicles which can launch solo or constellations of satellites for the likes of the brands you have mentioned. We are keen to tap into the satellite launch market – nearly 30,000 satellites are likely to be launched in the next decade – and be a key player in the global space launch scene. We are at present steadily progressing towards our second space launch mission, which is poised to be another first for Indian private space. The Vikram 1 rocket mission is slated to be India's first private orbital rocket launch.

What's your reckoning of other aspects of satellite connectivity like the potential of GEO-based Internet, GEO vs. LEO Internet, hybrid (with FWA) vs. satellite-only broadband and latency?

We, by virtue of our services, support downstream services that build connectivity. Today, half of the



We are keen to tap into the nearly 30,000 satellites that are to be launched in the next decade, and be a key player in the global space launch scene

Companies are building earth observation and communication satellites, as well as downstream services like data analytics and communication services.

global population is either outside Internet coverage or having to live with very low bandwidth. Also, the cost of connectivity is high despite the efforts to reduce it. The scenario can change only when more satellites get launched, and the cost of building and launching them reduces. This calls for the entire ecosystem to explore better ways. From our perspective, it will be about using better, cheaper, reusable technologies to build and launch rockets.

What role do indigenisation and 3D printing play on costs, environmental impact, G2M speed, testing edge, etc?

India has developed a strong space ecosystem which includes OEMs focused on various aspects of the value chain, right from tools, components and software to manufacturing equipment. Nevertheless, there are gaps that should – and can – be filled soon. Indigenisation can address the delay in the TAT of sourcing complex technology globally, and also reduce costs in the due course, as greater demand is created locally. We have been employing 3D printing technology to develop our engines and various other components, not just because of the greater precision in manufacturing, but also in terms of innovation. 3D printing has vastly reduced the latency in manufacturing specialist components, and that augurs well for companies like us who are on a mission to make space launches affordable, regular and on-demand.

Why should anyone keep betting on innovation that is looking upwards and at the far end of the universe? What lies ahead for humanity and business here? How helpful it is when ISRO supports ideas like Raman-II engine testing?

Curiosity has been the catalyst of innovation in the space sector, and innovation is the magic potion which makes the impossible possible, for humanity to progress. Both governments and the private sector have a huge role in advancing innovation and promoting curiosity for collective benefits. From a business point of view, what lies ahead for the private sector in India will be the success

of commercial orbital launches in the coming years which will cement the sustainability of the sector.

Also, we can see companies emerging from the satellite domain building cutting-edge earth observation and communication satellites. We will also see growing downstream services like data analytics and communication services. While India's private space sector has already demonstrated its strength in research and development and the creation of proprietary technologies, primarily for domestic projects, the developments, such as magnetic beacons, are expected to stimulate more collaborative ventures globally.

These collaborations will position Indian private space technology enterprises not only as builders of comprehensive space systems and subsystems for the global market but also as researchers and innovators contributing to the advancement of global space technology. As a leading player among India's space-tech companies, we are closely monitoring the shifting global interest in India's space ecosystem, and we are highly optimistic that exciting opportunities lie ahead, not just for space companies, but for humanity as a whole.

How can SpaceTech innovations help in addressing the issues of Space debris? How much can reusable rockets and parts help?

SpaceTech has by itself, and with the guidance of watchdog organisations in the realm, increasingly become inclusive, sustainable and responsible. Today frameworks like the Artemis Accords are in place to ensure that spacefaring nations agree to the greater good of humanity, and not just on their gains. Space debris is one such aspect which is being addressed and discussed widely. Space companies are bound by laws that make them responsible towards the debris they contribute so that the ways to eradicate them become an inherent part of their missions. Also, we see a lot of commercial opportunities in this realm, and several start-ups entering the domain of debris management. 🌟

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Mapping the contours of connectivity beyond 5G

Industry veterans and experts share insights into the complexities of evolving communication standards in a dynamic and ever-changing technological landscape



BY V&D NEWS BUREAU

The 5th edition of the Telecom Leadership Forum (TLF), organised by the leading communication magazine Voice&Data, set the stage for a transformative discussion on the future of connectivity beyond 5G. The Voice&Data 5G+ Conference brought together industry leaders, domain experts, policymakers, technologists, and academia to explore the dynamic developments in communication and connectivity.

The conference was powered by HPE and PC Solutions, and supported by Reliance Jio, Vodafone Idea, AT&T Business, Niral Networks, Academia Partner Apeejay Education, and media partner Dataquest. It is also supported by ACTO, Broadband India Forum, COAI, CMAI, Digital Infrastructure Providers Association, Indian Cellular Association, Indian Space Association, TEMA, Telecom Sector Skill Council of India and Satcom Industry Association.

The conference focused on the changing technology landscape triggered by 5G, its challenges, sustainability aspects and the potential of the upcoming 6G era.

In a fireside session, industry stalwarts discussed the possibility of India driving global 6G standards, highlighting the nation's potential in this arena.

EXPLORING THE 5G AND 6G LANDSCAPE

The conference focused on the changing technology landscape triggered by 5G, its challenges, sustainability aspects and the potential of the upcoming 6G era. The attendees gained valuable insights into India's role in shaping 6G standards, driven by its 6G Vision Document, and its journey towards becoming a global manufacturing base for 5G and 6G equipment and hardware.

The event commenced with the ceremonial lamp lighting, symbolising the illumination of knowledge and innovation. This was followed by an insightful inaugural session featuring distinguished speakers. Setting the tone, Prashant Singhal, Emerging Market Technology, Media & Entertainment, and Telecommunications Leader at EY, delivered an opening note on the impact of 5G in India and key enablers. He also highlighted the key trends and sectors that could benefit the most from the changing technologies.

This was followed by special addresses by T.V. Ramachandran, President of Broadband India Forum; Shyam Prabhakar Mardikar, President – Group CTO Mobility at Reliance Jio; Lt. Gen. Dr. SP Kochhar, Director General, COAI; and Dr. Pavan Duggal, Chairman of the International Commission on Cyber Security Law and Advocate at the Supreme Court of India.

Ramachandran shared his insight into the impact of 5G on broadcasting, and Mardikar talked about how service providers can tailor connectivity for diverse applications. Lt. Gen. Dr. Kochhar explored the theme of enabling next-generation green networks, while Dr. Duggal provided insights into the Digital Personal Data Protection Act, 2023, and its implications for the 5G-led digital economy.

Earlier in the session, Pradeep Gupta, Chairman of CyberMedia Group, extended a warm welcome to the attendees. He also highlighted the role played by the CyberMedia group during its 40-year journey of chronicling the ICT industry in India.

THE 5G+ AGENDA

The conference featured engaging panel discussions on

topics such as monetising 5G services, creating networks for 5G and beyond, and evolving communication standards. Notable industry figures and experts moderated and participated in these discussions, providing valuable perspectives and insights.

A special address by Prof. Venugopal Achanta, Director of CSIR – National Physical Laboratory, shed light on India's vision of quantum communications, showcasing the country's commitment to cutting-edge research and technology.

In the industry fireside session, industry stalwarts discussed the possibility of India driving global 6G standards, highlighting the nation's potential in shaping the future of connectivity. The speakers included Akhil Gupta, Vice Chairman, Bharti Enterprises; Manoj Chugh, Chairman, Manoj Chugh Advisory LLP; and Prof Kiran Kumar Kuchi of IIT Hyderabad. It was moderated by CyberMedia Chairman Gupta.

MONETISING 5G SERVICES IN INDIA

Speakers at the panel discussion on 'Monetising 5G Services: Business Models, Value-added Services, and Revenue Streams', moderated by former KPMG Partner and industry veteran Jaideep Ghosh, shared their insight into the numerous opportunities and challenges ushered in by 5G and what the industry needs to do to capitalise on these.

The speakers included Himanshu Gupta, Country Manager – Telecom, Media & Entertainment, HPE India; Saurabh Mittal, VP & Head Industry and Technology, Bharti Airtel; Salil Khanna, National Head, Enterprise & Govt Business, Jio; and Rajesh Chharia, President, ISPAI. They also explored how businesses can create a balance between innovation, regulation, customer satisfaction and emerging trends in the context of monetising 5G services and strategies.

THE NEXT-GEN INFRASTRUCTURE

The speakers at the thought-provoking panel discussion on 'Creating Networks for 5G and Beyond' deliberated on the evolving networks and digital infrastructure and how it will be driving the future of connectivity. The

As India positions itself at the forefront of Industry 4.0 and 5G, insights shared during the event can help shape the future of manufacturing in the country.

session delved into the challenges and opportunities in building robust networks and evolving satellite-based communication to support emerging technologies, including 5G and beyond.

The participants also discussed the hurdles in fiberisation in India, explored various technology options, and emphasised the need for stakeholder collaboration to accelerate fibre deployment and bridge the digital divide. The session was moderated by Amitabh Singhal, Director, Telxess Consulting Services, and founder/former CEO, National Internet Exchange of India. The speakers included Kapil Malhotra, Head of Customer Engineering, Google; P. Balaji, Chief Regulatory & Corporate Affairs Officer, Vodafone Idea; Tilak Raj Dua, Director General, DIPA; and Lt. Gen. A. K. Bhatt (Retd), Director General, ISpA

The discussion also addressed the importance of effective collaboration between network providers, governments, and technology companies to overcome

challenges and ensure a seamless transition to advanced network technologies, emphasising best practices.

THE 4TH INDUSTRIAL REVOLUTION

A major impact of 5G+ technologies is their ability to transform businesses and drive Industry 4.0 across sectors. The session moderated by Ibrahim Ahmad, Consulting Group Editor, CyberMedia, delved into the convergence of Industry 4.0 and 5G, uncovering the immense potential for revolutionising smart manufacturing and automation processes.

The panel discussion on 'Industry 4.0: Leveraging 5G+ for Smart Manufacturing and Automation' provided a deep dive into the transformative potential of 5G+ in the realm of smart manufacturing and automation. It underscored the pivotal role that advanced communication standards and networks play in driving intelligent factories and streamlining automation processes. The session also highlighted that the country needs to strengthen the



The conference served as a vital catalyst for discussions, collaborations and innovations that will play a pivotal role in the nation's technological landscape.

device ecosystem to reap the benefits of the evolving technologies, especially 5G.

The speakers in the session included Shridhar Krish, Executive Director & COO, Tikona Infinet; Dharmender Khajuria, Head, Network Partnerships, Bharti Airtel; Vivek Roy, Head, Digital Connectivity & Power, Digital Industries, Siemens Limited; Purushottam Konar, Director and Head, Product Solution and Engineering (IOT and 5G), Wipro Limited; and Bhanu Pratap, Head of Sales, Niral Networks.

As India positions itself at the forefront of Industry 4.0 and 5G, the insights shared during this discussion are poised to shape the future of manufacturing in the country, fostering innovation and competitiveness.

DEFINING THE COMMUNICATION STANDARDS

Led by Prasanto K Roy, Managing Director, FTI Consulting and former Group Editor of CyberMedia, the session on 'Frameworks and Imperatives for Evolving Communication Standards' focused on the critical aspects of updating and adapting communication standards in today's rapidly evolving technological landscape.

The speakers included Lt. Col. Dr. Sidharth Shukla, Ex Jt. Advisor – QoS, TRAI; Anjali Hans, SVP, Public Policy, Vodafone Idea; Arvind Bali, CEO, Telecom Sector Skill Council; Prof. N. K. Goyal, President, CMAI Association of India & Chairman Emeritus, TEMA; and Cdr. Aditya Varma, VP, Defence Consulting, RAH Infotech.

The panellists stressed the necessity for communication standards frameworks to remain adaptable to keep pace with rapid technological advancements, ensuring that they continue to meet the evolving needs of the digital age. They also explored strategies and technologies aimed at achieving seamless communication across diverse platforms, devices, and networks while prioritising security and privacy.

Addressing the growing cybersecurity threats, experts emphasised the key imperatives for integrating robust

cybersecurity measures into evolving communication standards to counteract emerging cyber risks effectively. The panel examined how regulatory bodies can strike a balance between fostering innovation and ensuring compliance with evolving communication norms, highlighting the importance of regulatory frameworks that encourage both.

The discussion also underlined the pivotal role of international collaboration in developing cross-border communication standards that facilitate global connectivity and information exchange, emphasising the need for global cooperation in setting future communication norms, particularly the forthcoming 6G standards.

The panel discussion provided invaluable insights into the complexities of evolving communication standards in a dynamic and ever-changing technological landscape. It underscored the need for flexible frameworks, interoperability, cybersecurity, regulatory balance, and international collaboration in shaping the future of communication norms. These insights hold immense significance in ensuring that communication standards remain robust, secure and adaptable to meet the evolving needs of a digital society.

ANTICIPATING THE FUTURE

The Voice&Data 5G+ Conference 2023 acted as a convergence point for over 200 technology and business decision-makers; spanning telecommunications, enterprises, startups, academia, and the influencer community. It provided a platform for attendees to gain insights into the ever-evolving communication and connectivity space, emphasising the technologies that are shaping the future of communication.

As India continues its journey into the 5G era and beyond, the conference served as a vital catalyst for discussions, collaborations and innovations that will play a pivotal role in the nation's technological landscape. 🌐

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5G glass is half full and half cream

Here is an optimist who believes that it makes sense to get super-excited about this new technology, and for rational and practical reasons



BY PRATIMA HARIGUNANI

India has made remarkable strides in rolling out the 5G network and the rapid deployment across 300,000 sites has positioned the country among the top ten globally in 5G connectivity. The rollout has also raised hopes and hints at the transformative potential of 5G; envisioning a future where every aspect of Indian life, from healthcare to education, can experience a paradigm shift. The points were made by Prashant Singhal, the

Emerging Market Technology, Media and Entertainment, and Telecommunications Leader at EY. He was speaking at the Voice&Data 5G+ Conference, recently.

Turbocharging everyone with a confident and optimistic gaze, he said, “We have had a wonderful journey with 5G in the last few years. India, two and a half years back, suddenly saw 5G with spectrum auctions and allocations,

Telcos will see growth of 5G data usage. But a greater reason has to come from industries which will use it and from the government.



“With efficiency and productivity moving tremendously up, and the cost of production sliding down, we can also control inflation.”

Prashant Singhal

Emerging Market Technology, Media & Entertainment, & Telecommunications Leader, EY

showing the fastest deployment to date. Everyone came together to make it happen. If 30% of 5G connections experience 5G – among the top ten globally, then we are doing very well.”

He, however, reminded that despite the financial situation of the sector, one out of every two smartphones shipped is 5G-enabled. “The experience of downloads has gone up tremendously (19 times better) between 4G and 5G. Video content improvement is also 23-24%,” he said and kept adding one strong reason after another to get chuffed about 5G.

He also congratulated government efforts, especially G20's success in a massive digital innovation momentum. “Almost one-third of our population is online, using gaming, shopping and other things. The opportunity to develop the ecosystem is huge, especially with Digi-lockers, UPI and Aadhaar, with the staggering number of transactions and downloads happening in a limited broadband highway. Imagine what's possible when we are on the 5G runway!”

NO EMPTY HOPES

He pointed out that to achieve the 5G+ dream, the country will have to do more, collectively as governments, ecosystem players, users and service providers, to hit the ultimate potential. “Every Indian's life will change. Just think of use cases as basic, like connecting senior citizens with their kids far away, online education with zero latency, healthcare services, remote surgeries, automated ports, quick digital records that reduce queues in hospitals etc. With efficiency and productivity moving tremendously up, and the cost of production sliding down, we can also control inflation. We can also become a powerhouse of 5G use cases. Some pilots are in progress in manufacturing, healthcare and education already.”

For us to become the powerhouse of use cases, we need cross-sector collaboration, he strongly recommended. “Telcos will see growth of 5G data usage. But a greater

reason has to come from industries which will use it and from the government.”

He also talked about how India's industrial growth will shine on many fronts. “We can become an R&D hub; now that patents can be energised. O-RAN manufacturing, iPhone, indigenous telecom equipment... all that is getting strong in India. It will help to grow the digital economy and, hopefully, telcos will make money with 5G due to data usage. That is something crucial, with the financial stress that we see in the sector currently.”

CHEERS TO A NEW G

Home broadband, he added, will also be a big disruption. “With FWA and 5G, a new growth engine will be created for home-based entrepreneurs. We are all entrepreneurs in this country, if only we could have 5G-level connectivity.”

He urged some key changes like rationalisation of levies in the sector, licence fees, ROW charges etc. (and last-mile implementation of some of these policies). A look at tariffs with a fresh lens will also help, especially as they are among the lowest in the world, which is great for consumers but can lead to data misuse. And we should move towards better ARPU. The use of USOF funds is also something that needs attention. Plus, with all the data that will be generated with 5G, available with telcos, we also need to take care of utilisation of data, and new IP dynamics with AI's advent in alignment with new regulations that are developing, he added.

“All the 5G promises and more look possible, provided people experience 5G and operators can connect the entire country. We are on a good path. Now that we are on the moon and exploring the Sun, we are quite strong to achieve this future,” he said, adding, “I hope none of us retire in the next decade. Because the next 10 years are going to be exciting.” 🍷

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A quantum change in communications!

An insider's view on the current stage of India's journey to achieve the capacity to harness the transformational potential of quantum communications



BY PRATIMA HARIGUNANI

When it comes to quantum communications, India can discover a new trail, way before, and better, than other nations can, believes Prof. Venugopal Achanta, Director, CSIR-National Physical Laboratory.

We all know the many facets of security in communications, through beam or fibre splitting or other decrypting methods. In quantum communication, with the use of single photons (for strong security) and entangled photons (for capacity enhancements), a lot can be changed. That is the USP of quantum communications, Prof. Achanta explained. He was delivering his address on 'Defining India's vision of Quantum Communications'.

WHAT IS QUANTUM COMMUNICATION?

Quantum communication represents a cutting-

edge paradigm in the field of information exchange, harnessing the principles of quantum mechanics to achieve unprecedented levels of security and efficiency. At its core, quantum communication relies on the unique properties of quantum particles, such as photons, to enable the secure transmission of information.

One of its fundamental applications is quantum key distribution (QKD), a technique that allows two parties to securely exchange cryptographic keys. Unlike classical encryption methods, QKD ensures the security of the communication channel by detecting any eavesdropping attempts, as per the principles of quantum indeterminacy. This level of security is of paramount importance in the digital age, where sensitive information, ranging from financial transactions to national security data, is constantly under threat from cyber-attacks.



“We are engaged in the development of entangled photon sources, advanced entangled photon devices, metamaterials, and single-photon detectors.”

Prof. Venugopal Achanta
Director, CSIR-National Physical Laboratory

STRONGER AND BETTER

An integrated quantum communication network was demonstrated in 2021. Quantum networks also work with optical fibres on the ground with satellite links that cover a vast range of space and commercial users through quantum key distribution, Prof. Achanta spelt out.

These developments become relevant as we have come to the understanding of hybrid-satellite and fibre-technologies together; especially as blanking out satellite signals is a possibility.

Prof. Achanta also dwelt on what we need to have to unlock quantum communications. “Non-classical light sources, single-photon detectors like superconducting nanowire-based SPD, Silicon Avalanche Photodiodes, quantum repeaters, quantum memories, satellite, ground networks and fibre networks are factors that we need in place to make this shift realisable.”

The present and future of metrology for high-precision measurements will play a crucial role in driving significant progress in various areas, including testing and certifying sources, improving transmission systems and components, and enhancing precision positioning. “To achieve these, we need novel sensors that can leverage the quantum nature of matter. We are actively engaged in research and development in these areas, including the development of entangled photon sources, advanced entangled photon devices, metamaterials, single-photon detectors, and more.

GETTING THERE, FASTER

Drawing insights from the ‘National Mission for Quantum Technologies’ and referencing the ongoing work in his organisation and others, Prof. Achanta discussed various areas of advancement in this emerging field. He highlighted the potential of nano-diamonds for single photon applications and elaborated on the development of roadmaps for quantum cryptography, quantum network enablers, and quantum optics. “At present, the preliminary work is underway, which will be followed

by prototypes. We anticipate the actual systems will hopefully be in place within the next eight years,” he said.

Utilisation of terahertz bands with larger bandwidth is being looked at with high power source enhancers. Amplifiers and multipliers are also being explored. A lot of experts and organisations in India are working on terahertz antennae for source and detector, components for splitting, wave guiding manipulation, transmission spectroscopy and so on. “We are in the R&D stage of both components and systems, and we are going towards terahertz research and quantum communications,” Prof. Achanta informed.

IMPORTANCE OF QUANTUM COMMUNICATION

In modern society, the importance of quantum communication cannot be overstated. With the rise of quantum computers, traditional encryption methods, which form the backbone of internet security, are at risk of being broken. Quantum communication provides a solution to this impending threat by offering a fundamentally secure means of information exchange. Moreover, quantum communication has the potential to revolutionise fields beyond cybersecurity. It can enhance the accuracy and efficiency of global communication networks, enabling real-time and secure data transfer, which is crucial for applications in fields like healthcare, finance and scientific research.

Additionally, quantum communication plays a pivotal role in the development of quantum internet, a futuristic network where quantum information can be shared and processed globally, leading to advancements in fields like quantum computing, quantum teleportation and quantum-enhanced sensing technologies. As society becomes increasingly reliant on digital communication, the advent of quantum communication offers a promising and secure path forward, ensuring the confidentiality and integrity of information exchange in the modern world. 🌟

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DIGITAL PERSONAL DATA
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5G LEEDDIGITAL ECONOMY



Dr Pavan Duggal
Supreme Court of India

MONETISING 5G SERVICES: BUSINESS MODELS, VALUE-ADDED SERVICES AND REVENUE STREAMS



(L-R) Salil Khanna, Jio; Rajesh Chharia, ISPAI; Himanshu Gupta, HPE India; Jaideep Ghosh, ex KPMG; Saurabh Mittal, Bharti Airtel

IMPACT OF 5G IN INDIA AND KEY ENABLERS TO REALISE IT



Prashant Singhal, EY

DEFINING INDIA'S VISION OF QUANTUM COMMUNICATIONS



Prof. Venugopal Achanta
CSIR – National Physical Laboratory

CREATING NETWORKS FOR 5G AND BEYOND



(L-R) Amitabh Singhal, Telcess Consulting Services; Kapil Malhotra, Google; P. Balaji, Vodafone Idea; Tilak Raj, DIPA; Lt. Gen. A. K. Bhatt (Retd), ISPA

THE 6G VISION: CAN INDIA DRIVE THE GLOBAL STANDARDS?



(L-R) Pradeep Gupta, Cybermedia Group; Akhil Gupta, Bharti Enterprises; Manoj Chugh, Manoj Chugh Advisory LLP; Prof. Kiran Kumar Kuchi, IIT – Hyderabad

INDUSTRY 4.0: LEVERAGING 5G+ FOR SMART MANUFACTURING AND AUTOMATION



(L-R) Vivek Roy, Siemens Limited; Shridhar Krish, Tikona Infonet; Dharmender Khajuria, Bharti Airtel; Purushottam Konar, Wipro Limited; Bhanu Pratap, Niral Networks; Ibrahim Ahmad, CyberMedia

INDUSTRY 4.0: LEVERAGING 5G+ FOR SMART MANUFACTURING AND AUTOMATION



(L-R) Lt. Col. Dr. Sidharth Shukla, TRAI; Anjali Hans, Vodafone Idea; Arvind Bali, TSSC; Prof. N. K. Goyal, President, TEMA; Cdr. Aditya Varma, RAH Infotech; Prasanto K Roy, FTI Consulting

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Calibrating India's leap of faith to 6G

Challenges and opportunities of the upcoming technology came up for an in-depth discussion among experts and practitioners



BY AANCHAL GHATAK

As India stands on the cusp of the 6G revolution, it is not expected to play the playbook of the 5G rollout, but, having learnt lessons from the past, there is going to be more innovation along with inclusivity, more collaboration along a strategic focus.

That was the tone emerging from the 5th edition of the Voice&Data TLF conference, themed “Shaping the Future of Connectivity”. The session discussed the technological, economic, and policy aspects of India’s potential leadership in the 6G landscape. It also focused on India’s Vision Document and the Bharat 6G Alliance



“There is a need to reevaluate spectrum pricing in India to ensure a more equitable distribution of this pivotal resource.”

Akhil Gupta
Vice Chairman, Bharti Enterprises



“The transition from 5G to 6G marks a paradigm shift from Giga to Tera – a testament to humanity’s ceaseless technological progress.”

Pradeep Gupta
Chairman, Cybermedia Group

to understand the possibilities of research collaboration, regulatory strategies, international partnerships, and roadblocks.

Pradeep Gupta, Chairman of the Cybermedia Group, led the panel discussion. It was joined by Prof. Kiran Kumar Kuchi, Professor, IIT Hyderabad who is known for his groundbreaking work in electrical engineering. Akhil Gupta, Vice Chairman of Bharti Enterprises, brought his extensive experience and insights to the discussion. Completing the quartet was Manoj Chugh, Chairman of Manoj Chugh Advisory LLP, a seasoned telecom expert.

JOURNEY FROM 5G TO 6G

Pradeep Gupta noted that the transition from 5G to 6G went beyond an incremental advancement. It marked a paradigm shift from Giga to Tera – a testament to humanity’s ceaseless technological progress. The Prime Minister’s vision document for 6G, he said, was a cornerstone in this journey. He lauded Prof. Kuchi as one of the architects of this monumental vision.

“The transition from 5G to 6G marks a paradigm shift from Giga to Tera – a testament to humanity’s ceaseless technological progress,” Gupta said.

SIGNIFICANCE OF THE VISION DOCUMENT

Prof. Kiran Kumar Kuchi shared with the audience his journey in crafting India’s 6G vision document. This document, he emphasised, signified a departure from earlier generations, a testament to India’s audacity.

Notably, there were no 4G or 5G vision documents. This marked an unprecedented moment in India’s technological narrative. “The Vision Document signifies a departure from the 4G and 5G generations; it is a testament to India’s audacity of aiming to shape the 6G ecosystem,” Prof. Kuchi noted.

Expounded on India’s global impact, he recalled that the International Telecommunication Union (ITU) initiated the IMT 2030 project, a precursor to 6G. India’s contributions, notably in the form of ubiquitous communications, faced initial resistance. Yet, after strenuous negotiations, India’s vision was integrated. This stood as a resounding victory in India’s pursuit of 6G leadership.

THE AFFORDABILITY IMPERATIVE

Manoj Chugh, a stalwart in the telecom industry, offered a pragmatic perspective. He acknowledged India’s history of playing catch-up in previous generations but stressed that the era of catching up was over. As substantial investments have already been made in the 5G infrastructure, the transition to 6G posed financial challenges. The question arose: Could India afford this monumental leap?

“The era of catching up is over. With substantial investments in 5G infrastructure, the transition to 6G poses financial challenges,” he noted.

Akhil Gupta interjected, underscoring the paramount importance of inclusivity and affordability in India’s 6G



“The era of catching up is over. With substantial investments in 5G infrastructure, the transition to 6G poses financial challenges.”

Manoj Chugh
Chairman, Manoj Chugh Advisory LLP



“The Vision Document signifies a departure from the 4G and 5G generations; it is a testament to India’s audacity of aiming to shape the 6G ecosystem.”

Prof. Kiran Kumar Kuchi
Professor, IIT Hyderabad

journey. He underscored the need for an incremental investment approach, ensuring the transition’s accessibility to all strata of society. He called for a reevaluation of the spectrum pricing, advocating for a more equitable distribution of this pivotal resource.

“Inclusivity and affordability are paramount in India’s 6G journey,” he asserted.

GEOPOLITICAL CONSIDERATIONS

The discussion shifted to geopolitics. China’s dominance in 5G had been a resounding wake-up call for the world. Now, with 6G on the horizon, what role would China play? Prof. Kuchi, drawing on decades of experience, acknowledged China’s remarkable progress in 6G research and development. He also pointed out that India, with its scale and domestic demand, was uniquely positioned to emulate China’s success.

“India, with its scale and domestic demand, is uniquely positioned to emulate China’s success,” Prof. Kuchi said.

Chugh, offering a strategic viewpoint, stressed the significance of building alliances and supply chains. He

acknowledged that supply chains would inevitably be global, but India’s contributions could be monumental. The emphasis was on seizing the moment, creating a circle of trust and collaborating with friendly nations to actualise India’s 6G vision.

With the global race towards 6G gaining momentum, India is poised to assert itself as a key player. The transition from 5G to 6G represents not just a technological leap, but a redefining moment for the nation’s digital landscape. The vision document, carefully crafted under the guidance of luminaries like Prof. Kuchi, stands as a testament to India’s commitment to shaping the future.

Inclusivity and affordability have emerged as the watchwords of this transformative journey. The call for an incremental investment approach, led by Akhil Gupta, resonates as a pragmatic strategy to ensure every stratum of society reaps the benefits of this technological revolution. The reevaluation of spectrum pricing, as advocated by Gupta, holds the promise of a more equitable and accessible digital future for all.

The geopolitical landscape casts a long shadow over the race to 6G. China’s strides in 5G serve as a stark reminder of the stakes at hand.

However, as Prof. Kuchi affirmed, India’s scale and domestic demand position it uniquely to emulate China’s success. Strategic alliances and supply chains will play a pivotal role, with Chugh urging India to seize the moment and establish a circle of trust with like-minded nations.

As the session drew to a close, it was evident that India stood at the precipice of a technological revolution. The vision, shared by the panellists, was one of inclusivity, affordability and global leadership. India’s 6G journey would be marked by collaboration, innovation, and strategic partnerships. 🌟



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Watch out for the coming tango of 5G and broadcasting

Complementing broadcasting with 5G technology offers a tantalising promise; provided firms keep the end-user in mind, remain adaptable and forward-thinking



BY AANCHAL GHATAK

The promise of 5G also raises the question of its relationship with broadcasting. Will the two complement each other? How will that impact the broad architecture of connectivity in India?

TV Ramachandran, President of the Broadband India Forum, provided the best answers we can formulate today, as he delivered a special address at the Voice&Data 5G+ Conference. The topic for Ramachandran's address promised to delve into the Impact of 5G on Broadcasting.

Stakeholders must recognise the significance of affordability and envisage a future where both mobile and terrestrial broadcasting can complement each other.



“The emergence of personalised, on-demand content has paved the way for the concept of direct-to-mobile as a transformative approach to content delivery.”

TV Ramachandran
President of the Broadband India Forum

Acknowledging the provocative nature of the theme, he expressed gratitude for the opportunity and emphasised the need to move beyond conventional discussions of 4G and 5G. Instead, he encouraged a forward-looking perspective, contemplating 5G’s potential to revolutionise broadcasting in ways yet unexplored.

Addressing a gathering of experts from the telecommunications industry, policymakers, and academia, he reminisced about discussions on convergence between telecom and broadcasting that had echoed for over two decades. He, however, posited that the advent of 5G might finally herald the long-awaited convergence. He stressed the importance of shedding the notion of 5G as merely an evolution of 4G, urging all to think in terms of a paradigm shift and explore new applications and use cases.

Ramachandran painted a vivid picture of the current era, characterised by hyper-connectivity. He evoked a visionary image of a world in which technology would be seamlessly integrated into every facet of life, resonating with the audience’s experiences in an age of technological disruption on an unprecedented scale.

Delving deeper into the topic, he emphasised the growing demand for personalised, on-demand content. “The emergence of personalised, on-demand content has paved the way for the concept of direct-to-mobile as a transformative approach to content delivery,” he stated. He argued that this would be a crucial aspect of broadcasting in the future of connectivity.

He then took the audience on a historical journey, recounting the early consultations by the Telecom Regulatory Authority of India (TRAI) in 2007-08 on mobile television. He highlighted the co-evolution of broadcasting technologies, both terrestrial and satellite, and the strides made in defining standards for content delivery on mobile devices.

Among the various ways of accessing television content on mobile, Ramachandran shed light on terrestrial broadcasting, which had long-standing advantages in terms of wider coverage, especially in remote areas. He emphasised that while broadcasting had its niche, the emergence of 5G would significantly elevate its role in content delivery.

Drawing attention to 3GPP’s work on converged mobile and broadcasting technologies, he pointed out that the standards set by the organisation were crucial for the seamless integration of broadcasting into the 5G landscape.

On the coexistence of technologies, Ramachandran argued that India’s diverse demographics and preferences necessitated the continued existence of various broadcasting technologies. He urged stakeholders to recognise the significance of affordability, especially in a price-sensitive market like India and envisaged a future where both mobile and terrestrial broadcasting would complement each other.

In his closing remarks, Ramachandran called for an open-minded approach, allowing market forces and consumer preferences to dictate the trajectory of these technologies. He said that success would ultimately be determined by the end user, urging the industry to remain adaptable and forward-thinking.

As he concluded his address, Ramachandran left the audience with a thought-provoking perspective on the coexistence of 5G and broadcasting, envisioning a future where both technologies would play pivotal roles in shaping the landscape of connectivity in India. His insightful discourse set the tone for further discussions on the future of telecommunications. 🙌

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What 5 of 5G will do to 4 of Industry 4.0

The scene may look like at sixes and sevens, but the new technology in connectivity has already started transforming the shopfloor, pushing the limits of imagination



BY PRATIMA HARIGUNANI

A lot of hype and excitement surrounds Industry 4.0, but we need to wrap our heads around what it means and transpires.

What exactly is Industry 4.0 and how exactly is it different from previous manufacturing models? How will 5G transform manufacturing with smart factories and Industry 4.0, asked Ibrahim Ahmad, Group

Consulting Editor, CyberMedia, as he moderated a panel discussion on 'Industry 4.0: Leveraging 5G+ for Smart Manufacturing and Automation' during Voice&Data TLF 2023.

A PEEK AT THE NEW FACTORY-IN-MAKING

Earlier, a lot of data was generated in the manufacturing space but used only in factory space and not in the



“Now the industry is looking at flexible manufacturing due to various challenges. This ‘flexibility’ cannot happen without digitisation.”

Vivek Roy
Head – Digital Connectivity & Power, Digital Industries, Siemens Limited



“In healthcare, real-time diagnostics and connected ambulances can be massive advantages. We have showcased such use cases already.”

Dharmender Khajuria

Head – Network Partnerships, Bharti Airtel

enterprise, explained Vivek Roy, Head – Digital Connectivity & Power, Digital Industries, Siemens Limited. “Now the industry is looking at flexible manufacturing due to various challenges. This ‘flexibility’ cannot happen without digitisation. And that is only possible with Industry 4.0 where 5G plays an important role. It takes technology beyond the shop floor, with enhanced mobile broadband connectivity, massive machine type communication and URLLC.”

Dharmender Khajuria, Head – Network Partnerships, Bharti Airtel, seconded that outlook and spoke of how all this plays out in various industries. “In healthcare, real-time diagnostics and connected ambulances can be massive advantages. We have showcased such use cases already. Similarly, in manufacturing, advantages like these can be tapped – before, during and after manufacturing. 5G is all about ultra-low latency and a lot of outcomes can come with that, like digital twins, flexible manufacturing, customisation, logistics with real-time data and more.”

Keeping the trail of these examples flowing, Purushottam Konar, Global Head, Product Solution and Engineering, Wipro Limited, talked about customised productivity, hybrid production models, IIoT convergence, process digitisation and bespoke products. “Data will be a key lever. 5G will contribute strongly to the aspect of data acquisition. Decentralisation of production with hybrid manufacturing is one such instance where Industry 4.0 will shine. A lot is happening at the Edge too.” He also underlined how MTTI and Mean Time to Identify and Repair a problem (MTTR) will be redefined with 5G.

Bhanu Pratap, Head of Sales, Niral Networks, helped to spell out how private 5G will play a part here. “There would be network slicing and uses where data is used without interference amongst various services. Bringing the data back and augmenting response time are also areas where 5G will be impactful.”

BETTER FACTORIES, HAPPIER CUSTOMERS

Taking the lens beyond technology and focusing on end-users, Shridhar Krish, Executive Director and COO, Tikona Infinet, cited how Asian Paints is more of a data science company and less of a paint company. “Today that company has a competitive edge through data – with precise and customer-preference-backed colour combinations. We have come a long way from ‘Any car as long as it is black.’ Now a customer can choose anything and a factory can produce it even if it is just one order. That was not possible with line manufacturing and traditional assembly lines.”

Vivek Roy zoomed in a bit on this talking of how all this is not possible in conventional manufacturing set-ups. “In flexible set-ups, you need the same machines to do multiple activities. Data has to travel back for process changes for the next batch or model to be quickly implemented. The response time here has to be finite; it cannot be infinite. That is where 5G plays an important role. It is sensor-edge-Cloud, a new set of layers now. A lot of computing power comes to the Edge now.”

As to how enterprises get started and keep moving on this new path, the experts shared many suggestions



“5G will contribute to the aspect of data acquisition. Decentralisation of production with hybrid manufacturing is an instance where Industry 4.0 will shine.”

Purushottam Konar

Global Head, Product Solution and Engineering, Wipro Limited



“Today Asian Paints has a competitive edge through data – with precise and customer-preference-backed colour combinations.”

Shridhar Krish
Executive Director & COO, Tikona Infinet



“There would be network slicing and uses where data is used without interference amongst various services.”

Bhanu Pratap
Head of Sales, Niral Networks

about strategy and execution. Konar emphasised understanding the use cases of 5G: Planning on what you want to achieve with 5G in your business. “Day zero is all about network optimisation. Define the number of nodes. Understand which network needs to play where in your factory. You need to find out the blind spots.”

As to the dilemma of legacy systems, Khajuria suggested using clarity on what is required – the outcome that is needed. “People get confused between digitisation and automation. Here, opportunities are immense but an enterprise needs to realise what it exactly needs.” Roy echoed that problem: manufacturing industries are automating well but automation is not digitisation. “One

challenge in both cases is the skill level of people that needs to go up, especially on the shop floor.”

Khajuria also confronted the fears of security threats that some people have. “5G is secure by design. There are also features for home control authentication- already built into 5G, for example. In network slicing, you get separate networks. Localised networks will emerge as billions of devices emerge and talk to each other. As the technology grows, the security issues will be navigated well.”

The panel also touched upon 5G adoption in other regions across the world, ROI from these investments, the advantage of 5G over 4G in precisely focusing on subscribers (beam formation which was not present in 4G) and other facets. There is good traction in some verticals, such as oil and gas, ports, discrete manufacturing, and manufacturing in mining sectors, which are witnessing a lot of adoption in India too. The experts recommended how solution-focused approaches, adaptability, the need for domain expertise, integrating new use cases with legacy IT and addressing skill gaps can help to propel this progress.

When you drop ink in a glass of water, it sits for a bit before it dissipates in a fast way. The same path can be seen with 5G, Konar augured. Right now, the drop is sitting, waiting to spread fast. 🍯

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5G: Where is the jam on this bread?

With B2B applications, FWA, WiFi6, and super-apps, 5G can decode the puzzle of monetisation. Industry experts explain how



BY PRATIMA HARIGUNANI

Monetising 5G services is a tough nut to crack for many players despite all the hype and hoopla around them. But, would apt and innovative business models, value-added services, and revenue streams help? That is what a discussion unlocked in a panel discussion at the Voice&Data 5G+ Conference.

Jaideep Ghosh, Former Partner, KPMG, who moderated the panel discussion, started with a brief sketch of the broad picture: Despite having over one billion 5G subscriptions, the world is still grappling with the issue of monetisation. “India is adding 5G

subscriptions at a very fast pace. Thanks to the massive population base and industry growth, it is expected that the country will have around 500-700 million 5G subscriptions by 2028. A lot of money has been committed to the spectrum auction and then there are other investments and network rollouts in progress. With such huge bets being made, there would be a need for some kind of returns too.” Would we get them, and how, he asked the panellists.

TAP MORE GBS, FWA, USE CASES AND B2B

Salil Khanna, National Head, Enterprise and Government



“A lot of money has been committed to spectrum auction and then there are other investments... With such huge bets, there would be a need for returns too.”

Jaideep Ghosh
Former Partner, KPMG



“Many said India does not need or cannot afford 4G. But India, including telcos and consumers, gained so much. It has been transformative.”

Salil Khanna

National Head, Enterprise and Government Business, Reliance Jio

Business, Reliance Jio, took this question head-on by rewinding a little to the pre-4G days. “The industry faced the same question. Many said India does not need or cannot afford 4G. But India, including telcos and consumers, gained so much. It has been transformative. 5G needs massive investments. Expected rollouts are on the way. The entire India would be covered by the end of December, at least from Jio’s perspective.” As to monetisation, before 4G, India was consuming less than a GB per month, and with 4G we grew from 10GB to 20 GB, and with 5G, we can touch 30 to 40 GB a month, he pointed out.

“As you consume more, you pay more – that is simple maths,” Khanna explained. “India has a lot of headroom, especially when FWA fills the gap of making every home a broadband home. That will pave the way for revenue monetisation. A lot of opportunities will also come from B2B’s share in the incremental side of 5G revenues. You will see all this happening shortly,” he remarked.

Saurabh Mittal, VP and Head, Industry and Technology, Bharti Airtel, took everyone even further back. “When 3G was being standardised in the mid-90s, the Internet was not even created properly. When the 4G standards were being defined, smartphones had not even been invented. This is the first time that networks have more capability than 5G use cases. Today, we are in a position to deliver a lot. A multitude of solutions will emerge. In the spectrum space also, there is a great potential to create initial capacity. FWA, IoT and Edge Computing would unlock

many kinds of solutions in materializing monetization. And the whole ecosystem has to come together in addressing these areas.”

TELCOS: FLIP THE SCRIPT NOW

From the lens of Himanshu Gupta, Country Manager, Telecom Media and Entertainment, HPE India, many monetisation opportunities lie in the telco space. “5G will be evolutionary in the first two to three years and then revolutionary. The second half of this decade will be the time when B2B will pick up momentum and we will start seeing realisation of revenues. As to how telcos can tap this, they will have to become outcome providers and go up the value chain.”

He further sliced this into three horizons. “One, better connectivity at reliable speeds to customers through better data packs, 5G boosters and premium 5G services. Two, bundled entertainment and media etc. at the backend. But ARPUs will be tricky as high-ranking customers will go for premium plans but at the bottom revenues go flat. Selling a productised 5G is another way to monetise it. Telcos can also become CaaS player. The third would be where telcos start to sell solutions and platforms with open APIs and avenues for developers and software programmers who can talk to telco systems and monetise solutions.”

As to where ISPs jump in this revolution, Rajesh Chharia, President, ISPAI, dissected that real Internet growth started in 2019 through COVID-19. “The pandemic allowed the Internet to grow the way the Internet should



“This is the first time that networks have more capability than 5G use cases. We are in a position to deliver a lot. A multitude of solutions will emerge.”

Saurabh Mittal

VP and Head, Industry and Technology, Bharti Airtel



“The second half of this decade will be the time when B2B will pick up momentum and we will start seeing the realisation of revenues.”

Himanshu Gupta

Country Manager, Telecom Media and Entertainment, HPE India



“Almost every home is drawing good bandwidth for many uses. Now it is a requirement to have the same bandwidth when we get to mobility. 5G satisfies that need.”

Rajesh Chharia

President, ISPAI

proliferate. From students to home connections, a lot changed. Now with FTTH, almost every home is connected with fibre, drawing good bandwidth for many uses. Now it is a requirement to have the same bandwidth when we get to mobility. 5G satisfies that need. In metros, it is working fine. But in some pockets, there are gaps in speed. It is due to spikes in bandwidth needs in some areas. Content and video have given a big boost to 5G.”

As he illustrated, in those days when the Ramayana serial would play, everyone would be in front of the TV. But now everyone watches a big match on the road, no one rushes to their home for a big content view. In short, there would be a lot of opportunities for 5G in the days to come.

WHERE IS THAT KILLER APP?

Where are those two or three killer apps, though? Ghosh spurred everyone to think about that.

Mittal felt that there is no killer app right now. “But digital quality is now a quality-of-life index thing. On the consumer side, there is the biggest impact of broadband anywhere and on any device. On the B2B side, there is no single use case. Low latency ability and slicing functions can create some good use cases. Enterprises need three solutions: help them grow, cut their costs and help in digital transformation. If we can give them that, we will get there. Also, use cases on Metaverse and Digital Twins would be great avenues,” he explained.

Khanna illustrated how Jio has deployed the first private 5G commercial network along with a 5G-enabled

test-bed for drones, successful POCs for an American agri manufacturer on fibre backhaul, apps on robotics surgery and mining, as well as an offshore solution for an oil major. “The use cases are ready and I am sure we will see revenue monetisation coming in very soon. What the 5G ecosystem delivers for the B2B segment has never been possible before. As to B2C, 5G creates a super-highway but the money can only be extracted when you have destinations – with applications that engage the customer in newer ways.”

Gupta added that HP has many innovations and IP build-up in emerging areas. “HP has put in a lot of effort to acquire skills around AI, which will come in very critical with 5G use-cases as networks become complex and there is a need for end-to-end service management with the right automation and orchestration. We also provide the most cost-effective architectural blueprints, validated and pre-tested through our partners. These infrastructure stacks and software stacks can reduce a lot of T2M. Wifi6, along with 5G, will also co-exist. So, having a solution for a seamless handshake can come in very useful and we are in a very good position to encapsulate all these services.”

Mittal summed it up best: “We should not be too hard on telcos. The greatest burden is the burden of potential.”

To wrap it all up, monetisation is a long-haul game. But it will happen. 5G is not just 4G-plus, but a new age and opportunity altogether. 🍀

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With 5G, onwards to digital thinking and digital living

The coming technological revolution promises an exciting era ahead that, according to an industry leader, is not going to be short on challenges



BY MINU SIRSALEWALA

As the world stands on the cusp of a digital revolution, it is evident that 5G is not just a technological advancement but a paradigm shift, ushering in an era of hyper-connectivity and digital living. An exciting, new world is opening up, though the ride ahead is not going to be without its share of hurdles.

Prabhakar Mardikar, President and Group CTO – Mobility at Reliance Jio, assumed the spotlight to illuminate the ever-evolving terrain of connectivity across a myriad of applications. With an aura of expertise that has been instrumental in shaping the future of connectivity, his insights promised to lead to new ways of thinking about the challenges ahead.

In a captivating special address during the Voice&Data Telecom Leadership Forum (TLF) event, Shyam

Opening with a fascinating reference to the ancient Chinese curse, “May you live in interesting times”,

It is evident that 5G is not just a technological advancement but a paradigm shift, ushering in an era of hyper-connectivity and digital living.



“India deployed nearly a million 5G cells within just ten months. This astonishing feat, unparalleled globally, signifies India’s rapid progress in 5G.”

Shyam Prabhakar Mardikar

President and Group CTO – Mobility, Reliance Jio

Mardikar set the tone for an engaging discourse. He acknowledged that we indeed live in captivating times, particularly when it comes to the telecom landscape of India. These are times that promise both challenges and opportunities, he added.

Mardikar’s address touched on several key points:

- **The 5G milestone:** India had embarked on a remarkable journey, deploying nearly a million 5G cells within a span of just ten months, he said with a touch of pride. This astonishing feat, unparalleled globally, signifies India’s rapid progress in the realm of 5G.
- **5G’s impact on connectivity:** Mardikar highlighted that more than 50 million Reliance Jio customers were already using 5G. This transformative technology is not merely an evolution from 4G but a distinct paradigm shift. It brings hyper-connectivity to the forefront, enabling capabilities far beyond conventional connectivity.
- **Digital thinking:** He emphasised the need for a shift from conventional thinking to digital thinking. This digital mindset encompasses a holistic understanding of data processing and its applications, cutting across various domains, including business, finance and technology. It’s about relearning, adapting and embracing a new era of digital living.
- **The decade of virtuality:** He painted a compelling vision of the current decade as the era of virtuality, wherein 5G plays a pivotal role in transforming how we live, work and consume data. It’s a shift from digital connectivity to digital consumption and, ultimately, digital living.
- **5G’s unique attributes:** He underlined 5G’s unique attributes, including its ability to compute on the fly, distribute compute on the network and provide storage. This convergence enables the creation of an elastic, adaptive, and aware network.
- **The spectrum of services:** He went on to illustrate how different services require distinct attributes from 5G. Whether it’s media and entertainment, agriculture, education, or the Internet of Things, each service demands a tailored approach, emphasising speed, latency and concurrency.
- **Distributed intelligence:** With the advent of 5G, distributed intelligence becomes paramount. It’s about planning networks intelligently, automating processes and ensuring efficient resource management. The focus shifts from radio planning to holistic network planning.
- **Infrastructure engineering:** Mardikar underlined the importance of infrastructure including towers, power supply and fibre optics. These elements are the building blocks of a robust 5G ecosystem.
- **Customer-centric approach:** Lastly, he stressed the significance of understanding the end user’s needs and behaviour, with a view to creating services that enhance the customer experience and address their evolving demands.

Mardikar summed it up with a profound thought, “There is no greater burden in life than that of having potential.” 5G, with its transformative potential, is poised to revolutionise the telecom industry and pave the way for a digital renaissance.

The emphasis on a customer-centric approach, coupled with intelligent network planning and robust infrastructure highlights the holistic transformation needed in the telecom industry. As the world embraces the challenges and innovations, 5G stands as the beacon guiding businesses towards a future where connectivity knows no bounds, and where the boundaries between the physical and digital worlds blur, opening new horizons for progress and innovation. 🌐

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Navigating fiery landscape of data protection in 5G era

The new technology will have to contend with the new data protection law, stricter regulations and the risk of heavy fines. Plus a tsunami of litigations



BY MINU SIRSALEWALA

The 5G era is a land of opportunities, but it is also a minefield of legal and cybersecurity challenges. To thrive in this landscape, stakeholders have to equip themselves with compliance and due diligence to navigate the fiery terrain of data protection and cybersecurity.

That was what Dr Pavan Duggal, Chairman of the International Commission on Cyber Security Law and Advocate at the Supreme Court of India, chose to highlight as he addressed an electrifying session at the 5th edition of the Voice&Data Telecom Leadership Forum (TLF) conference. The event, themed “Shaping the Future

Data stakeholders have to understand the law’s nuances and differentiate between normal, personal and sensitive personal data.



“The Digital Personal Data Protection Act, 2023, though seemingly simple, is poised to have an enormous impact on the digital landscape.”

Dr Pavan Duggal

Chairman, International Commission on Cyber Security Law, and Advocate, Supreme Court of India

of Connectivity”, was already buzzing with legends of the tech world, and Dr. Duggal’s address added fuel to the fire.

He began by addressing the 5G revolution, acknowledging its massive advantages and paradigm-shifting potential. He, however, didn’t shy away from shedding light on the darker side of this blazing ecosystem – the imminent rise of cybercrime and the reign of 5G fraudsters.

Dr Duggal warned that in this 5G era, terror and cybercriminal activities would surge, posing unprecedented challenges to stakeholders. Prime Minister Modi’s call to stay ten steps ahead of cybercrime seemed prophetic as Dr Duggal painted a picture of the escalating ransomware attacks plaguing India in the first half of 2023.

But the heart of the matter was the Digital Personal Data Protection Act, 2023, a game-changer of colossal proportions. “This law, though seemingly simple, is poised to have an enormous impact on the digital landscape. It is about personal data, and the good news is the Bill has been passed.” The not-so-good news? Its implementation was imminent.

The law has introduced three distinct concepts: data principal, data fiduciary and data processor. Every data belongs to data principals who are individuals. The entities determining how this data would be processed become data fiduciaries and data processors.

What sets this law apart is the need for explicit, written consent from data principals. No more verbal agreements or call centre permissions; it has to be written. Non-compliance could lead to staggering fines that may potentially cripple any company.

Dr Duggal highlighted that data stakeholders in the 5G ecosystem needed to identify and protect personal data meticulously. They have to understand the law’s nuances

and differentiate between normal, personal and sensitive personal data. It was not just about speed and innovation; data protection is paramount.

The introduction of this law marks a significant shift, as previously, there were no stringent data protection regulations in India. However, the Supreme Court’s recognition of the Right to Privacy as an integral part of an individual’s Right to Life set the stage for this legislation.

Dr Duggal navigated the audience through the law’s intricacies, emphasising the need for stringent due diligence and compliance. He cautioned that the government would soon be armed with a new revenue stream in the form of hefty fines. The Rs 250 crore fine could fall like a sword, disrupting operations.

He urged stakeholders to create structures and processes in the 5G ecosystem to comply with the law’s requirements. The need for obtaining written consent and documenting compliance becomes the lifeline in this evolving landscape.

But the law was just the tip of the iceberg. Dr Duggal predicted a tsunami of litigations as India grappled with the conflicting provisions of the Digital Personal Data Protection Act and the Information Technology Act.

Intriguingly, the law has created two bubbles: one for corporates and the other for governmental agencies. The potential tension between the two spheres could further complicate matters.

Dr Duggal also touched on the right to erasure, which would be a challenge to implement in the rapidly evolving 5G landscape. He emphasised the need for cybersecurity, noting that the law fell short in addressing this aspect. Companies would still have to comply with cybersecurity regulations, adding another layer of complexity. 🧩

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Unshackling the Virtual Network Operators

VNOs have remained an underutilised entity in India due to multiple reasons, but recent policy and industry moves may finally give them a leg up



BY VERNIKA AWAL

Virtual network operators (VNOs) have been an exciting proposition in the telecom field for long. However, multiple hurdles such as potential conflict with infrastructure-owning telecom operators themselves, high entry fees and licensing costs and potential difficulties in finding new monetisable users have kept the adoption of VNOs in India at bay.

Why, though, are VNOs even needed? What do they exactly bring to the table, and why would telcos even need them? More importantly, what could they mean for consumers in India?

UNDERSTANDING VNOS

In the semiconductor industry, there is a clear bifurcation between companies that design chips and intellectual

A VNO is like a fabless chip-maker: While it offers telecom services to users, it does not own the network spectrum or other infrastructure.



IN BRIEF

- **Regulatory Landscape:** India has permitted VNOs through a Unified Licence (UL) since 2016. Entry fees, licence costs, and spectrum usage charges, though high, have not deterred the potential players.
- **Challenges Faced:** High licence fees and network overutilisation by major telcos have limited VNO growth. Private operators lack unused capacity, hindering collaboration with VNOs.
- **Regulatory Changes:** TRAI proposes reducing entry fees by 50% and licence fees by 75%, encouraging VNO participation. Satellite internet rollout, pending approval, offers a potential backhaul boost for VNOs.
- **Market Opportunities:** VNOs can thrive by offering specialised services in sectors like banking and e-commerce. This opens avenues for B2B collaborations, enabling data analytics and enhanced services monetisation.
- **Win-Win-Win Scenario:** Successful VNO integration benefits telcos, VNOs and businesses by maximising unused spectrum, generating revenue and providing unparalleled access to customer data for tailored services.

In June 2016, the Department of Telecommunications decided to offer a Unified Licence (UL) to VNOs, to operate in India.


property in the field. While the likes of Taiwan Semiconductor Manufacturing Company (TSMC) are firms that make chips, it is the likes of AMD, Apple and Qualcomm (known as ‘fabless’ chip-makers) that create the fundamental designs, based on which TSMC and others make chips. There are, of course, companies such as Intel and Samsung, which both own chip-making factories and the IP for the chips.

This analogy is crucial to understand how, and why, VNOs are important. A telecom operator typically owns the spectrum and infrastructure required to sustain a network and uses these to run its operations and offer services to customers. As a result, you see the likes of Bharti Airtel, Reliance Jio, and Vodafone Idea offering their telecom services to customers. But, to do so, they also need to own and operate their spectrum and infrastructure across all regions where they want to be present.

A VNO, in this regard, is like a fabless chip-maker: While it offers telecom services to users, it does not own the network spectrum or other infrastructure. Instead, it leases the latter from operators that do own the full stack and pays them a licence fee for it. Such a mechanism allows telcos to reach out to areas where they have not reached yet, and expand the scope and density of their service. In other words, this helps telecom operators utilise all their infrastructure capacity to the fullest, thereby maximising their revenue, while the virtual operators sustain by offering additional services at an extra cost.

ARE VNOS ALLOWED TO OPERATE IN INDIA?

Despite a rather slim market and limited adoption so far, VNOs are indeed allowed to operate in India. In June 2016, the Department of Telecommunications decided to offer a Unified Licence (UL) to VNOs, to operate in India. Any party interested in the segment could apply for a UL and is required to pay a one-time entry fee, a licence fee and spectrum usage charges (SUC) to operate as a VNO.



One of the biggest issues for the sector has been the licence fees. But the TRAI has now proposed revising the cost of licences and entry fees.

So far, state-run telecom operator Bharat Sanchar Nigam Limited (BSNL) has tied up with Singapore-based AdPay and Plintron to enable them to operate as VNOs, while in 2020, Exotel was also issued a licence.

WHY HAS THE SEGMENT BEEN SO LIMITED, THEN?

One of the biggest issues for the sector has been the licence fees. At present, ULs for VNOs come for Rs 7.5 crore as an entry fee, followed by Rs 50 lakh as a licence fee in each telecom circle, and SUC of 8% of the annual revenue of a VNO. Licence fees are also payable during renewal, which comes up every 10 years.

The other major issue plaguing the sector is network capacity. While state-run BSNL and MTNL have plenty of unused capacity in their network infrastructure, the three private operators, Bharti Airtel, Reliance Jio and Vodafone-Idea, have already overutilised the network infrastructure, thus leaving no room for further capital expenditure optimisation through VNOs.

IS THERE A SOLUTION IN SIGHT?

In an encouraging move earlier this year, the Telecom Regulatory Authority of India (TRAI) proposed revising the cost of licences and entry fees charged to VNOs for granting a UL. The new proposal has suggested reducing the entry fee by 50%, while the licence fee could be reduced by 75% and could also see its periodic renewal cost foregone.

There is also the impending rollout of satellite Internet capacity, which is currently awaiting spectrum allocation approval from the Ministry of Communications. Once satellite services begin, backhaul for telcos and capacity for enterprises will receive a boost. For VNOs, this could be a significant move. To cash in on this, the industry body Virtual Network Operators Association of India (VNOAI) announced having met the chairman of BSNL, to ramp up the latter's existing associations with VNOs.

VNOs could benefit from running niche market services in sectors such as banking, e-commerce and retail. These niche services could prove to be particularly beneficial as B2B offerings, which can see companies in these sectors gain access to customer data and run analytics atop this data for better monetisation of services. This, in turn, could be a win for all. For BSNL, utilisation of unused spectrum could lead to an impressive revenue recovery. For VNOs, the biggest opportunity lies in creating and operating the additional services layer for nearly 1 billion subscribers in India, which represents a massive monetisation potential. Finally, for companies working with a VNO or operating by themselves, it will allow them unprecedented access to first-hand customer data.

Synchronisation of all these factors can throw the gates of adoption wide open for VNOs, who stand at a crucial juncture of expansion in the country. 🍀

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Global networking infrastructure is going local

More nations are seeking greater control over how the world's data flows, potentially altering the gate-keeping network infrastructure economy



BY VERNIKA AWAL

On August 11, the government of India notified the Digital Personal Data Privacy (DPDP) Act, 2023. In addition to this, it is currently holding consultations for the upcoming data and technology legislation, the Digital India Act. These two regulations, taken together, will bring a holistic range of technology laws to the country and bring India in line with an increasing

number of geographies, such as the European Union, Singapore and the United States, in regulating technology and related fields.

In all of this, one key area that is set to come under fire is the regulatory impact on networking infrastructure. This is so because of multiple reasons – increasing geopolitical concerns around the transfer and integrity

The balance of the network infrastructure ecosystem has lasted for decades now, albeit on the thin ice of cross-border collaborations.



IN BRIEF

- **Regulatory landscape:** India introduced the DPDP Act, 2023, and is contemplating the Digital India Act, aligning with global tech regulations seen in the EU, Singapore and the US, leading to stricter control over technology.
- **Geopolitical impact:** Growing concerns over data integrity, cyber warfare, and localisation of data drive India's focus on networking infrastructure. Geopolitical tensions influence the localisation trend in the networking industry.
- **Shift in hardware manufacturing:** India attracts brands with PLI schemes and legislation, encouraging localisation of networking infrastructure. Initiatives like Micron's chip manufacturing pave the way for complete stack assembly in India.
- **Software implications:** Companies like Akamai and Cloudflare leverage global technical expertise to manage data-driven operations worldwide, capitalising on the shift toward localised networking. Compliance with diverse global tech regulations becomes vital for businesses.
- **Data sovereignty concerns:** The DPDP Act introduces 'blacklisting' for data storage, indicating certain nations approved for storing Indian data. Increasing regulations worldwide lead to a fragmented, localised global network infrastructure.

India is increasingly attracting brands to make devices in the country, through multiple PLI or production-linked incentive schemes.

of data, cyber warfare, localisation of nation-wise data and the rise of the demand for increasingly granular manufacturing of equipment across the world.

THE STATE OF NETWORKING HARDWARE

Just like semiconductors, networking hardware is also majorly driven by China. A large chunk of routers, data centre chips for processing, memory and storage, and even network fibre-end components are designed by legacy firms with historical capacity in these fields. These designs have typically been given by firms such as Cisco, Broadcom, Texas Instruments, Qualcomm and others to manufacturing partners in China, who have built and supplied them to these companies and their clients.

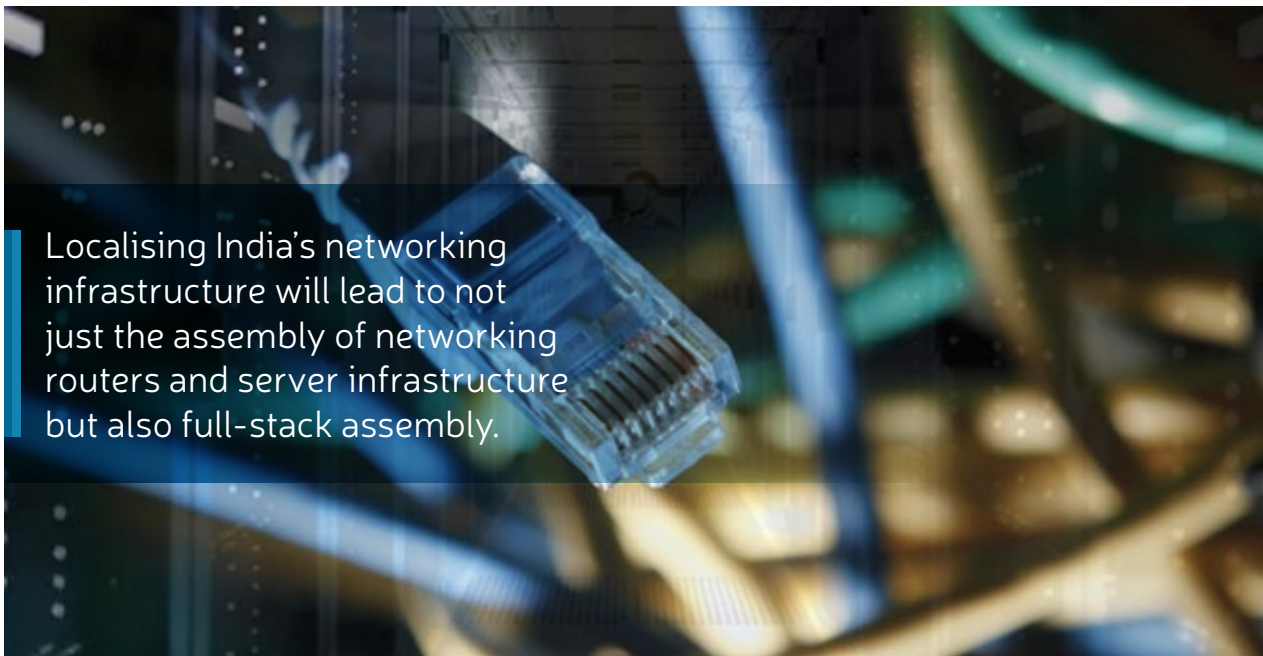
This balance of network infrastructure ecosystem has lasted for decades now, albeit on the thin ice of cross-border collaborations. Now, however, this multi-billion-dollar industry faces multiple points of stress and, most importantly, geopolitics-driven localisation.

The most obvious point at which this industry came under duress was when former US President Donald Trump slapped sanctions against Chinese tech conglomerate Huawei, barring its equipment from all government and eventually public networking infrastructure. These sanctions eventually progressed to include consumer hardware too, leading to a global decline for the then-rampant Huawei around the world. This, in turn, also led to the decline of fellow China-based brands such as ZTE, even in India.

Today, India is increasingly attracting brands to make devices in India, through multiple production-linked incentive (PLI) schemes. In cases where the government has not rolled out incentive-driven manufacturing, legislation is driving us towards a trusted geography approach, giving us several nations whom we may trust.

WHY IS THIS IMPORTANT?

At the epicentre of this shift is one big gaping concern:



Localising India's networking infrastructure will lead to not just the assembly of networking routers and server infrastructure but also full-stack assembly.

cyber security. One of the key reasons why the US-China soft conflict began was the allegation from the US that China was conducting cyber espionage, by secretly installing 'backdoors' to access sensitive US government data through networking equipment supplied by it. Huawei was also alleged to have close ties to China's government, which it has denied.

These concerns expanded to India, too, leading to the government banning nearly 500 mobile applications that were said to have ties to Chinese data servers. As a result, India began to see an increasing requirement to localise its networking infrastructure as well. One of the biggest moves for this has come in establishing Micron, the US chipmaking firm, as India's first benefactor of semiconductor incentives. Micron, which began work on its factory in Sanand, Gujarat, in September, will be testing and packaging NAND flash memory and storage chips from India, as early as the end of next year.

This is essentially the first step towards localising India's networking infrastructure, which will eventually see chips being made here in the long run, leading to not just assembly of networking routers and server infrastructure in the country, but full-stack assembly.

NOT JUST HARDWARE

Such moves would not only benefit hardware firms but also the software end of networking. In an interview with a business newspaper last month, Tom Leighton,

Co-founder and Chief Executive of the global content delivery network (CDN) operator Akamai Technologies said, "If you are a global company, you have got to comply with all of the tech regulations around the world. This gives us a chance to come in because we already have global technical skills that we can leverage across a large number of customers. Financially, this makes more sense, to be able to go to a company and manage their data-driven operations in different countries. That is added value we can provide, which would otherwise be harder for individual companies."

Operating some of the world's largest networks of delivering content such as web traffic, payments and more around the world, companies such as Akamai and Cloudflare are best poised around the world to witness this shift in how localisation of networking takes place.

Going forward, an increasing volume of hardware will need localisation. India's DPDP Act has already proposed a 'blacklisting' approach to storing data, legislatively suggesting that certain nations will not be sanctioned for storing the data of Indian individuals.

With concerns around data sovereignty growing around the world, more regulations like this will grow and the global networking infrastructure is also likely to see increasing localisation and fragmentation. 🌐

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