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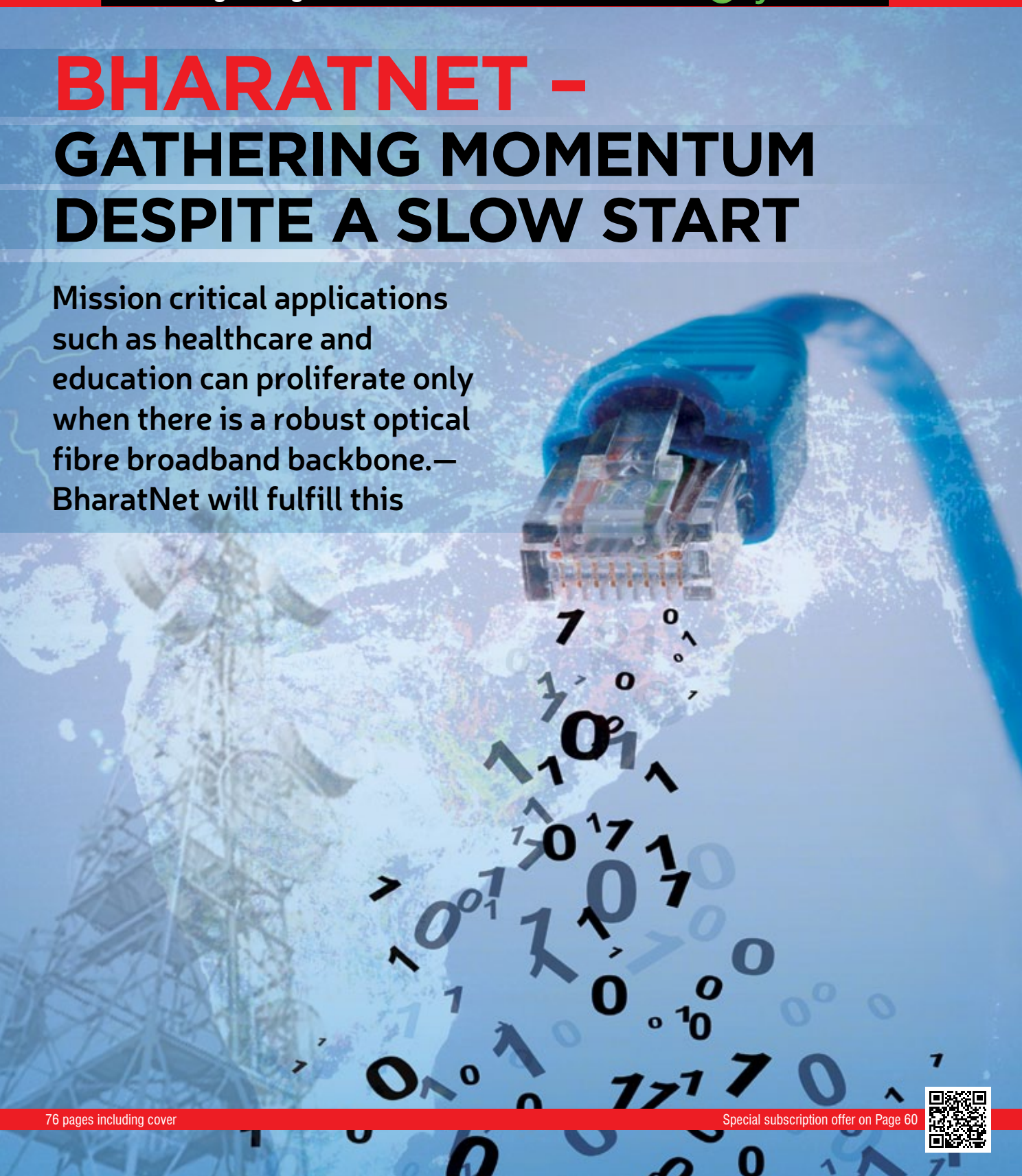

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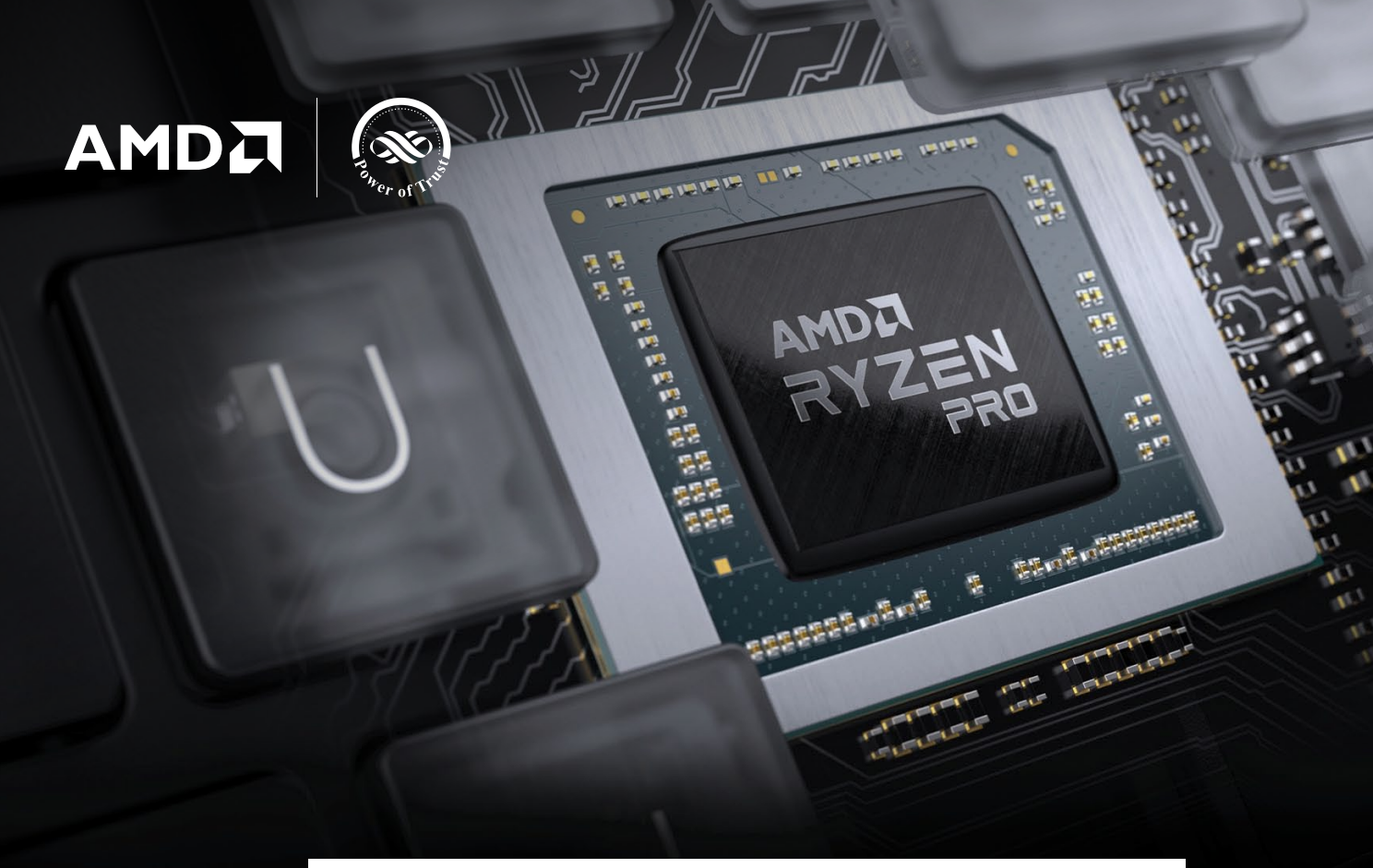

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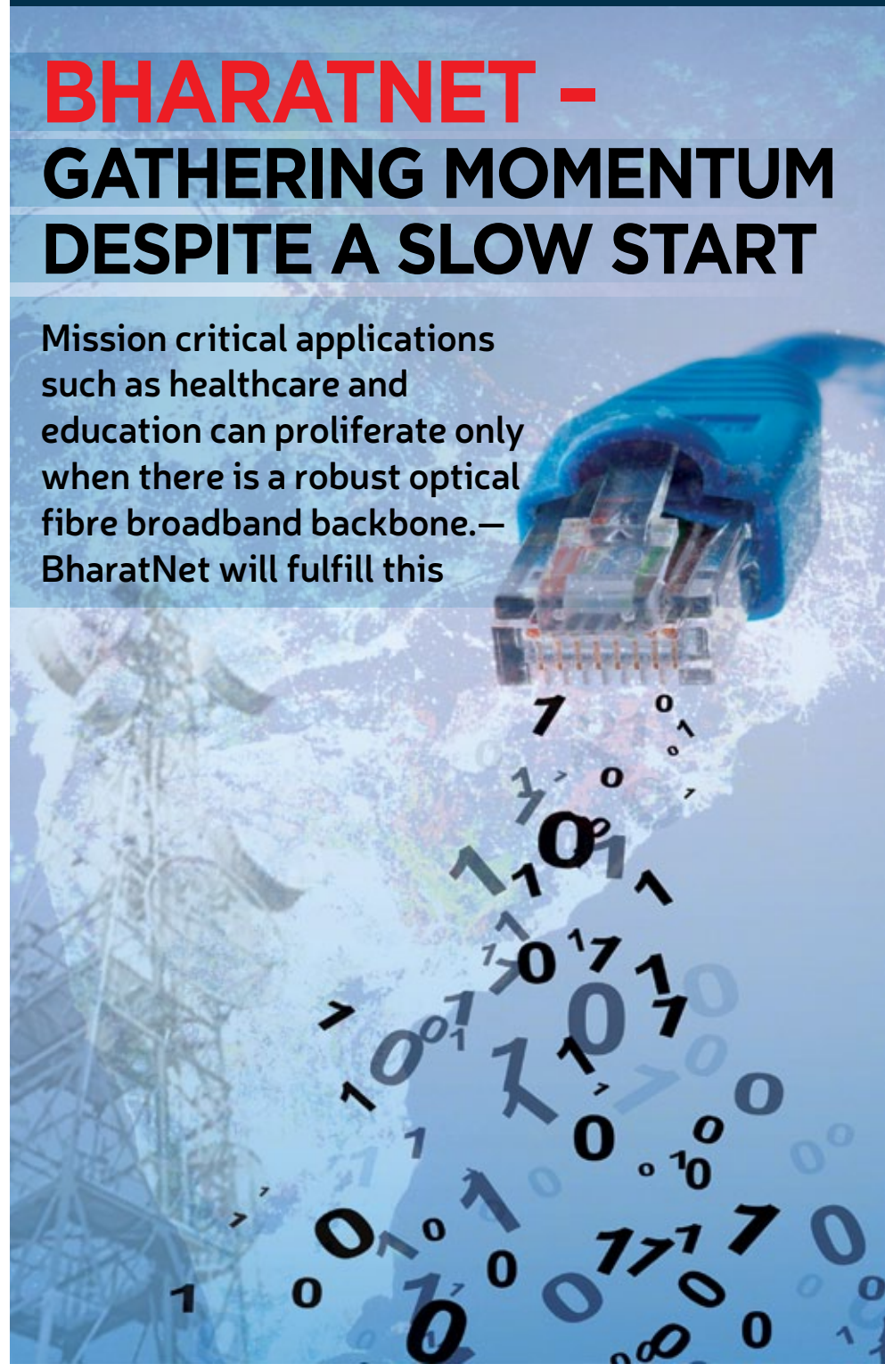
[CONTENTS]



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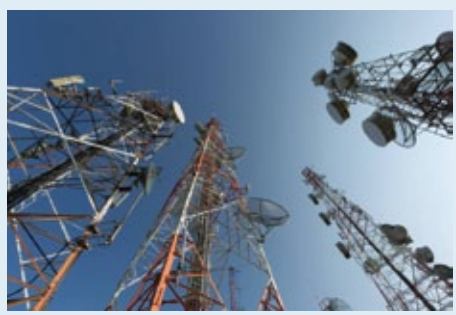

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GAJENDRA UPADHYAY

[OPENING NOTE]

5G DATA - PRIVATE (AND ENTERPRISE) NETWORKS WILL DRIVE REVENUES

BharatNet is one of Digital India's largest infrastructure projects that started in 2011 and 11 years later is still a little distance from reaching its final destination.

BharatNet has connected 183,306 Gram Panchayats out of approximately 250,000 on 6 lakh kilometres of high speed Fibre. 104,288 Wifi Hotspots have been installed in rural areas and close to 214,714 Fibre to the Home (FTTH) connections commissioned —all at a cost of 47,200 crores so far.

Another 18 lakh more kilometres of fibre needs to be laid in the ground before it reaches its final target of 23-24 lakh kilometres of Optical Fibre Cable (see interview with CMD of Bharat Broadband Network Ltd) — covering all of India. We take a comprehensive look at BharatNet, a single story with a plethora of facts.

5G

DoT issued the Notice Inviting Applications for 5G Spectrum Auctions on 15th June.

It allows for allocation of 5G spectrum through an auction to mobile operators, for 20 years (TRAI had recommended upto 30 years, but this is shelved for now).

DoT also makes an interesting allowance for setting up of Captive Non Private Networks (CNPN). There has been intense lobbying between mobile operators and the indigenous 5G gear makers of our country. The enterprise and captive markets are seen to be a very lucrative segment by 5G operators and international tech platforms like Google and Amazon. The battle for revenues of captive networks in Industry 4.0 or medical and healthcare is an intense one.

There are four options for CNPN allowed by DoT:

- Existing mobile operators can set up CNPN as a service on their existing networks (using techniques like network slicing). This means that no dedicated network will be created.
- Existing mobile operators can set up an isolated / dedicated CNPN for enterprises using spectrum acquired by them
- Enterprises (the end user) can themselves set up CNPN by obtaining spectrum on lease from the mobile operators, who just bought these in the auctions.
- Alternatively, enterprises can set up CNPNs by buying spectrum directly from DoT and establishing an isolated network.

But there is a catch in the last option. The matter will be referred to TRAI for recommendations on pricing, size of market etc. Only after TRAI issues its recommendations will CNPNs be able to acquire spectrum. It could easily take another year or more before that happens.

In the meanwhile, mobile operators are free to lease the spectrum to CNPNs or set up the services themselves. It is anyone's guess, which one is more likely.

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Bharatnet – Gathering Momentum Despite a Slow Start

Mission critical applications such as healthcare and education can proliferate only when there is a robust optical fibre broadband backbone.– BharatNet will fulfill this

BY JOSE JN & V&D BUREAU

Rajesh Nair (name changed on request), a technical assistant working at a Gram Panchayat (GP) office in the vicinity of Kottayam district in Kerala is frantically trying to reach local BSNL officials.

For the past two days, the broadband connection at the GP office under the Bharat Net project has not been working after nearby roadworks caused a break in the underground optical fibre cable.

"The BharatNet broadband has been functional here for the past two years. We use it to offer e-governance services to citizens," says Nair. However, when there is an issue with the connection then it takes time to rectify because Bharat Broadband Network Ltd (BBNL) is no longer managing the network and BSNL has its own broadband services here," Nair adds. Thankfully, the GP has backup internet connectivity from a private operator to enable smooth office functioning when the BBNLconnection is down.

Some twenty-five kilometers away, in another gram panchayat, Jimmy Mathew (name changed), also a technical assistant, faces similar issues. "The connection is working now, but when there are issues it takes longer to get rectification. When we call for help we are told that the BBNL contract is over, and a private operator has taken over. We are forced to take a backup internet

GRAM PANCHAYATS, GP, WHERE BBNL FIBER IS READY FOR USE AS OF MARCH 2022 (BBNL WEBSITE).

S.No	State	Count
1	Andaman & Nicobar Islands	27
2	Andhra Pradesh	1727
3	Arunachal Pradesh	776
4	Assam	1637
5	Bihar	8834
6	Chandigarh	13
7	Chhattisgarh	8921
8	Dadra & Nagar Haveli	21
9	Daman & Diu	20
10	Gujarat	14361
11	Haryana	6204
12	Himachal Pradesh	412
13	Jammu & Kashmir	1090
14	Jharkhand	4521
15	Karnataka	6250
16	Kerala	1130
17	Lakshadweep	9
18	Madhya Pradesh	17586
19	Maharashtra	22179
20	Manipur	1442
21	Meghalaya	650
22	Mizoram	387
23	Nagaland	232
24	Odisha	6930
25	Puducherry	101
26	Punjab	12807
27	Rajasthan	8991
28	Sikkim	23
29	Telangana	7026
30	Tripura	750
31	Uttar Pradesh	36783
32	Uttrakhand	1677
33	West Bengal	2597
	Total Count	176114

*Map not to scale

> There is no doubt that optical fibre is critical to India's digital roadmap and Bharat Net, despite its shortcomings, is well on its way to become one of the largest OFC networks with 23 to 24 lakh Km of cable assets.

connection to enable smooth functioning of the office," Mathew told Voice & Data.

The two gram panchayats are part of an ambitious initiative by the Centre to provide high-speed broadband connectivity to 2,50,000 gram panchayats across the country. The project, announced in October 2011, was supposed to be commissioned in two years at a cost estimated at ₹20,000 crore. More than ten years later, after missing many deadlines and trying out different models, the Bharat Net project is now picking up steam even though it continues to face many issues on the ground.

What is BharatNet project

The BharatNet project, initially called the National Optic Fiber Network (NOFN), was approved by the Government in 2011 to connect 2.5 lakh Gram Panchayats (GPs) in the country. This connectivity could be extended to cover all 6.5 lakh villages in the country, providing services like e-gov, telemedicine, tele-education, e-health, etc.

The optical fibre network is an ambitious initiative aimed at triggering a broadband revolution across the country. NOFN was envisaged as an information super-highway through the creation of a robust middle-mile infrastructure for reaching broadband connectivity to all Gram Panchayats. The Centre created a special purpose vehicle (SPV), Bharat Broadband Network Limited (BBNL), to act as the executing agency responsible for overseeing the project, determining reference prices for each activity, and procuring optical fibre. BSNL, RailTel and PGCIL were responsible for trenching and ducting as well as laying the fibre.

The initial phase

Under Phase-I of BharatNet, a target of connecting one lakh GPs through optical fibre cable was set. But by 2014 the network had reached only around 5000 gram panchayats. Lack of coordination among the various agencies involved in the project was a common theme wherever the broadband network has been rolled out. One of the key bottlenecks was that the appointed agencies possessed limited autonomy to make decisions in matters of price discovery.

With the primary objective of controlling costs and minimising unnecessary expenditure, BBNL established reference prices for each activity to be undertaken by the central public sector undertaking (CPSU) – BSNL, Railtel and PGCIL.

As a result, however, any time the price discovered by the CPSU for contracting exceeded this reference price by over 10%, the CPSU was required to obtain additional approvals from BBNL. Such constant back and forth mired the project in time overruns while also triggering institutional friction between BBNL and the CPSUs.

Realising the slow pace of implementation and marred by day-to-day issues, the Department of Telecommunications constituted a Committee to review the strategy in January 2015. The Committee, in its report, said that the design of the NOFN programme assumed that the final leg of last-mile access and service provision to end-users would be covered by the private sector. However, this resulted in the executing agencies lacking inherent incentives to ensure that the network is built to high-quality standards.

The Committee's report also identified a lack of long-term planning in other network elements such as service provisioning, bandwidth utilisation, operations and maintenance and allocation of responsibilities for individual project components, which it attributed to BBNL's shortage of a large professional staff with relevant management proficiency.

Despite outlining the challenges in the model, the Committee proposed to continue with the CPSU-led model and State-led model in most regions. It proposed to introduce private operators under an EPC model only in 10 of the 22 telecom circles.

In March 2016, the TRAI issued a paper punching holes in the Committee's observations. "It appears that the CPSU and State-led models outlined in the Committee Report share many of the same characteristics of the NOFN implementation model that have been previously outlined as increasing the risk of failure due to misaligned incentives," the TRAI said.

"Rural broadband penetration in the country is extremely poor. No private telecom operator has taken significant steps to improve the situation. Hence optical fibre network being created by Government of India through BBNL is the only hope to increase the poor penetration of Broadband in rural India."
R K Upadhyay, former Chairman, Bharat Sanchar Nigam Ltd.

Criticising the EPC model for private players, the TRAI said, "With the private contractor having no long-term stake post-deployment and the weak monitoring capacity of the public monitoring agency (especially given the highly technical nature of the project and the sheer volume of work that must be monitored), there exist perverse incentives for private contractors to increase profit margins by reducing costs through the deployment of poor quality infrastructure and there exist no incentives for speedy implementation (since the executing agency's source of revenue is independent of how quickly the network is made operational)."

Instead, the telecom regulator proposed a public private partnership (PPP) model as it creates long-term private engagement. "The concessionaire should be responsible for deployment as well as operating and marketing the network. Given the desirability of leveraging private sector efficiency and technical capacity but recognising that many rural areas may not be perceived by it as lucrative enough, Viability Gap Funding (VGF) should be offered to encourage private infrastructure deployment and operations in such area," the TRAI said in its recommendations issued in March 2016.

Need for Fixed Broadband Network

While the initial slow progress in the rollout prompted many experts and industry executives to call for the termination of the project, it is clear that BharatNet is perhaps the most important infrastructure project if India wants to achieve the status of becoming a digital super power. Broadband penetration in India is 55%which is significantly lower compared to that of China at 95%, and other European nations at around 95-115%. Mobile penetration in countries like Japan & USA is 180% & 150%. (Source: OECD, TRAI, Mbit report 2021).

Further in terms of Broadband speed, India is ranked 131stamong 140 nations (source...) in terms of mobile broadband speed and 66thamong 177 countries in fixed broadband.

Whereas global average speed in the case of mobile and fixed broadband is 33.71Mbps and 76.94Mbps respectively. For fixed-line broadband, the highest speed reported is of Singapore at 205Mbps (Source: Speed Test, TRAI)

But when it comes to adopting digitisation and online platforms Indian users are among the top consumers globally. The consumption of video and online content has been growing exponentially over the last two years. The tectonic shift from an analogue world to a digital future is visible across all aspects of life.

At the centre of this transition to a digital world is the availability of a reliable and affordable data network. Optical fibre networks have the capability to carry much more data than a wireless network because of inherent limitations of radio spectrum.

Mission critical applications such as healthcare and education can proliferate only when there is a robust optical fibre broadband backbone. Private telecom companies including Reliance Jio have announced plans to connect over 1,100 cities with optical fibre. While this will cater to the urban consumers, BharatNet is critical in ensuring that the rural folks also reap the digital dividends.

"Rural broadband penetration in the country is extremely poor.No private telecom operator has taken significant steps to improve the situation. Hence optical fibre network being created by Government of India through BBNL is the only hope to increase the poor penetration of Broadband in rural India," says R K Upadhyay, former Chairman, Bharat Sanchar Nigam Ltd.

Wireline subscribers in India were just under 24 million as of December 2021 with a growth rate of 1% per month. Urban and rural subscribers accounted for approximately 92% and 8% respectively. Compare these figures with

> Criticising the EPC model for private players, TRAI had said, private contractors have no long-term stake post-deployment and therefore there is a perverse incentive for private contractors to increase profit margins by reducing costs through the deployment of poor quality infrastructure.

BharatNet utilization models

Bandwidth Utilization: Any service provider/ government agency who intends to provide its services at Gram Panchayat level may connect to BharatNet at block OLT location from where its traffic is carried to Gram Panchayat (GP) level on BharatNet. At the GP, service provider has to extend its services to the end-customers using its own last mile.

Dark Fiber Utilization: Service providers may also utilize the dark fibre on the new cable laid by BBNL between block and GPs, called incremental cable, for extending its services to GPs. The dark fibre is available from Fibre Point of Interconnect (with the existing fibre) to the GPs.

the total number of 1178 million telecom subscribers and 792 million broadband subscribers. Obviously, the fixed line broadband coverage is very low in proportion to the overall telecom coverage and rural area fixed line coverage is abysmal.

So, it is clear that India has a problem in so far as fixed line broadband coverage is concerned and an acute problem as far as rural area coverage of broadband is concerned. But at the same time the average mobile data consumption in India touched 17GB per user per month in 2021, according to Nokia's annual 'Mobile Broadband Index (MBiT) Report 2022'.

As data consumption keeps growing exponentially and with new technologies such as 5G on the way, wireless platforms will not be enough to meet the demands of bandwidth-guzzling consumers.

Rentala Chandrashekhar, former Secretary, Department of Telecom told V&D: "Fixed line broadband is important for India for several reasons. The newer generation of services and many of the existing ones require high-capacity, reliable and sustained broadband connectivity for a meaningful user experience. Some of the critical services in the social sector like education, skilling, healthcare, agri-related services require such connectivity."

Educational institutions, for example have a large number of users at a single location. Such needs simply cannot be met by wireless services. At best, a combination of wireline and wi-fi can serve the purpose. Developments like the Metaverse which present an AR/VR interface cannot even function without reliable broadband.

"Barely 3% of broadband subscribers are connected via fixed line. The quality, reliability and sustained high bandwidth provided by wireless broadband providers is uneven and patchy. Moreover, it is dependent on traffic patterns, with poorer quality during peak times. So, for many critical uses, wireless broadband is simply not good enough. Wireline broadband is very important for schools and colleges, for example," says Chandrashekhar.

PPP Model

Given the importance of fixed line broadband to the overall digital economy, Hon. Prime Minister Narendra Modi on 15thAugust 2020 in his Independence Day speech announced connectivity to all inhabited villages through Optical Fibre Cable.

Thus, the mandate of BharatNet was revised to extend the connectivity from Gram Panchayats to all inhabited villages, thereby enhancing the scope of BharatNet to provide connectivity to all ~6.5 lakh inhabited villages together with a focus on creation, maintenance and utilization of the network.

A global tender for development of BharatNet, through PPP model was floated by BBNL.

The tender was for the development of BharatNet through a design, build, operate and transfer model in nine

"If you go by the number of kilometres of fibre laid or the number of villages that have been covered, then, progress has been substantial, though far less than what was projected. However, there is little doubt that it has not had the revolutionary impact that was anticipated."

Rentala Chandrashekhar, former Secretary, Department of Telecom

separate packages across 16 States in India. This essentially meant that the government would give responsibility of upgradation, maintenance and operation of the network to private players. To make this undertaking commercially attractive for private players, the government also promised to foot the bill partially, through viability gap funding capped at ₹19,041 crores overall. Recognizing the importance and need for building this digital infrastructure as well as encourage private participation, the threshold was extended to 60 per cent for BharatNet, instead of 40% for other government projects under similar PPP models.

However, not even a single private player submitted a bid even though 50 players had initially shown interest. According to industry sources, the PPP model envisaged by the government had several issues but the biggest worry for the private players was that they were dependant on their ability to generate revenues from the fibre. "The tender conditions were tough especially when one considers that the project was essentially aimed at rural markets. No one was sure about making revenue to make the project viable," said an industry source.

"The normal principle in PPP is that you should transfer only those risks and uncertainties to the private partner that they are in a position to control. Here, you were transferring the uncertainty of uptake and payment for these internet services by numerous government institutions like schools, panchayats, PHCs, cooperatives etc. in rural areas and that too, over an extended period of time," said another source.

According to Chandrashekhar, "Private players are not very interested in areas where there is low demand and are preferring to go on their own in the few areas where the demand is high. There could also be some concerns regarding indirect dependence on BSNL as the perception is that BharatNet and its operations, including personnel, are dependent wholly or partly on BSNL."

Multiple industry sources also raised concerns around negative bidding. According to the notice inviting tender (NIT), the project will be assigned to the enterprise that can complete the project with the least financial support from the government. This means that the project will be assigned to the player submitting the bid with lowest subsidy requirement or highest rate of premium for the government.

Experts cite the 2007 tender where USO Fund aimed to provide subsidy support to set up mobile infrastructure in rural and remote areas, however, that tender invited negative bids. That is, enterprises ended up paying the government for project ownership. These undertakings were later abandoned due to commercial unviability. Thus in the enthusiasm to bid for the project, costs were poorly estimated and lowballed, and the industry was apprehensive that this could have happened again.

The other big worry for many potential bidders was that there was no clarity on the quality of network already rolled out by BBNL. "Bidders might have been worried that they would be taking on a network that was poorly laid out and maintained, therefore they might not be able to accurately estimate the cost of maintaining the existing network," an industry expert said.

Current status

Despite these challenges industry experts agree that BharatNet has picked up steam over the past few years. As of March 2022, about 5,70,115 Kms of optical fibre has been rolled out connecting 1.83 lakh gram panchayats.

Over 1 lakh WiFi hotspots have been rolled out to provide direct connectivity to villagers on their mobile phones. As on February 2022, about 4028.87 TB of data has been used up on this network. The Government has so far disbursed ₹27,000 crore from the Universal Services Obligation fund to finance the roll out. "Pandemic highlighted the importance of effective and robust digital infrastructure. In a transitional economy like ours the absence of broadband remains a key issue for digital divides between populations, communities and ethnic groups. Building broadband connectivity on

"Pandemic highlighted the importance of effective and robust digital infrastructure. In a transitional economy like ours the absence of broadband remains a key issue for digital divides between populations, communities and ethnic groups."

Lt. Gen Dr S.P. Kochhar, Director General, Cellular Operators Association of India

top of existing mobile broadband infrastructure is a fast and cost-efficient option to bridge the digital divide. It will help to expand service to far-flung areas of the country which will enhance rural teledensity and play a stellar role in enhancing connectivity to the rural sector," says Lt. Gen Dr S.P. Kochhar, Director General, Cellular Operators Association of India.

Experts agree that the full potential of the project has not been unleashed yet. "If you go by the number of kilometres of fibre laid or the number of villages that have been covered, then, progress has been substantial, though far less than what was projected. However, there is little doubt that it has not had the revolutionary impact that was anticipated," says Chandrashekhar who was at the helm of DoT when the national optical fibre project was envisaged.

According to Chandrashekhar there are several reasons for the project to miss out on targets but all of which can be resolved with a concerted strategy accompanied by focused action. The first is that the project was viewed and implemented as an infrastructure project involving laying of fibre and installing the active electronics required for connectivity. In fact, it needs to be viewed as a full-range service provision which looks at the QoS available to the rural user as the measurable outcome. This has, perhaps not been the case.

Secondly, the utility of such services depends critically on applications in various sectors including the social sectors mentioned above. "There has been both a lack of adequate applications and end infrastructure at the public institutions. Lack of coordination in aligning all of these has meant that apps are ready in some places, but connectivity is not or infrastructure is not available, or the other way around. Involving states in driving usage is critical given the nature of these services many of which fall in the state list. Consequently, the business case remains doubtful," says Chandrashekhar.

What next

Given the national importance of the project the Government is now putting in place a new blueprint. In a bid to rope in private players to roll out the national optical fibre project BharatNet, the Department of Telecommunication is looking to bring a new model where private players will be given annual payments over a period of 20 years for constructing and maintaining the rural broadband connectivity infrastructure. Last-mile services using this infrastructure will likely be given out separately to interested private players with viability gap funding support from the Centre.

According to sources, the DoT is discussing various models to bring private players into the project after the last attempt under a PPP model did not attract any bidders.

"The PPP model had several issues because private operators did not want to be dependent on potential revenues for recovering their investments. Under the new model, the DoT may delink the revenue aspect from managing and operating the broadband network," said a source close to the development.

The government may foot the entire capital expenditure for constructing the network under the new model. In the previously proposed setup, the government would have only given the differential (viability gap funding) to make the project economically viable.

In addition to this, the government is also considering splitting the bidding on the network into two categories.

In the first category, private players will bid on constructing and maintaining the core network, and the entire exercise will be paid for by the government. As per sources, private entities bidding on this tender will, however, be unable to collect revenue from the network.

The second category of tenders is reserved for service providers, who can provide last mile rural services using

"Fibre is a key asset. It is a digital highway. Your information highways should be under government control. The only thing is the way it is being implemented. Government agencies do not have competencies to build, manage and maintain such networks."
KS Rao, Chief Corporate Officer, STL

the internet connectivity provided by BharatNet. Here, the government may consider providing viability gap funding to make providing services in a low revenue rural market economically viable.

DoT may also order a third-party audit of the Bharat Net assets to give a clear picture of the quality of the infrastructure to potential bidders.Official sources in the DoT told V&D that "Our immediate objective is to ramp up utilisation and increase the availability of the network to 98% in hilly regions and 99% in the plains."

"For increasing this commercial utilisation, we are requesting BSNL to provide immediate connectivity to ISPs, VNOs and other application service providers at the village level where the Fibre from Block to GP is already there," he added.

For maintenance of the Bharatnet network at those locations where there is no SPV either by the State or by any other private player, BSNL will be given the responsibility.

"The PPP tender is being redrafted and will soon be issued with a new set of terms," he confirmed. System integrators such as Tech Mahindra, STL, L&T and HFCL may bid for the revised project.

In a recent interview with V&D, KS Rao, Chief Corporate Officer, STL had proposed to create a wholesale entity to hold all optical fibre assets owned by public and private sector companies.

"Our recommendation has always been that the government has a significant role in creating a national backbone. Fibre is a key asset. It is a digital highway. Your information highways should be under government control. The only thing is the way it is being implemented. Government agencies do not have competencies tobuild, manage and maintain such networks. We are recommending that the Government should create a wholesale entity," Rao had said in the Aatmanirbhar issue of Voice & Data.

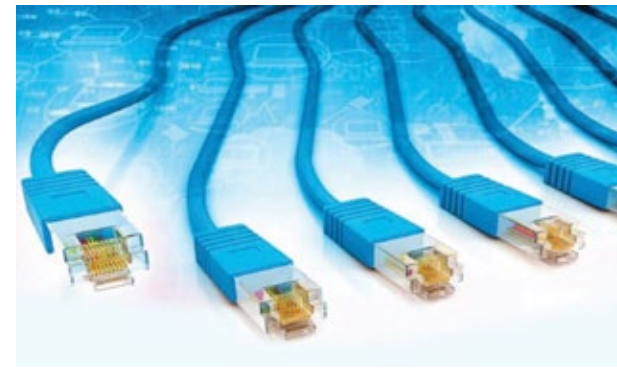
For example, India has several fibre assets. Telcos have their own networks. BSNL has 7 lakh kms. of fibre in the ground. Then there is RailTel andPowergrid.

"If all of this is pooled together as a government asset, it can be made into a wholesale entity, with a key focus on rural connectivity. That is true BharatNet," said Rao.

Chandrashekhar believes that a concerted plan of action that combines rollout of infrastructure with actual provision of services with QoS guarantees, development/ usage of apps/content that provide important services, coordination with states both for rollout, ROW and app development and usage are key.

"Incentivizing states based on rollout and usage would help. Creating localized models of extensive utilization in collaboration with progressive states would help immensely in demonstrating the transformative impact that is possible with effective implementation and utilization of BharatNet.

Lastly, a dialogue by DOT with private TSPs to understand their expectations and reservations and how to achieve/overcome them is important," the former DoT official said.



"There are villages under the administrative control of the GPs that need to be served using an appropriate last mile connectivity means (wired or wireless). Alternate Technologies to NOFN, include the wireless technologies of - TV White Space; RF including Wi-Fi hotspots."

Dr B M Baveja, ex Senior Director, MeitY

BBNL merger with BSNL

The government is also considering a potential merger of BSNL and BBNL in order to streamline processes and find synergies. BharatNet is a middle mile infrastructure between Block and the Gram Panchayats. The GPON equipment (OLTE) at the Block level is kept in the BSNL Exchange and also fed from its power supply system.

In BharatNet Phase I, the BSNL fibre was used till the Fibre Point of Interconnect (FPOI), beyond which incremental fibre has been laid up to the Gram Panchayats. BharatNet Phase I used more than 1.9 lakh Km of BSNL fibre which is almost 40% of the Phase I network.

BharatNet Phase II does not use BSNL fibre but GPON equipment at most of the places (except States adopting ring architecture) is still kept in BSNL exchanges. In order to provide the services at the GP level, the Internet bandwidth is to be fed into the OLTE at BSNL Exchange. BSNL with its own ILL at the Block level and its network of TIPs in the last mile is better placed to utilise the network. BSNL has the largest OFC network in the country. This experience can be used for end to end maintenance of BharatNet network.

"Considering all this, to bring synergy in operations, maintenance and utilisation of BharatNet, the O&M and Utilisation of BharatNet has been entrusted to BSNL since April 1 this year.

It is also felt that handing over of BharatNet assets to BSNL for O&M and Utilisation will provide the much needed financial support to BSNL in times to come," Sarvesh Singh, Chairman and Managing Director of BBNL told V&D in an interview.

But others like Chandrashekhar do not think this is a great idea. Firstly, BSNL has its own issues and limitations. Secondly, BBNL is envisaged as a common infrastructure that can be used by all players. "This would be severely undermined if it is merged with BSNL, which makes it a competitor in the market and not an ally. These aspects need to be considered very carefully before taking any decision. It would be useful to look at the example of British Telecom and Openreach in UK which are somewhat analogous to BSNL and BBNL respectively and study their evolution and draw appropriate lessons from that," Chandrashekhar said.

But the support for handing over to BSNL still resonates with many. "BharatNet has lost its initial momentum," said an industry veteran who has been closely tracking the BharatNet project and been part of its evolving framework.

"The initial design of 2014-2016 had envisaged at least 5 Wifi Hotspots at Village level with assured takeoff. Now it is all fragmented in terms of ownership, maintenance and usage. Some hard decisions may be required. The existing network has to be handed over to BSNL for operations, maintenance and rural use. Bring in new operators for the remaining areas. Those areas which are not yet covered under BharatNet should be auctioned under the PPP model," he added. "The assured culture of usage in remote areas for applications like Telemedicine and Tele Education was to be developed first to drive this at the grass root levels," he said.

Dr B M Baveja, ex Senior Director, MeitY said there are various wireless technologies to complement the BharatNet Project for provisioning broadband connectivity at a faster pace. "There are villages under the administrative control of the GPs that need to be served using an appropriate last mile connectivity means (wired or wireless). Alternate Technologies to NOFN, include the wireless technologies of - TV White Space; RF including Wi-Fi hotspots," Baveja said.

There is no doubt that optical fibre is critical to India's digital roadmap and Bharat Net, despite its shortcomings, is well on its way to become one of the largest OFC networks with 23 to 24 lakh Km of cable assets.

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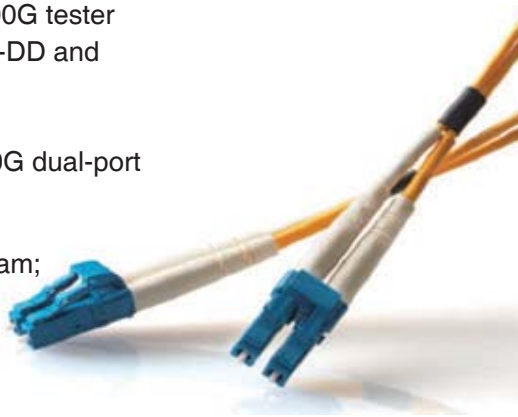

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Sarvesh Singh
Chairman & Managing Director,
Bharat Broadband Networks Ltd.

"Overall, more than 1.76 lakh GPs have been connected and work for another 40000 GPs is in progress. Connectivity to balance Gram Panchayats and all the villages of the country."

Sarvesh Singh, Chairman & Managing Director, Bharat Broadband Networks Ltd. (BBNL) spoke to Gajendra Upadhyay, Editor, Voice & Data about the past, present and future of the BharatNet project.

BBNL has already created a huge infrastructure on the ground with close to 5.7 lakh kilometres of fiber reaching Gram Panchayats and beyond. Bharatnet has seen some great initial successes and a few hiccups, which is expected to be overcome with the new Public Private Partnership model in phase III. It is one of the most critical building blocks of Digital India and future of our Economy.

Sarvesh Singh took over as CMD of BBNL in February of 2019. He belongs to the Indian Railways Service of Signal Engineers (IRSSE) cadre and is an engineering graduate (Electronics & Telecommunications) with more than 30 years of experience in Indian Railways' Signalling and Telecommunications.

He has worked at various levels and in different positions at Zonal Railways throughout India. His work experience has given him a rich understanding of telecommunications networks and technologies.

What is the core difference between the first and second phases of the Bharat Net project.

BharatNet Phase-I has been implemented by tapping existing Fibre of Bharat Sanchar Nigam Limited (BSNL) and by laying underground incremental 24 F optical fibre cable in linear topology with Gigabit Passive Optical Network (GPON) technology. Phase-I has been implemented through three central Public Sector Undertakings (CPSUs) – Bharat Sanchar Nigam Limited (BSNL), RailTel Corporation of India Limited (RailTel) and Power Grid Corporation of India Limited (PGCIL).

The target of completing 1,00,000 GPs under Phase-I of BharatNet was achieved in Dec 2017. Subsequently, the work front of Phase-I was revised and about 1.19 GPs have already been made Service Ready.

The Cabinet approved a modified strategy for BharatNet on 19th July 2017, which integrates the

> The maintenance of BharatNet Phase I network has now been entrusted to BSNL, who has come out with tenders for end to end maintenance of the network.

> BharatNet is now to be extended beyond the Gram Panchayats to cover all the 6.4 lakh Villages (including GPs) of the country. The target is to be achieved by 2025.

implementation experience of Phase-I of the project and aligns it with the vision of Digital India.

The modified strategy of BharatNet Phase-II permits an optimal mix of media – OFC (aerial / underground) / Radio / Satellite unlike the underground OFC alone in Phase I. It allowed for minimum 1 Gbps bandwidth (on wired media) while in Phase I it was minimum 100 Mbps; laying fresh (48 F & above Underground or 24 F & above Aerial) fibre right from the Block till GP unlike Phase I where BSNL existing fibre was used in part of the network till FPOI (Fibre Point of Interconnect), laying incremental fibre beyond till the GP; it allowed for multiple implementing models – like, State-led Model, Private Sector – against the CPSU led model in Phase I; implementation in Phase II had been largely in EPC mode with O&M work entrusted to the implementing agency.

The second phase also had a provision for introducing the Ring Architecture. Can you briefly elaborate on its value vis a vis the linear format of Phase - 1.

The funding for BharatNet Phase-II was approved for GPON technology with linear topology, however States implementing under State led model were given flexibility to undertake implementation of an enhanced network architecture (including ring topology) and technology using their own additional funds.

Five States viz. Andhra Pradesh, Tamilnadu, Telangana, Maharashtra and Chattisgarh are implementing BharatNet Phase II on ring topology using IP-MPLS technology.

In Ring topology network element / devices are connected in circular path whereas in linear topology network element / devices are connected in linear path. Normally, in ring topology IP-MPLS routers are used whereas in linear topology GPON (OLT/ONT) equipment are used. The ring topology gives the protection from single OFC cut; as such network availability figures are high. The cost of implementation of ring topology is however higher than the linear topology.

What is the main objective of Phase III and is this likely to be the final phase to cover all Gram Panchayats (GPs) and villages.

As per Cabinet approval of 19th July 2019, BharatNet Phase III would be in the nature of upgradation of network to meet future requirements, however, the detailed methodology for the same was to be worked out subsequently.

Now, BharatNet under Public Private Partnership (PPP) model, would extend connectivity to Villages and the remaining GPs. It would also include upgradation of network from Linear to Ring based on population criteria, along with long term maintenance and Utilisation.

There have been several models used by BharatNet, including partnerships with BSNL / Railtel, EPC and now PPP. Which of these in your view is probably the Optimum framework.

So far, implementation of BharatNet has been tried though various models such as CPSU led model, State led model, Private led models etc. The target of completing 1,00,000 GPs under Phase-I of BharatNet was achieved

> Once implemented fully, BharatNet will be one of the largest OFC networks in the country with 23 to 24 lakh Km of OFC assets.

> For the PPP model, almost all the prospective Bidders were concerned that the VGF offered is low, possibly due to conservative estimation of Project Cost coupled with unrealistic Revenue Projections.

in Dec 2017. Overall, more than 1.76 lakh GPs have been connected and work for another 40000 GPs is in progress. All the models have made their share of contribution to the present achievement on implementation front.

The ultimate objective of BharatNet will however be achieved when the rural lives are changed by delivery of broadband services using BharatNet. The Utilsation of BharatNet is an issue of concern which we are collectively trying to address.

The PPP model aims to co-opt the private sector as partners with a stake in the success of the project. Would that be a correct way to look at it.

BharatNet is now to be extended beyond the Gram Panchayats to cover all the 6.4 lakh Villages (including GPs) of the country. The target is to be achieved by 2025. Besides pace of implementation, maintenance of the network to industry level standards and its Utilsation are other challenges.

Co-opting of the Private sector would expedite implementation, improve network uptime and drive the much needed Utilsation, in the most efficient and effective manner.

Maintenance of such a massive infrastructure that is mostly underground is a key activity and also a continuous one – spread over decades. What are the main requirements to ensure this does not fall short of expectations.

BharatNet OFC has encountered wide scale damages due to road widening, water pipeline laying and other ongoing developmental works in rural areas. At the Gram Panchayats where the GPON equipment is kept, many a times the GP officials do not exercise sufficient ownership of the equipment; at many places the condition of GP buildings is not good and some GPs have no or inadequate power supply. This leads to theft and damage of equipment at GP level. Putting enough resources to protect and maintain the network in the rural remote areas is a costly affair.

Maintenance of BharatNet Phase I is with multiple agencies viz. BSNL, CSC, GPON vendors and coordinating for the same is a challenge due to divided responsibility.

To overcome this challenge, the maintenance of BharatNet Phase I network has now been entrusted to BSNL, who has come out with tenders for end to end maintenance of the network.

Additionally, BBNL has procured additional spares of GPON equipment to reduce downtime. The GIS mapping of BharatNet assets is being expedited to aid maintenance.

In the long run, it is planned to select a Private Service Partner, through PPP mode, who would do long term Operation and Maintenance of the network for 10/20 years along with construction and upgradation of the network.

For the PPP tender, prospective concessionaires had raised hundreds of queries and doubts. What are your observations on their key concerns?

The Request for Proposal (RFP) was floated in July 2021 for implementation of BharatNet through Public-Private Partnership (PPP) model in 16 States of the country covering about 3.61 lakh villages (including 1.37 lakh GPs) for an estimated maximum Viability Gap Funding (VGF) of Rs. 19,041 crore. Thousands of queries were raised by the prospective bidders which we attempted to clarify within the ambit of Cabinet approval. However, almost all the prospective Bidders were concerned that the VGF offered is low, possibly due to conservative estimation of Project Cost coupled with unrealistic Revenue Projections.

The Bidders also had concerns on quality of BharatNet assets being transferred to them. Lack of flexibility in use of technology and network design, including leveraging of Bidder's own assets were other concerns which kept the Bidders away from participation. The Bids were finally discharged in Februray'2022.

> Five States viz. Andhra Pradesh, Tamilnadu, Telangana, Maharashtra and Chattisgarh are implementing BharatNet Phase II on ring topology using IP-MPLS technology.

BharatNet PPP strategy is being reworked now to address these concerns. Fresh tenders will be floated once the Cabinet approval is obtained.

BSNL - BBNL are in the process of being merged. Will this deliver a better execution for the network.

BharatNet is a middle mile infrastructure between Block and the Gram Panchayats. The GPON equipment (OLTE) at the Block level is kept in the BSNL Exchange and also fed from its power supply system. In BharatNet Phase I, the BSNL fibre is used till the Fibre Point of Interconnect (FPOI), beyond which incremental fibre has been laid up to the Gram Panchayats. BharatNet Phase I uses more than 1.9 lakh Km of BSNL fibre which is almost 40% of the Phase I network. BharatNet Phase II does not use BSNL fibre but GPON equipment at most of the places (except States adopting ring architecture) is still kept in BSNL exchanges.

In order to provide the services at the GP level, the Internet bandwidth is to be fed into the OLTE at BSNL Exchange. BSNL with its own ILL (internet leased line) at the Block level and its network of franchises in the last mile, is better placed to utilise the network.

BSNL has the largest OFC network in the country. This experience can be used for end to end maintenance of BharatNet network.

Considering all this, to bring synergy in operations, maintenance and utilisation of BharatNet, the O&M and Utilisation of BharatNet has been entrusted to BSNL since April 1st of this year (2022). It is also a thought that handing over of BharatNet assets to BSNL for O&M and Utilisation will provide the much needed financial support to BSNL in the times to come.

What is your own vision of BharatNet over the next 3-5 years. It is a critical component of our economic infrastructure.

Presently, BharatNet has 5.7 lakh Km of OFC laid to connect 1.75 lakh Gram Panchayats. Majority of the balance 40,000 GPs for which the work is in progress will be completed in the current financial year and the remaining GPs, mainly of Tamilnadu and Andhra Pradesh will be connected sometime in 2023-24 – taking the BharatNet OFC assets to 7 lakh kilometers.

Connectivity to balance Gram Panchayats and all the villages of the country, including upgradation of network from Linear to Ring would be undertaken through PPP mode. Once implemented fully, BharatNet will be one of the largest OFC networks in the country with 23 to 24 lakh Km of OFC assets.

The biggest challenge we are facing for the time being is Utilisation. We are trying to push Utilisation by roping in the private ISPs under a Revenue Sharing agreement. More than 100 such agreements have already been signed between BBNL and the ISPs. Meanwhile BSNL is also making efforts to push Utilsation of BharatNet through their own franchisee arrangement. As use of online platforms for commerce, delivery of groceries, of government services, development of tele-health, tele-education, remote work, not to speak of streaming music, videos and movies on over the top (OTT) applications, we expect demand for high speed broadband in remote and rural areas will multiply and BharatNet will play a role here.

As maintenance of network to industry level standards is key to Utilsation, BSNL has also undertaken SLA (service level agreement) based maintenance (end to end) of BharatNet network.

Providing services in rural and remote areas at an affordable price in the face of uncertain demand and poor network uptime has raised viability concerns. The government may provide subsidy to address the concerns on the viability front.

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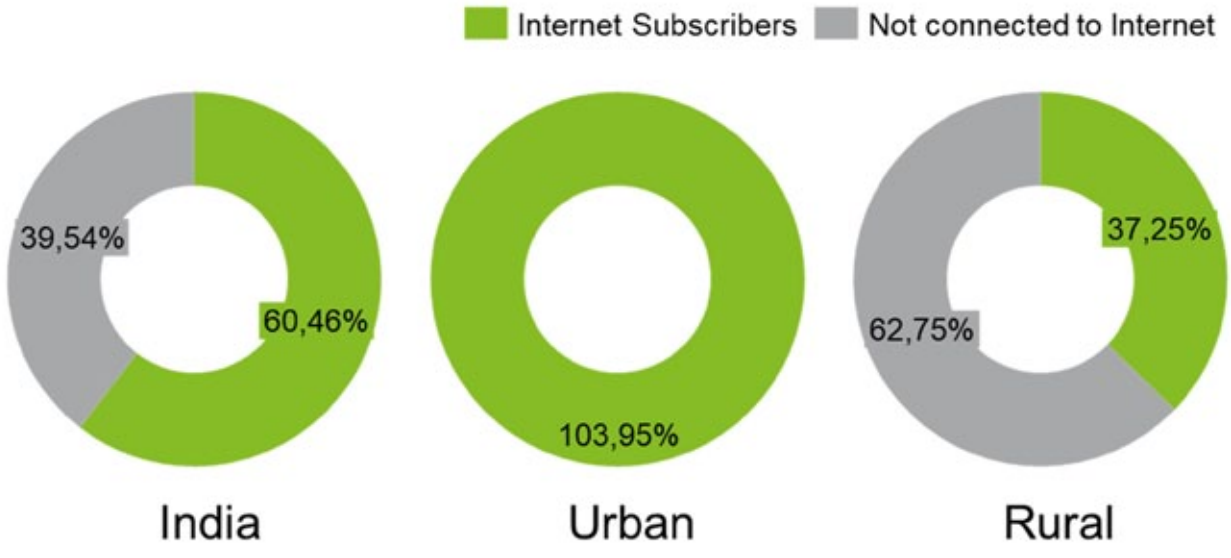
BHARATNET PHASE-III: TOWARDS THE FINAL DIGITAL INCLUSION OF INDIA'S HINTERLAND

A monumental effort to bring broadband access to the remotest corners of the country

BY ADITYA KHAITAN AND NIKHIL SRIVASTAVA

The National Optic Fiber Network (NOFN) initiative was approved by the Govt. of India in 2011 to connect 2.5 lakh Gram Panchayats (GPs) in the country. This connectivity could be extended to cover all 6.5 lakh villages in the country, providing services like e-gov, tele-medicine, tele-education, e-health etc. According to report by Indian Council for Research on International Economic Relations, a 10 per cent increase in internet penetration can increase the GDP by 1.08 per cent adding ~US$ 17 billion to the country annually. As opposed to a 103.95 internet subscribers per 100 population in the urban geographies, the internet penetration is only 37.25 internet subscribers per 100 population in rural India. Bridging the urban-rural digital divide, creating learning and employment opportunities for youth in the hinterland could have far reaching implications on the economy.

Figure 1: India Internet Penetration (Dec 2021)



National Optical Fiber Network or NOFN project gained impetus under the Digital India initiative of 2015 and was renamed 'BharatNet'. Driving digital inclusion through establishing Broadband Highways - a key program pillar of Digital India.

After a slow start in the initial years due to planning (design) and coordination related challenges amongst various executing agencies as well as supply of electronic equipment the project finally commenced in 2014. NOFN project gained impetus under the Digital India initiative in 2015; and was renamed 'BharatNet'. Driving digital inclusion through establishing Broadband Highways - a key program pillar of Digital India; encompasses rural broadband connectivity. The Telecom Commission approved implementation of the NOFN project in three phases with defined set timelines in 2016.

Three envisaged phases of BharatNet (2016)

- **Phase I:** Central Public Sector Units (C-PSUs) including BSNL, Railtel, PGCIL were appointed for implementation of the NOFN network in the first phase providing connectivity to 100,000 GPs by March 2017.

- **Phase II:** Phase II witnessed several deployment models across agencies for covering the remaining 150,000 villages including C-PSU led, State led, BBNL led model as well as some PPP models. Further, it was planned to be completed by December 2018.

- **Phase III:** Phase III was envisaged for upgradation of the fiber network laid across 2.5 lakh GPs to a futuristic ring topology between district to Block and Block to GPs.

Since then, 5.7 lakh KM of fiber has been laid and 1.77 lakh GPs have been made service ready through fiber or use of satellite for connectivity to remotest parts of the hinterland. Phase I goals are completed, and Phase II is underway with implementation hampered in certain States.

The Phases I & II were primarily driven under Engineering, Procurement and Construction (EPC) models under various agencies with construction and procurement costs borne by the Govt. The focus was on network creation; network Operations and Maintenance (O&M) for varying time duration was included as part of the contract. The contracts were dominated by C-PSUs and EPC players who have collectively deployed 5.7 lakh KM of fiber and achieved the milestones (Phase I & II) as shown in Figure 2. in the domestic market for performing network creation and O&M of the network infrastructure.

Key challenges experienced in Phases I & II

Post network construction (deployment) completion; the network maintenance suffered due to delay in finalization of O&M contracts in one part and absence of service delivery/ monetization models in another; with under-utilized network not mandating desired upkeep in terms of quality of service. with hindered repair of fiber cuts, lossy fiber, and network Quality of Services (QoS) degraded over the period. The network was envisaged to provide non-discriminatory access to service providers

Figure 2: Overview of the status of BharatNet Phases I & II

Phases	Gram Panchayats	Model	Timeline	Status	Fiber Deployed (Kms)	GPs Connected	GPs Service-Ready	Outlay* (Rs. Crores)
Phase I	100,000	C-PSU led	March 2017	Completed	309,961	124,175	123,318	11,148
Phase II	150,000	Various models**	December 2018	In-progress	260,154	59,131	53,697	30,920
	250,000 GPs				570,115 KMs	183,306 GPs	177,015 GPs	~Rs. 42,068 Cr.

WI-FI Hotspots Installed 1,04,288 Active 53,353

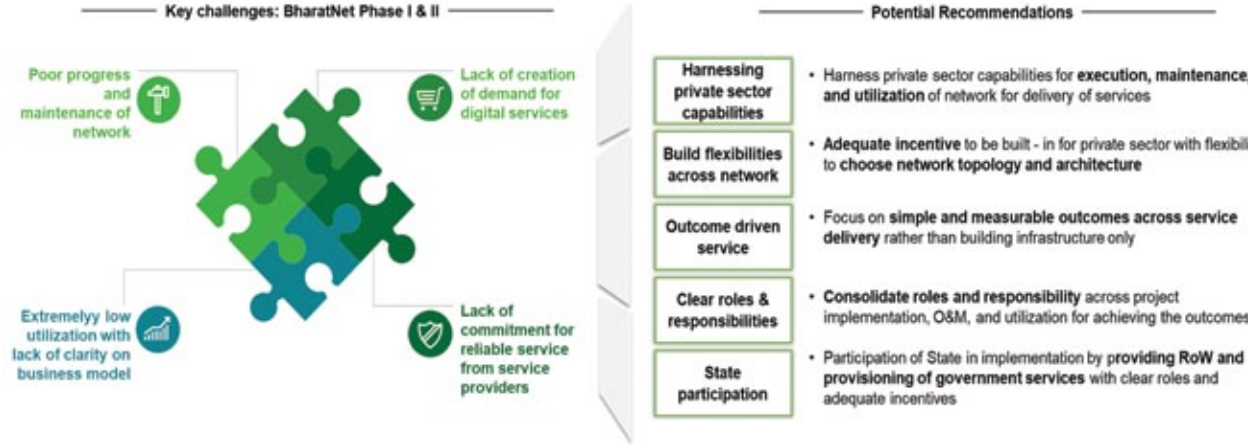
FTTH Connections Commissioned 214,714

Dark Fiber 37,294 Kms

*Outlays indicate the envisaged outlays for the Phase completion
** Various models include C-PSUs/ State-led/ BBNL (Pvt. Model)/ PPP Model/ Misc.

Source: Deloitte analysis, various sources

Figure 3: Key challenges faced in BharatNet Phases I & II and potential recommendations on enabling broadband services in rural India.



for delivering services to end-users. However, with the network quality hampered, service providers leasing the fiber or bandwidth on BharatNet, experienced poor delivery of Service Level Agreements (SLAs) on quality and uptime. With the scope of BharatNet projects not including service delivery (for monetization of the network); whilst connectivity was provided till GPs, last mile connectivity was not established to homes, institutions, enterprises which would enable delivery of digital services to end users. The key challenges are indicated in Figure 3.

With the omission of last mile in BharatNet and service provider inability to leverage the network, broadband services and delivery of digital services suffered. Approximately 2.14 lakh Fibre To The Home (FTTH) connections have been commissioned for 65% of the country's population. BharatNet infrastructure created with an outlay of approximately Rs. 42,068 Cr. remains largely under-utilized with no return on the investment.

Thus, it became imperative to leverage private sector capabilities for execution, maintenance and utilization of the network. Hence the Phase III earlier envisaged in the approved BharatNet plan by Telecom Commission transitioned to a Public Private Partnership construct with focus on network creation, upgrade, operations and maintenance as well as monetization (service delivery) offering incentives to private sector to choose network topology and architecture and focus on service delivery outcomes Based on the experience of previous phases, it was also imperative to ensure State participation in providing Right of Way (ROW) and provisioning of government services.

The Hon'ble Prime Minister on 15th August 2020 in his Independence Day speech announced connectivity to all inhabited villages through Optical Fiber Cable (OFC). Thus, the mandate of BharatNet was revised to extend the connectivity from GPs (as in Phase-I and Phase-II) to all inhabited villages, thereby enhancing the scope of BharatNet to provide connectivity to all ~6.4 lakh inhabited villages as well as focus on creation, maintenance and utilization of the network.

BharatNet under PPP model (first round)

Based on the new scope for BharatNet, the Govt. rolled out the tender encompassing connectivity to approximately 3.61 lakh villages in 16 States. The States where BharatNet is being executed under State-led models were not included for this tranche). The BharatNet project in 16 States was divided into 9 packages based on geographical synergies and size.

> The Phases I & II were primarily driven under Engineering, Procurement and Construction (EPC) models under various agencies with construction and procurement costs borne by the Govt.

Figure 4: Extended scope of BharatNet in Phase III

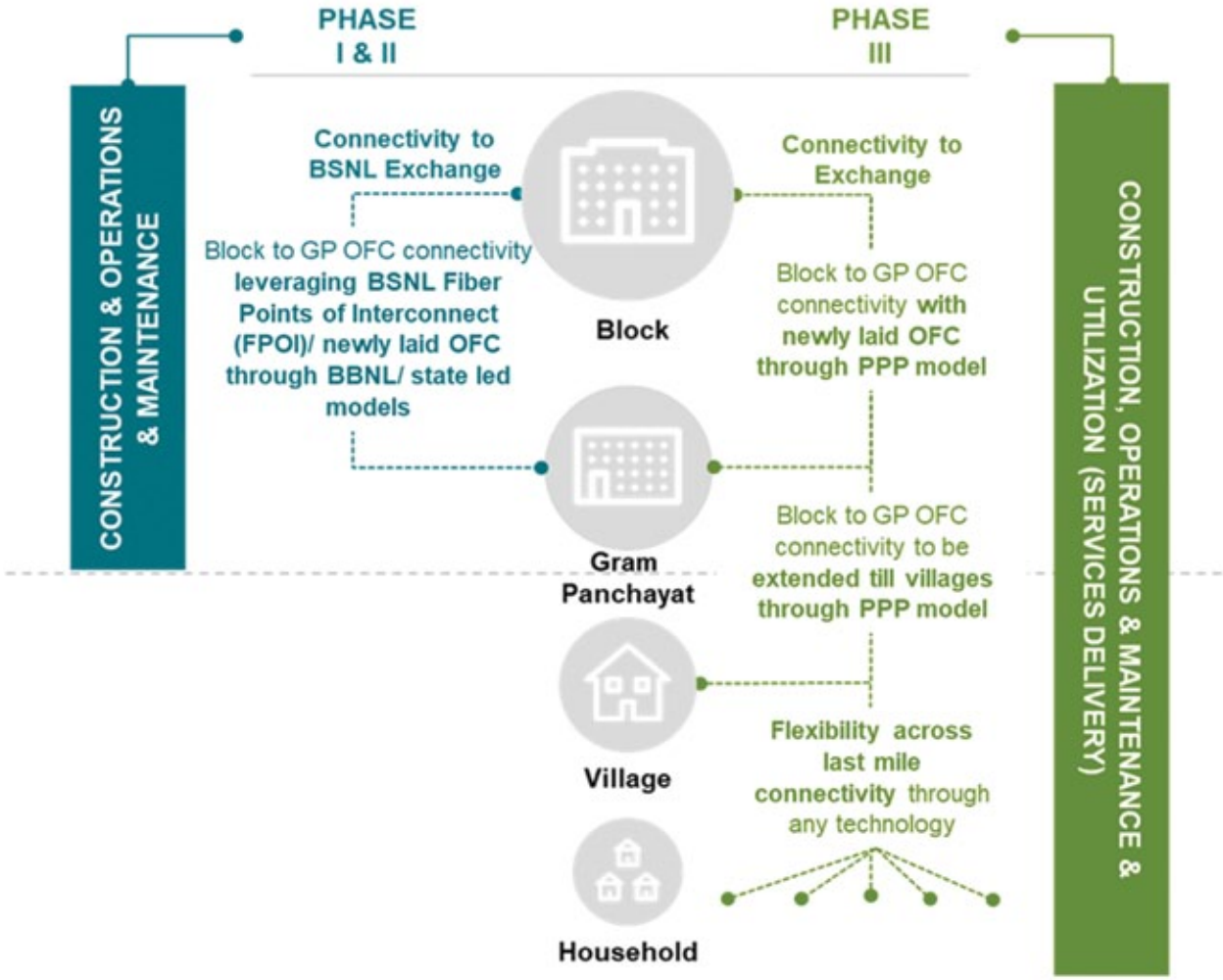
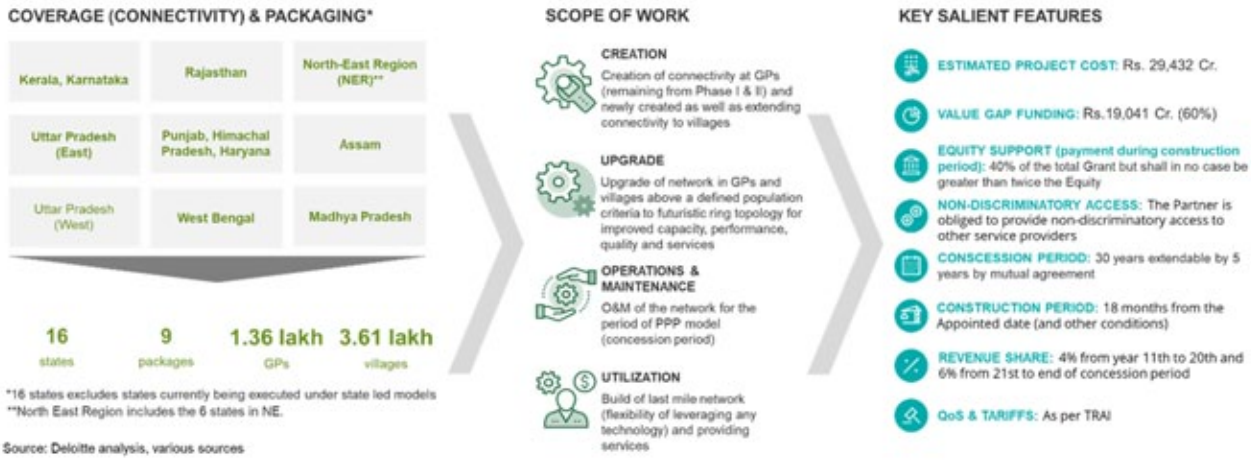


Figure 5: Overview of the BharatNet tender for creation, upgrade, O&M and utilization of the network under PPP model



> Ownership model for creation of infrastructure is similar to the ownership model for PPP projects in infrastructure sector such as roads etc. in India.

The scope included creation, upgrade, O&M of the network as well as enhancing utilization by providing end user connectivity (to homes and enterprises) as well as leasing of dark fiber. The overall period of the PPP model was envisaged to be 30 years extendable by 5 years by mutual agreement. The packaging, scope and salient features of the tender are indicated in Figure 5.

The Govt. had estimated the project cost for the project based on certain network design and architectural principles arriving at Estimated Project Cost (EPC) of Rs. 29,432 Cr. with Value Gap Funding (VGF) of Rs. 19,041 Cr which would be 60% of the EPC.

The estimated project cost does not include the operational costs. It would be pertinent to note that the cost estimation was based on futuristic ring-based architecture delivering improved capacity, performance, quality and services to cover 80% of the population in the rural areas. The Concessionaire (could be either an engineering procurement construction agency, a telco, an ISP, any business entity meeting the eligibility criteria or a consortia) was required to deploy requisite network architecture as per the GP/ village segregation based on population (future ring-based topology or liner network topology) to deliver network and service delivery service level outcomes defined in the RFP.

Furthermore, Value Gap Funding (VGF) of 60% far exceeded the previously established threshold for PPP models. As per Department of Economic Affair (DEA) guidelines; the VGF maximum threshold is at 40% (even after adding additional grant assistance at discretion of sponsoring ministries) for PPP for infrastructure sector. Recognizing the importance and need for building this digital infrastructure as well as encourage private participation, the threshold was extended to 60% for BharatNet. The tender allowed open and competitive global bidding, subjected to the Foreign Direct Investment (FDI) policy of Government of India

The ownership of the network was envisaged to remain with the Govt. and the Special Purpose vehicle (SPV) created under the PPP model for execution of the scope would work under Design- Build-Operate-Finance-Transfer (DBFOT) with handover at the end of concession period. It would be noteworthy that this ownership model for creation of infrastructure is similar to the ownership model for PPP projects in infrastructure sector such as roads etc. in India. Considering the vast investment by the Govt. and view on this digital infrastructure of the hinterland as strategic asset for the nation, the ownership principle might have a merit. However, this PPP model for creation of broadband infrastructure in rural geography is in stark contrast to the PPP model deployed in the United States, where the ownership of the network is intended to be passed to the private player at the end of the concession period. However, the PPP model bidding in U.S. was based on reverse auction a (whereas BharatNet was on least cost selection model) maximizing the private sector participation in bearing the cost burden whereas in case of India 60% of the VGF was being provided by the government.

Anti-monopoly measures were added to the tender whereby maximum bidding by one bidder was restricted to four of the nine packages.

Non-participation by industry in the tender

When the tender was floated, around 50 companies, including telcos, internet service providers (ISPs), EPC players, original equipment manufacturers (OEMs) etc. engaged with the government during two rounds of bid interactions. The government issued clarifications for around 3,000 queries from the prospective bidders. However, the tender saw no participation by the industry and was cancelled subsequently. The agencies have gone back to the drawing board focused on revising the PPP strategy and model to garner interest and participation from the industry. There was thorough consultation process with the industry and several aspects were highlighted that hampered participation.

- **Low estimated project cost:** The project cost estimated was deemed as underestimated by the industry. There was a need to re-look at the design assumptions.
- **Viability of the project:** The private sector had apprehensions about the project viability with mobile broadband penetration in the rural areas. The revenue potential was uncertain. This could translate to expectation of greater value gap funding from the Govt.

> The implementation (construction) timeline of 18 months from date of appointment was challenging for creation of connectivity to uncovered GPs/ villages.

- **Large packages requiring significant investment:** The package size amplified the investment requirements and there was suggestion from industry to fragment the packages. Smaller ISPs have higher penetration in rural areas and can offer business models for last-mile delivery. However, they would be incapable of raising vast amounts of credit needed to invest and participate in the BharatNet tender

- **Service level agreements for connections:** Service levels defined for number of connections were indicated as a challenge with uncertainty of uptake.

- **Onerous terms and conditions:** The tender had design conditions as well as service level outcomes with penalties in additions to terms and conditions which were too onerous. The industry expectation is around relaxation around in the design conditions.

  Typically, the industry demands pertain around greater thresholds for use of alternate technology (instead of fiber connectivity) for remote GPs/ villages, greater flexibility in deployment of network architecture, relaxation of network QoS related service levels.

- **Stringent implementation timelines:** The implementation (construction) timeline of 18 months from date of appointment was challenging for creation of connectivity to uncovered GPs/ villages.

- **Revenue sharing model:** The revenue sharing model proposed was deemed unsustainable and later eliminated in the corrigendum to the RFP.

- **Assistance for ROW permissions:** Based on experience from past BharatNet projects, the industry sighted challenges related to obtaining Right of Way (RoW) permissions particularly from central agencies such as forest, railways, highways; and sought greater assistance in the area (single window clearances)

Way Forward

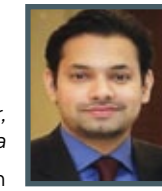
Department of Telecommunications (DoT) recently highlighted that the government might chose to assume the revenue risk for the second round of bidding. The agency indicated that bidders would only have to bring in the capital expenditure and operational expenses for the project without worrying about the fluctuations associated with revenue . This could potentially mean that the scope of BharatNet might get segregated with creation, upgrade and O&M of the network up to GPs/ villages as one part and enhancing utilization of the network in the second part. The scope for enhancing utilization through last mile service delivery might be covered in a subsequent tender.

With the second round of bidding for creation, upgrade and O&M of the network up to GPs/ villages the mid-mile will be created over which service can be delivered to end customers.

The Govt. is striving to convert this Digital India dream into reality by driving the build of the broadband highways that would connect the hinterland and drive digital inclusion. For service delivery and driving utilization as well as return on investment on this massive infrastructure, the private sector needs to come forward.

With already significant investment and arguably decent success in connecting over 70% of the GPs; the labor required to create the world's largest rural broadband network cannot be understated but the Govt. is pushing to achieve the goal where the fruits of this labor will be reaped by its people. The willingness to make those investments and inviting private sector participation would possibly overcome the challenges witnessed in previous phases and provide that monumental push and impetus to the program and its success.

Aditya Khaitan, Partner, Deloitte India



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BharatNet Network Management System (NMS)

The mammoth BharatNet Fibre Network depends on C-DoT's indigenous NMS platform to monitor performance and flag incidents

BY DR RAJ KUMAR UPADHYAY

As one of the world's world's largest rural broadband projects, BharatNet aims to provide high speed digital connectivity to every village and rural area of the country.

Its aim is to bring Internet and broadband connectivity to the 2.5 Lakh Gram Panchayats and cover 6 Lakh villages with high speed communications networks. This high speed digital connectivity will be the foundation for the digital economy. It will be provided over optical fibre backbones. BharatNet aims to make digital inclusion a reality and will transform rural India into a digitally empowered society and a knowledge economy. The core technology that was deployed for the first two phases of BharatNet was GPON (Gigabit Passive Optical Netowrk).

It is an access network technology, over which bandwidth is offered Telecom Service Providers, ISPs (Internet Service Providers), LCOs (Local Cable Operators) and government agencies. so that they can extend their services from block to gram panchayats and beyond by providing other technologies like FTTH (Fibre To The Home), WiFi etc.

Given the huge spread and complexity of the BharatNet Fiber Network, it is critical to maintain the network KPIs (Key Performance Indicators) and ensure customer service continuity. CNMS (C-DOT Network Management Solution) is an indigenously designed and developed Network Management Solution from C-DOT that monitors, manages and provisions TSP's / ISP's networks with Multi-Vendor, Multi-Technologies.

> CNMS uses an indigenous CSMP (Customisable Service Management Platform) Framework, which is a readily available core engine from C-DOT to support the development and customization of OSS products.

BharatNet NMS and UNMS (Unified NMS) are the customized products from CNMS to provide end to end solutions to BBNL.

BharatNet NMS was implemented in Phase 1. It consists of GPON technology from multiple vendors and monitors the network operations in 1.25 Lakh Gram Panchayats.

BharatNet UNMS was implemented in Phase 2. It consists of State led NMSs along with BharatNet Phase1 and satellite. It provides a state-of-the-art web interface to monitor multiple network technologies like GPON, MPLS, Satellite and Radio covering Multiple vendors like ITI, UTL, Alphion, Tejas and TCIL etc., that are involved in providing the services through BharatNet network across India.

BhartNet UNMS keeps monitoring the PAN-India network continuously and presents a unified view of the entire network displaying the live status of the network with a location hierarchy so that the field operatives and NOC operators can view and take corrective action as soon as a fault data / alarm is presented in their respective location.

C-DOT has also captured all of this in a MobileApp that gives a view of the network status on the mobile. It automatically assigns the Trouble Tickets (Dockets) to a field operator, indicating network faults, fibre faults in their area so that the operator will take immediate corrective action and thereby reducing MTTR, OPEX and maintaining the SLAs.

BharatNet NMS – Key Features

BharatNet NMS (CNMS) is a fully featured, vendor and technology-agnostic solution suite that supports the complete Service Fulfillment and Service Assurance capability. Standard REST APIs provide integration with the BSS (Business Support Systems) systems such as the Order Management system, Trouble Ticketing, Billing component etc.

The CNMS Service Assurance Platform provides Fault Management and Performance Management capabilities, playing an important role in ensuring efficient operations. A key component in this is the topology-aware Root Cause Analysis module, which in tandem with Service Impact Analysis, rapidly identifies services that could be affected as a result of network outages. The Performance Management System along with the Service Quality Management System provides an efficient framework for service quality management and improved customer experience.

The CNMS Trouble Ticketing System is an ITILv3compliant Help Desk solution whereby an Alarm / failure can be tracked from initial reporting till closure driven approach to proactive issue identification and time bound SLA driven problem resolution.

The CNMS Dashboards and Reporting Management module provides various reports for Inventory, Fault, Performance, Service Provisioning & Activation and Trouble Ticketing. The Web-portal provides a single sign-on for NOC (Network Operations Centre) users to access the CNMS applications. CNMS can also be accessed via a Mobile based application on both Android and iOS platforms. CNMS uses an indigenous CSMP (Customisable Service Management Platform) Framework, which is a readily available core engine from C-DOT to support the development and customization of OSS products.

• Dashboard

Dashboard is a tool presenting the network information of equipment status. It keeps track and informs whether the systems are “up” and working or “down” and out of service. It flags the reasons for equipment being “down”. Tickets are raised and tracked. Graphs, charts and reports, with time series and trend analysis helps visualize the status. (An illustration below, based on dummy data)

• Fault Management System

C-DOT Fault Management system is an IT system for managing network failures. This state-of-the-art tool quickly identifies, isolates, diagnoses and helps to resolve all critical network issues that are affecting the network performance. This aims to ensure that services are up and running continuously without interruption.

C-DOT Fault Management System is based on TMF e-ToM standards and is useful for all telecom technologies like Optical, IP, MPLS, wireless etc.

• Trouble Ticketing System

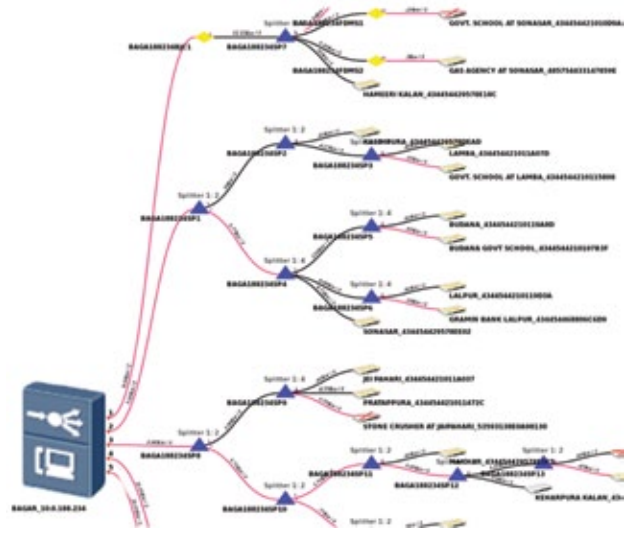
C-DOT Trouble Ticketing System is an ITIL compliant docket management system that provides mechanism for raising tickets on Network Faults, QoS Faults and SLA Violations in the system. The system tracks and manages the life cycle of all the dockets / tickets for faster resolution and restoration of the faulty conditions in the network.

• Messenger

Messenger is a product that effectively and instantaneously sends network faults and performance conditions as and when they occur to network operators/ concerned persons via various communication channels (SMS and Email) so that corrective measures can be taken and network effectiveness is restored.

• Fiber Management

Fiber Management system is an application to efficiently manage and monitor fiber links, joints, splitters in optical networks. It has features for configuring, provisioning, fault monitoring and reporting on fibers. It raises tickets on fibre faults/alarms. Fiber Management system is also used to Configure End to End Fibers (OLT to ONT) along with configuration of passive elements and represent them in graphical display for ease of management at operators end. It also does root cause analysis for identifying probable segment's fault. Operator can configure required fiber details using this application.



• Network Services Management System

Network Services Management System provides a centralized monitoring and management framework for the telecom network services provided by TSPs to their B2B and B2C customers. It provides a generic framework where in telecom network services can be modelled/ designed and configured for services of access networks, core networks and backbone networks.

• Performance Management System

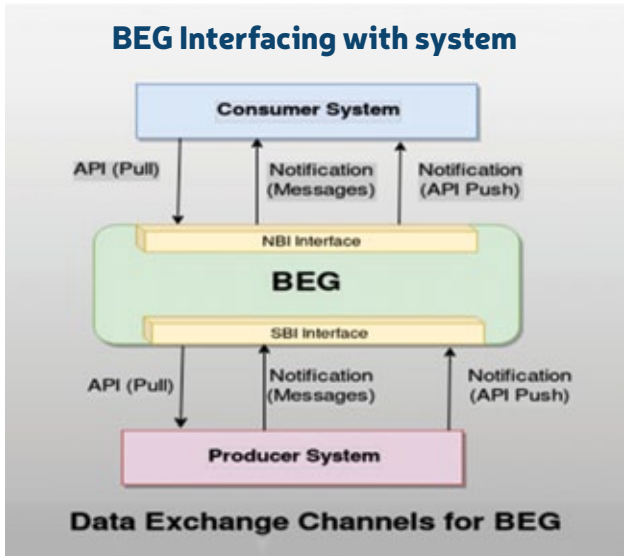
C-DOT Performance Management system is aimed at a wider audience, from small LANs, SMBs (Small to Medium Business) and to large corporations. The software focuses strongly on monitoring the performance of infrastructure and services.

• Telecom Asset Management System

C-DOT TAMS (Telecom Asset Management System) is an application to manage any type of telecom equipment life cycle i.e from their purchase to disposal. It manages the end-to-end life cycle management process from procuring physical assets through Purchase Order to installing & commissioning, verification, re-location, Operation & maintenance, AMC, repair/scrap.

• Business Enterprise Bus

C-DOT Business Enterprise Bus is an application to



provide a central access point for managing enterprise APIs, providing a mediator between internal and external services, systems and devices. It gives an abstraction layer for the O&M data which simplifies and facilitates interaction and integration of systems for business processes.

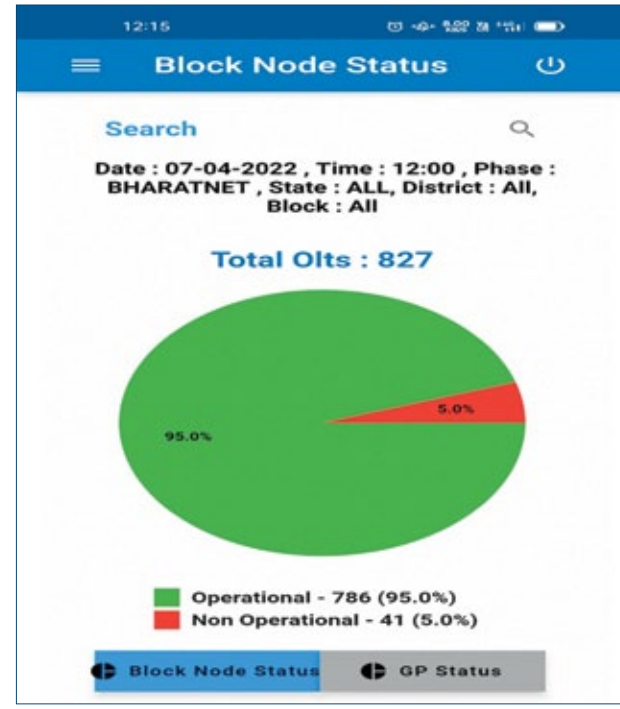
Business Exchange Gateway (BEG) is an abstraction layer which simplifies and facilitates interaction and integration of systems for business processes. It absorbs the changes and provides conversion and generic modelling of data exchanged between systems. The data producer can extend available APIs as per its syntax, semantics and processes.

The consumer system gets data as per their requirements of O&M and map it to their own user interface. It can also cater to business logic which an enterprise wants to bring in during data exchange insulating both its NMS and third-party systems from integration issues.

• BharatNet MobileApp

BharatNet Mobile App is a Mobile Application which is a light weight smarter NMS solution to reduce OPEX of the network. The Mobile App helps the field operators to view all the pending tickets for which the operator is responsible, as soon as the ticket is created and enables them to take corrective action at the earliest. This will reduce the Operational delays and help in faster restoration of faults to keep the MTBR lower.

It provides a bird's eye view of the network status to the higher management with complete drilldown



features. The higher management will be able to get the required status faster along with the failure reasons, if any.

Dr Raj Kumar Upadhyay,
Executive Director, C-DOT

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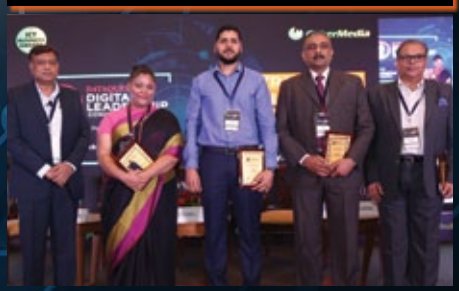

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[INTERVIEW]
IIT MADRAS

"We are making a very big entry into the medical arena from the technological perspective"

Professor Kamakoti Veezhinathan *took charge as Director of IIT Madras in January 2022. He is most well-known for leading the team that developed India's very own indigenous microprocessor, Shakti.*

An alumnus of IITM himself, he has already laid out a roadmap that will build on the institute's stellar past and deliver greater value to the industry and country.

Strong Industry-Academia connect is one of the hallmarks of IITM's technology development focus – one of the factors it has so successfully incubated over 100 Startups.

Under Prof. Kamakoti this will be replicated in a range of new fields – for example in medical science and sports. Dr Kamakoti himself is an expert in the field of artificial intelligence (AI) and a member of the National Security Advisory Council.

In an exclusive chat with ***Gajendra Upadhyay,*** *Editor, Voice & Data, Professor Kamakoti shared his thoughts on the future of the Semiconductor industry in India, advances in medical technology, the reasons why IITM has forged ahead in incubating startups and making them successful and the roadmap for technology education in our country, and a range of other topics.*

The Startup sector is making waves. IIT Madras has incubated close to 100+ startups a lot of them in deep tech with some great successes. Why is IITM ahead of the curve in this area?

At IIT Madras for the last 20 years or more, my predecessors and those before them, have been concentrating on transformational research. About 30 to 40% of our faculty

> This year, we have a record 214 patents filed and around 170 or so granted. We work very hard and meticulously in this area.

Prof Veezhinathan Kamakoti
Director, Indian Institute of Technology (IIT) Madras

invest their valuable time on product-oriented research. Our motto is: whatever we do as a research finally has to end up as a product in the market. It should be useful to the country, the society, to mankind.

We also focus a lot on patenting. The first necessary condition for getting into the startup mode is an idea. That idea needs to be protected. So, we have been working very closely with all the faculty to ensure that their ideas become patentable quickly.

This year, we have a record 214 patents filed and around 170 or so granted. We work very hard and meticulously in this area. We have a system of very well-defined service level agreements and deadlines – in order to achieve specific outcomes for filing of patents. It is a template and we follow the template rigorously.

This encourages faculty and students. Once they go through the grill of patenting, immediately they understand what is the novelty what is the market potential, what is the total addressable market. If they have an idea how it can translate into part of a product or whether the idea itself will become a product.

Then, we have four massive incubators here at IITM.

We have a Health Technology Innovation Center, we have Rural Technology Incubator, we have a Biological Incubator for Cyber Physical Systems opened under the national mission for interdisciplinary cyber physical system and then we have an IIT Madras incubation cell, which is the mother incubator.

So, in every leading field, we have an incubator which encourages students – guided by faculty as mentors - and in some cases faculty as even founders for startups. And that is very, very important.

And finally, we have established a mechanism for turning a product idea into a prototype or a design that could ultimately lead to a prototype. IIT Madras has set up a place called Nirman, for this, where the initial hand holding starts.

We also have the Gopalakrishnan-Deshpande Centre for Innovation (named after Krish Gopalakrishnan and Gururaj (Desh) Deshpande our distinguished alumni), which gives shape to a final product. Our incubation cells help incubate the company.

All in all, IIT Madras has a well-defined process, for handholding at every stage to basically guide students and faculty in the startup process. All these together really motivates the startup ecosystem within the campus.

Of the recent startups from IITM, which are the most promising, in your view?

We have many promising startups like Ather Energy which launched the smart electric scooter incubated

> We would like to make the institute's resources and knowledge sharing accessible to all. We are working on trying to reach rural areas in the country, starting with Tamil Nadu and setting up rural interaction centers with technology hubs.

at IITM. There is Agnikul in the space technology area. We have the project Aavishkar Hyperloop team – an immensely promising startup. There are many more which will scale up quickly.

There was Tejas which was also incubated at IIT Madras.
Yes, Gururaj (Desh) Deshpande was one the earliest persons who funded Tejas and we have our distinguished alumnus there, Shiv Kumar Sivarajan. Tejas also became very big.

IITM has been at the forefront in the communications sector, including research on 5G technology. The 5Gi standard was an IITM brainchild and expected to become part of the global 3GPP Standard.
There was a debate on whether 5Gi and 5G should be two different standards. Ultimately, we agreed on a specific approach as the global body (3GPP) wanted to harmonize it.

There is no point in having two standards. When the 3GPP did not agree on 5Gi being a part of the core standard, we went and fought it. And it was agreed that the two should be harmonized. IITM did the harmonization. I think this is something big that we have achieved.

5Gi is going to be a sort of a pathbreaker. We believe that we have part of our design inside the core standard, without it being diluted. A large part of our 5Gi is part of the entire 5G offering.

5Gi we believe will double the distance of reach of spectrum and that essentially means we halve the total deployment of base stations. Unreachable spots in India will get network coverage because of this extended reach of 5Gi.

5Gi is also very good on energy conservation. This is good from the global ecological point of view. We achieved this after several years of trying to get our technology into 3GPP.

It is a great landmark for us as a country. A lot of youngsters have worked very hard, young faculty across multiple institutions and I'm sure there's a very good fitting reward for them.

The government supported this initiative in all international fora, without which we would not have achieved this. Their support gives us a lot of confidence to work on problems of national interest.

Certainly, this is of national interest. Any nation that wants to become a technology leader contributing to technology standards, depends directly on the amount of leadership that they get. As a country, 5Gi is a very good opening and people across the board – the government, academia and industry – have realized the importance of what has happened.

There is the other initiative of the Government – the production linked incentive or PLI – aimed at firing up the manufacturing sector. This has now been augmented with design linked incentive or DLI. Where do you see DLI programs creating a value for us as a country?
The main thing is when you look at semiconductors per se, when you make a system on a chip (SOC), there are two costs involved.

First, there is the one-time non-recurring cost; another is the cost of production. The cost for production per chip is miniscule. Not even one by a million of what actually goes in the non-recurring fixed cost.

When you look at the overall design, if I did not have the initial non-recurring fixed cost, then the chips that we sell, can be sold at 1/3 or probably half the price, the remaining half essentially goes for the investment that you had made initially for the non- recurring fixed cost.

That's why when the volume increases the amortization for the fixed costs keep decreasing. If I have spent $1 million and I make 1 million chips then the cost is $1 per chip.

> It is now a wakeup call for the industry to participate. We should look for our own Indian design our own IPs being siliconized.

If we make 10 million chips at this investment, then it is $ 0.1 dollar per chip. For 100 million chips it becomes $ 0.01 dollars per chip – that is the amortized cost. So as volume increases, your cost per chip decreases.

Startups when they get into the market, don't have these volumes. They have to make the product to get the volumes. They invest so much money to make a product. And they don't get volumes. That's the bigger question which investors have. Investors ask themselves, what will the company do with this money.

They know that the fabs are costly, the initial design has to work and this design has to become commercially viable, then the product has to sell.

Investors when evaluating a Semiconductor company see all these things and then decide – mostly it is negative. Design linked incentive is basically there to offset some part of the non-recurring expenditure. It solves some part of this chicken and egg problem. I don't say all. But to a large extent the non-recurring costs will be reimbursed through these incentives. Even the Government cannot support a non-existing design. But once the design is successful then startups can essentially seek a loan, for example.

There is a lot of hope from the new Semiconductor policy. As a pioneer in semiconductor research you are one of the leading minds in this sector. What are your expectations from the Policy.

From Chennai to Pondicherry it is 163 kilometers. There is a signage which says 163 kilometers with directions. It guides you to your destination. There is a well laid road and provisions to fix a puncture or repairs on the route. But you have to buy your own car, your own driver, your own fuel and you have to drive.

So, in my view, what the Government has done today is they have put the signboard / placard, plus the infrastructure creation (roads). This $10 billion is a very good beginning. It is a good investment with a very good promise. Indian industry has to now wake up.

They should start investing in Indian startup companies or just start their own design houses. Its going to be a long journey. Importing a system from outside could be easier and more profitable. But working for India would involve sacrificing profit margins, to start with and needs some patience. They need to have the mindset. They need to have the confidence. Before Atmanirbharta should come Aatmavishwas. Self confidence in the Indian industry, Indian Academy, Indian man power, Indian human capacity is needed and investments are needed.

Government has come a long way forward and $10 billion cannot solve the complete semiconductor problem for the country. But $10 billion is not insubstantial. It states we are here to support you. We are serious about it.

At the recent industry event, Semicon 2022 the Hon. Minister was present for three days. This indicates the amount of commitment the Government and the Ministry of Electronics and Information Technology has for us.

It is now a wakeup call for the industry to participate. We should look for our own Indian design our own IPs being siliconized and basically put into products that will bring India the bigger credit. Will lead India to technical leadership. Indian industry is using electronics, every industry is using electronics.

For example, between you and me, on this call, there will be at least 1000 micro-processors which takes my speech and my video over optical and mobile networks to you and vice versa. Everybody in this field should start making the investment, start believing that we can do it, through a joint effort and with an open mind.

Your contribution in this area has been immense also.

Yes, but the point finally is we need to see Indian products and I have to use an Indian mobile phone. Otherwise, you know, all the efforts that we have put remains theoretical. In the next, next two to three years, we need to have Indian designs in the market. Contributions by academicians like me is all okay but the next three years are crucial.

I am appealing to the Indian industry. Please come forward. Please talk to startups in this field, define the goals, we will achieve the goals. We will make world class

systems and use it. A lot of semiconductor startups in the country are struggling for funds.

I think investors should come forward and encourage them. Investors need to take some risks. The outcomes can only be great. They stand to benefit. Let us make India proud. That is what we are requesting.

What is your vision for IIT Madras going forward - what are your main goals in the next two years.

From the outreach side, I want to make IIT Madras an Institute for all. So, I want to bring in more and more people. We opened up our online data science degree, a BSc degree, where we have admitted around 12,500 students. We would like to make the institute's resources and knowledge sharing accessible to all. We are working on trying to reach rural areas in the country, starting with Tamil Nadu and are setting up rural interaction centers with technology hubs.

On the technology side, there are two major initiatives. We want to start a Department of Medical Sciences – where technology and medicine goes together. We are making a very big entry into the medical arena from the technological perspective. Our team is working on this and very shortly we will be opening up a school.

Next, we are trying to take our entire industry connect to 10x that is 10 times of what it is. We have incubated 100 startups this year, these are our own 100. We want to make it 1000. We have started working on these areas.

Our outreach has to become both locally relevant and globally recognized.

Enlarging our complete startup ecosystem and entrepreneurship is a major part of this. Rural entrepreneurship is a serious venture for us especially as a means to generate jobs.

I've been telling my students, the entire placement cell of IIT Madras should be able to place our students in our own started up companies. They should come and recruit our own students. That's a major goal.

I should have hundreds of companies incubated by IIT Madras who will recruit our students. An IIT-ian will join your company and make it a Unicorn. This is something I've been advocating and I'm sure we will realize that goal at the earliest point of time

Can you expand a little more on the medical sciences focus – is it health technology or the digital side of healthcare?

Essentially today any major analysis of medicine – for example, the root cause of say why smoking causes cancer – are all results of collaborations. Technology and doctors. Many devices that are in wide use today – be it the ECG, blood pressure monitoring – have all come out because of a coordination between an engineer, a technologist and a doctor. And this is precisely what we are trying to enhance.

We are looking at the heart, we are looking at nephrology, we are looking at orthopaedics, we are looking at neonatal care. Everywhere, there is a need for technology - which could be very helpful in diagnostics and in preventive care.

And it's not limited to just that. Evaluating a sports person can be an entirely new area. There are a lot of things that we can do about evaluating the fitness of a sportsman, for example. These are some of the very big problems that exist today. We see an enormous market, enormous need for people who can do this type of niche area of work. We must also be aware that it is easier to teach technology to a doctor than teach a technologist to be a doctor. The applications field is always tougher (in this case medicine) than the field that implements that application (technology). Understanding the subject matter is the core. That's where this medical technology school will play a role, where we will take some doctors and MBBS students and we will make them do the other parts of engineering. When they are operating an equipment, they know what the treatment should be and how it works. This will be the first seed of thought for them. From a technological perspective, we will be having some considerably larger results. Which can basically make the life of a patient more peaceful and enhance the living quality of patients.

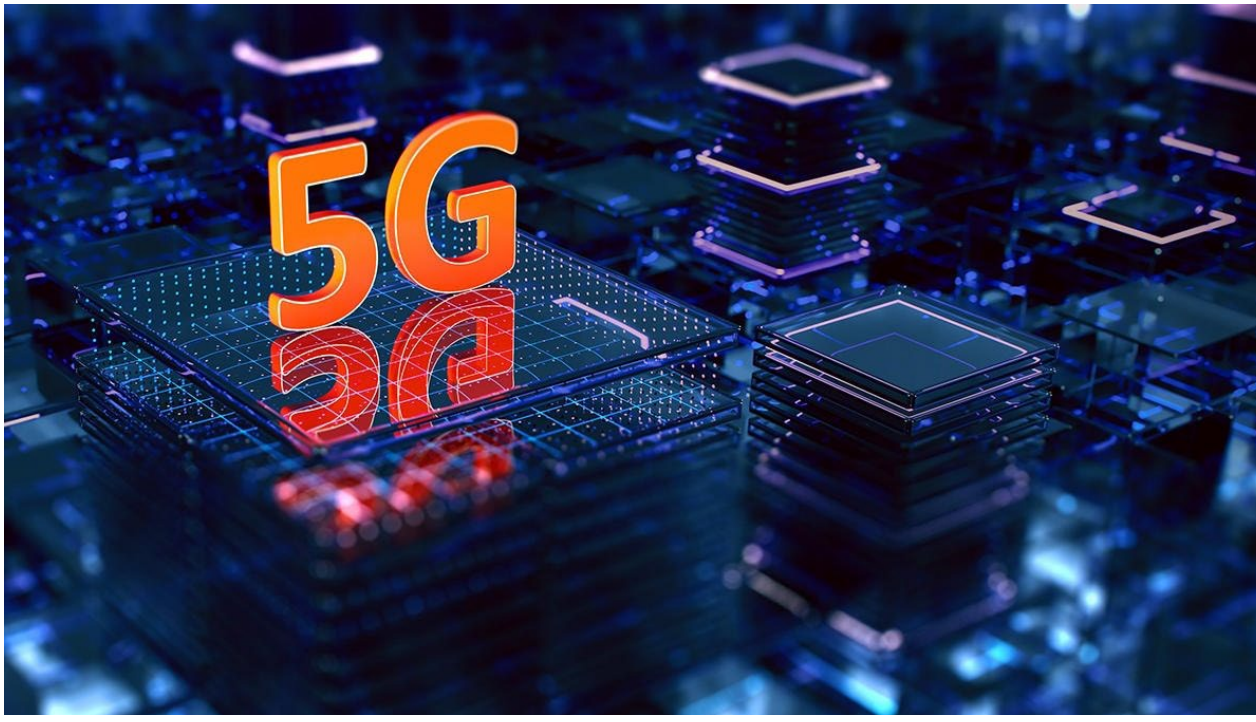
Will Metaverse be a part of this? We are talking of Metaverse and new breakthroughs in diagnostics and healthcare?

These are very high layers that you're talking of. I think there are more fundamental problems of engineering that a doctor faces today. If Metaverse could be an intermediate layer that can enhance the way in which the solution can be provided, certainly we will look into it.

feedbackvnd@cybermedia.co.in

The War For Private 5G Networks

Captive Networks will Boost Revenues & The Aatmanirbhar 5G Eco-System Could Leverage This



BY S. KRISHNA

On 19th May 2022, Union Minister for Railways, Communications, Electronics, and Information Technology Ashwini Vaishnaw made the first 5G call on a trial network set up at IIT Madras using completely indigenously developed technology.

Taking to Twitter, Vaishnaw wrote, "Aatmanirbhar 5G successfully tested 5G call at IIT Madras. The entire end-to-end network is designed and developed in India." Quite the historic moment indeed.

This came immediately on the heels of a live demonstration held by indigenous network technology companies, coordinated under the banner of "Voice", (Voice of Indian Comtech Enterprises), a society of Indian telecom design companies. It hosted demonstrations of "end to end" Private 5G /4G networks using indigenous technology developed by SMEs and Startups between 16-18th May, 2022.

The entire eco-system was stitched together using different equipment developed by Indian entrepreneurs – to build a full blown 5G network – because an end customer (be it enterprise or a captive private network)

> 5G networks are expected to bring in improved connection density (support for larger numbers of users or devices), even greater capacity, as well as major improvements to latency that enable use of mobile technology for time-critical applications.

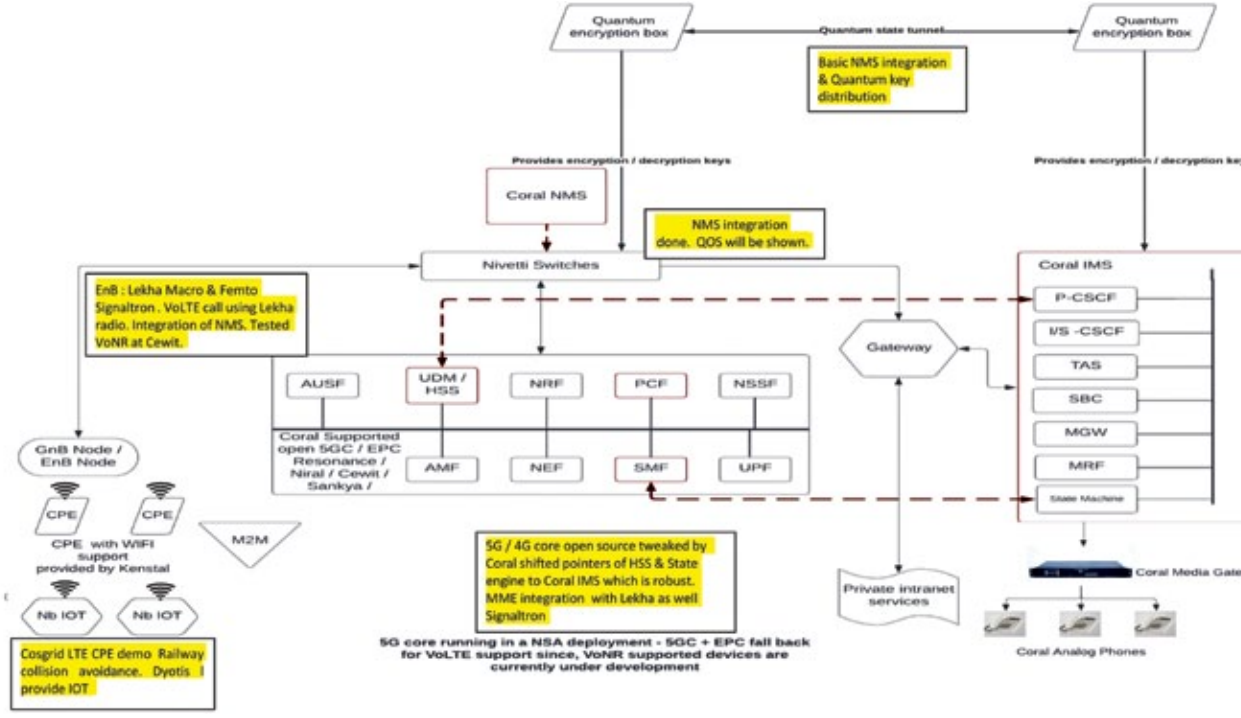
does not buy a radio access network, RAN, IP multimedia system, IMS, a network management system, NMS, or an internet of things, IOT or machine to machine, M2M device in isolation. Customers want an end to end solution.

Ashwini Vaishnaw individually spoke to each of the participants at their booths on the 13th Floor in Sanchar Bhawan and tried to understand their technology, the use cases, their plans for the future and how they could scale up their deployments in India (see story "Domestic Platform for 5G")

All of this comes at a time, when the Indian Government is soon expected to finalise conditions for 5G spectrum auctions. The Digital Communications Commission on 17th May approved the 5G Spectrum auctions in line with the TRAI recommendations and is awaiting Cabinet approval.

It is an interesting moment because the Cellular Operators Association of India (COAI) had submitted a letter opposing any reservation of spectrum specifically for Private Captive Networks. COAI has requested not to reserve any spectrum identified for IMT, for Private Captive Networks, and instead require this to be provided by sub leasing of the network of mobile operators. This is a concept that is endorsed by DoT which has suggested using Network Slices to be leased from the public network run by Operators. Else private networks should participate in upcoming Spectrum Auctions directly.

A FULLY INTEGRATED SOLUTION USING COMPONENTS A RANGE OF INDIGENOUS 5G INDIAN EQUIPMENT SUPPLIERS



COURTESY: VOICE (Consortium members share API & limited SDK such that each one can build the entire network and buy sub-components of others)

COAI

DG/COAI/2021/181
June 08, 2022

Shri Ashwini Vaishnaw
Hon. Minister for Communications
Sanchar Bhawan, 20 Ashoka Road,
New Delhi – 110001

Subject: Private Captive Networks

Dear Sir,

1. We are writing to you on behalf of our TSP members on a very critical issue of **private captive networks**. If this critical issue is not immediately addressed, there really **will be no business case for roll out of 5G networks.**

2. Our members, during their interactions with their corporate clients, who are also serviced by other entities, have learnt that these other entities are promising these corporates that they would be able to meet their growing technological needs by setting up private 5G captive networks of their own by direct allotment of Spectrum by DoT.

3. Worldwide it has been seen statistically **that wherever 5G has been rolled out, there is hardly any consequent revenue increment from the retail segment. The revenue and efficiency enhancement can happen only from the Enterprise segment** .

4. In this regard, as you are aware that the needs of voice and data of the entire nation is being adequately met by the TSPs through their 4G networks today. As such the revenues of TSPs are not going to increase from the retail segment despite very heavy capital investments for rollout of 5G networks. This is further accenuated because India is a highly price sensitive market especially in the consumer segment.

5. The new segment that would be benefitted by 5G services of the TSPs is the enterprise segment including manufacturing, logistics, education, hospitals, campuses, factories, etc. Our TSP members have also conducted successful 5G trials for many of these use cases in the last one year. With 5G auction, the TSPs are targeting the enterprise segment for revenue enhancement and overall increase in productivity and efficiency. This is where TSPs 5G business case lies.

6. If private captive networks for enterprises are set up independently by other entities then this would mean dramatically altering the industry dynamics and hurting the financial health of the industry and will strike at the very heart of the business case enumerated above.

7. If independent entities set up private captive networks with direct 5G spectrum allotment by DoT, the business case of TSPs will get severely degraded. **This will diminish the revenue so much that there will be no viable business case left for the TSPs and there will not remain any need for 5G Networks rollout by TSPs.**

8. We believe that the aim of the Government is to cater to industrial needs of various industry verticals by ensuring they get the connectivity they need to support their use cases. This can easily be provided by the TSPs as per their existing licensing conditions. Giving away dedicated spectrum for private captive networks will render the rollout of 5G services by the TSPs needless because of lack of business case.

In view of the above, we request your urgent kind intervention in the matter so as to ensure that the interest of the TSPs as well the enterprise segment is efficiently catered to.

Regards,

Lt. Gen Dr. SP Kochhar
Director General

Email id: dg@coai.in
Mobile No.: +91 9871554400

CC

1. **Shri PD Vaghela, Chairman TRAI, Mahanagar Doorsanchar Bhawan, Jawaharlal Nehru Marg, New Delhi**
2. **Shri K. Rajaraman, IAS, Secretary DoT,Sanchar Bhawan, New Delhi**
3. **Shri A.K. Tiwari, Member (T), DCC, DoT, Sanchar Bhawan, New Delhi**
4. **Shri Dilip Padhye, Member (F), DCC, DoT, Sanchar Bhawan, New Delhi**
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As industrial/enterprise applications of 5G are considered key enablers of 5G monetization, it is important to understand these developments and why 5G for vertical markets makes a big difference to fuelling innovation and driving socio-economic development in India.

What is a Private Network?

3GPP has referred a private network in 3GPP TS 22.261 as a Non-Public Network (NPN) and has been defined as "a network that is intended for non-public use".

According to GSA, the demand for private mobile networks based on 4G LTE (and increasingly 5G) technologies is being driven by the spiralling data, security, digitisation and enterprise mobility requirements of modern business and government entities. While LTE delivered a remarkable improvement in network capacity and throughput, 5G networks are expected to bring in improved connection density (support for larger numbers of users or devices), even greater capacity, as well as major improvements to latency that enable use of mobile technology for time-critical applications.

How can we benefit from Private Networks in India?

1. Campus Networks

Campus Networks are small, local networks designed for a set geographical area. They can range anywhere from a few hundred square meters indoors to a few square kilometres outdoors. This implies such campus network deployments can work as extension of enterprise PABX systems, providing higher coverage and supporting mobility. Factory campuses with multiple plants over various sites can be connected via private wireless networks. With support of ultra-reliable low latency communications in 5G, such networks can help in plant monitoring and faster fault troubleshooting.

Value illustration: When oil and gas facilities deploy private cellular networks, reduced downtime and increased

> While collecting data based on sensors is important for forest fire tracking purposes, quick transmission and analysis of the data, for instance with edge computing, will be crucial to enabling rapid response, helping first responders to combat fires and evacuate those in the path of danger.

productivity make for an overall more cost-effective and efficient operation. On average, oil and gas producers experience 32 hours of unplanned downtime every month. By applying asset condition monitoring to pumps and compressors, maintenance sessions can be reduced by 25%, as well as unplanned downtime by 32%. It also extends the life of equipment by 25%. (Source: Ericsson)

2. Industry 4.0

Private Networks, which provide dedicated network resources, are ideal for Enterprises embarking on their journey towards digital transformation or Industry 4.0. Use cases with industrial applications include industrial monitoring and control, sensor data monitoring, connected workers, location and tracking, robotics, self-driving/autonomous guided vehicles and many other critical IoT technologies and next-gen emergency services.

In addition to connectivity, adding Multi-access Edge Computing (MEC) in order to host low-latency customer apps minimises the elapsed time from device to data. And ultimately, it speeds up analysis and decision-making.

Value illustration: In August 2020, Nokia in a blog post on its website, described how Private 5G was easily the best option in a bid for a private wireless networks for a large paper mill that had no wireless networks deployed; Nokia was competing with a well-known Wi-Fi 6 vendor. "The first thing that struck me and the rest of the team, was that our total bid came in lower than the competitor's Wi-Fi site survey cost," said the author in the blog post .

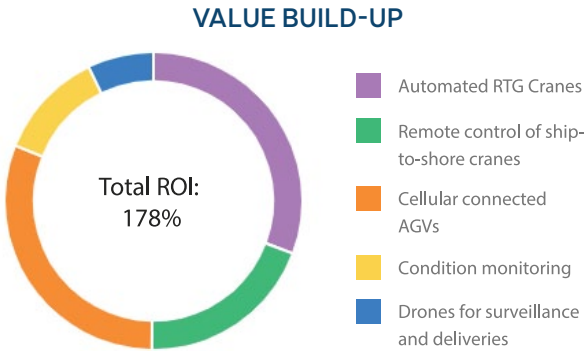
Like most paper mills, the plant was massive with very big machines, high ceilings, lots of metal, many moving assets — meaning, like in most industrial sites, a very complex radio environment with the need for extensive and pervasive coverage. As well as a large indoors, they needed to cover the outdoor area. The Wi-Fi vendor proposed close to several hundred Wi-Fi access points (APs) to ensure indoor and outdoor coverage.

With a private wireless (LTE/4.9G) solution, Nokia claimed they could do it with just a few tens of Micro-BTS outdoors, and a few Indoor-Pico BTS. Nokia's bid came close to 20% of the competitor's bid, showing the cost benefits with private networks based on cellular wireless. Further, WiFi is not great at handling interference in large areas as the number of access points are many.

3. Railways/Metro/Airports/Ports

Utility companies, railway stations, Airports, Ports and accident sites would benefit from a private network that would replace all legacy communications to create a unified communications platform. Railway accident relief trains can provide immediate voice and data

SOURCE: https://pf.content.nokia.com/t004f8-why-private-wireless/blog-beyond-reliable-performance-when-private-wireless-also-wins-on-TCO



SOURCE: https://www.ericsson.com/en/enterprise/reports/connected-ports/value-calculator

communication using private networks that will work seamlessly with their laid-out communication system.

Value illustration: The Smart Ports value calculator, developed by Ericsson, shows a 178% Return on Investment and payback within 2 years for a port with a container capacity of 4 million per year. This is based on the private cellular network-based deployment of automated RTG cranes, remote control of ship-to-shore cranes, cellular connected AGVs, condition monitoring and drones for surveillance & deliveries.

4. Disaster Management

In the immediate hours and days following a disaster, the demand for communication networks increases. During that time, it is critical that rescue workers and government officials synergises their efforts to provide relief and support to those affected. Rescue operation cannot be stopped or delayed even though the responding agencies are unable to communicate with one another. In these time-sensitive and mission critical situations, even few minutes lost can mean the difference between life and death for victims in need of rescue.

In India, primary PPDR (Public Protection and Disaster Relief) communication systems are designed and run by many independent state agencies. Currently, PPDR communication infrastructure in India is either old Analog Systems or it uses narrowband radios. These radios employ narrowband channels and are operated on spot frequencies that are assigned to different public safety entities on a case-by-case basis. The narrowband nature of these radios limits them to only 2-way voice communications with no inherent support for high-bandwidth transmission requirements such as interactive video communication, remote video surveillance of security or disaster sites etc. Such systems suffer from problems like interoperability failures, inefficient use of spectrum, and higher costs. Such systems do not provide the level of secure communication required by India's security forces resulting in easy leak of information to unwanted entities. (Source: TRAI)

Meeting the increased bandwidth, high availability, high reliability and low latency requirements of next-generation PPDR systems requires upgrade of existing systems to new communication technologies with a broader device ecosystem based on 4.9G/5G.

Value illustration: Every year large areas of forests are affected by fires of varying intensity and extent. Based on the forest inventory records, 54.40% of forests in India are exposed to occasional fires, 7.49% to moderately frequent fires and 2.40% to high incidence levels while 35.71% of India's forests have not yet been exposed to fires of any real significance. Precious forest resources including carbon locked in the biomass is lost due to forest fires every year, which adversely impact the flow of goods and services from forests. While collecting data based on sensors is important for forest fire tracking purposes, quick transmission and analysis of the data, for instance with edge computing, will be crucial to enabling rapid response, helping first responders to combat fires and evacuate those in the path of danger. Advances in connectivity, like the expansion of 5G coverage, will continue to power solutions that make it easier for public safety officials to save lives and limit impacts of disasters.

5. Mines and Construction Sites

The Metals and Mining sector in India is expected to witness a major reform in the next few years, owing to reforms such as Make in India Campaign, Smart Cities, Rural Electrification, and a focus on building renewable energy projects under the National Electricity Policy as well as the rise in infrastructure development. At the same time, construction industry in India will remain buoyant due to increased demand from real estate and infrastructure projects. Construction (Infrastructure) Activities as emerged as the top sector during F.Y. 2020-21 with around 13% share of the total FDI equity inflow. Private wireless networks can play an important role in connecting sites in remote areas with no/poor existing telecommunications networks. The Private network could be used to enable a host of activities such as automated / robotic or remote managed applications that are sensitive and mission critical.

Value illustration: According to Deloitte, 5G networks have the potential to provide opportunities to the mining

Source: Deloitte

industry such as automation and remote operations due to improved coverage, lower latency and higher reliability at every stage of its business operations.

As per their studies, use of 5G in mining operations can lead up to 25% increased ore production, 40% higher drill rig operations and 20% energy savings.

6. In-building solutions

A private 5G network allows large enterprise and public sector customers to bring a custom-tailored 5G experience even to indoor facilities where high-speed, high-capacity, low-latency connectivity is crucial, regardless of whether the premises is within a public 5G coverage area. As an example, Wipro states that 5G will provide retailers with uninterrupted business, a reliable network that handles peak time traffic, extreme personalization, AR/VR shopping experiences, fast access and real-time, streamlined operations, access to central systems and ease of tracking of product, price, inventory and customer information.

Indian retail market is estimated to reach $2 trillion by 2032, driven by socio-demographic and economic factors such as urbanisation, income growth and rise in nuclear families. Private networks can play an important role in ensuring profitability and increased customer retention rates in the face increased competition.

Value illustration: Telefonica has been working on the development of a private 5G network at the logistics centre of El Corte Inglés in Valdemoro (Madrid) with the aim of optimising parcel and sorting processes. The department store has achieved a significant improvement in handling and sorting times of around 20%. These automations always design the fastest routes in environments as complex as these logistics facilities, with dozens of high racks and full of diverse parcels.

• Rural & Greenfield Deployments

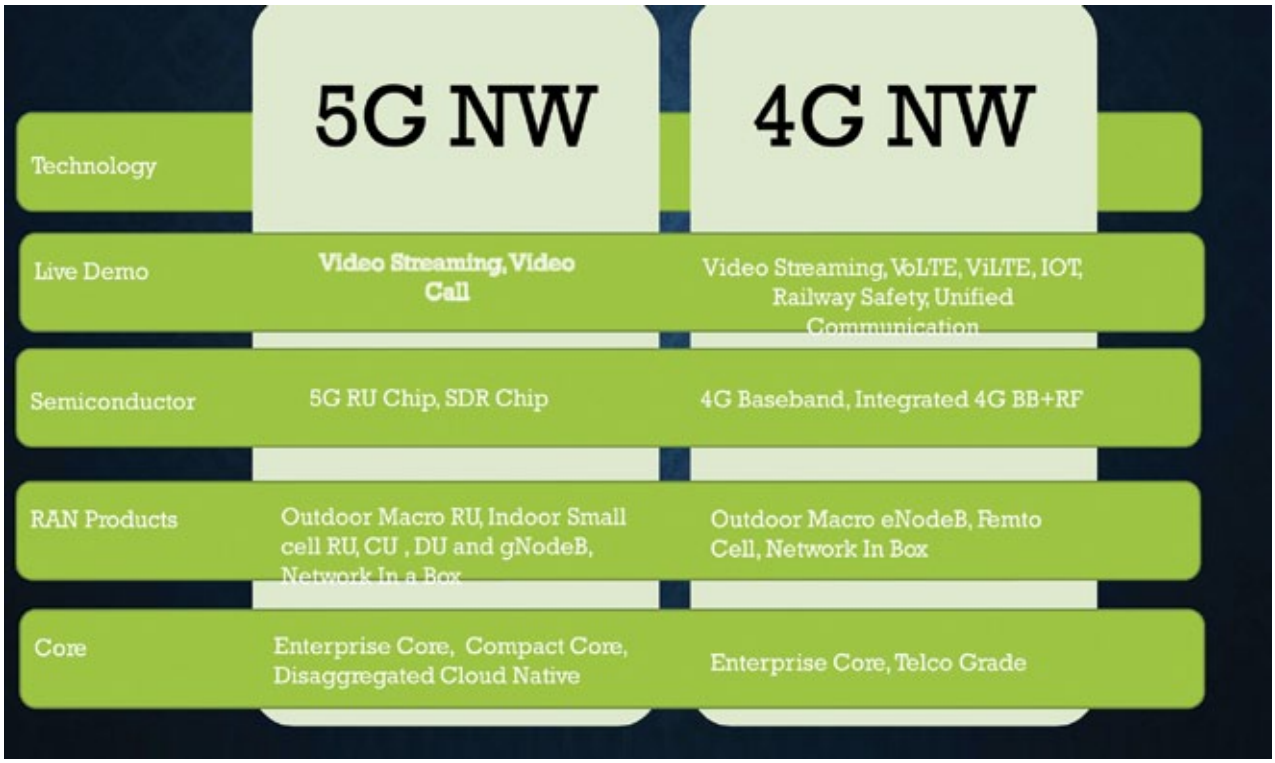
Greenfield deployments in rural areas using private networks can provide cost-effectiveness and quick deployment time. This can enable to manage and run such networks on commercial basis like GPAX operators. In turn, such solutions create employment and entrepreneurship opportunities for deploying and maintaining such networks. Such private networks can also be used for temporary deployments such as in a Games Village or holiday camp over a few kilometres and can be even powered by solar energy.

Value illustration: Many of the important trek routes like Kedarnath have good connectivity at the base camps but can suffer from limited coverage along the way. Private networks can help to provide enhanced coverage on the route and ensure better communication facilities.

What are the latest developments in India that can bolster the deployment of Private Wireless Networks?

An end-to-end 5G Testbed encompassing all the major subsystems of a 5G Network has been developed by eight leading academic (IIT Madras, IIT Kanpur, IIT Bombay, IIT Delhi, IIT Hyderabad and Indian Institute of Science, Banglore) and R&D (SAMEER and CEWiT) institutes of India. The project is a unique collaborative

> 5G will provide retailers with uninterrupted business, a reliable network that handles peak time traffic, extreme personalization, AR/VR shopping experiences, fast access and real-time, streamlined operations, access to central systems and ease of tracking of product, price, inventory and customer information.



Source: https://5gtestbed.in/

effort of a pan-Indian multi-institutional team which has enhanced national capability in telecom technology. The 224-crore project was funded by the Department of Telecom, Government of India for a period of three and a half years. Several industry players and startups in India are project partners in this initiative.

India is also developing its own 5G stack, which is expected to available by September-October this year, according to the Minister. Recently there has been a huge demo of local 5G networks. There has been active participation of all armed forces, ministry of defence, railways, smart cities, home, civil aviation, mines, power. The live demo of 4G/ 5G Enterprise network with IOT application included one on anti-collision system in railways who are doing modernisation of their network at 59000 crores.

What are some of the key challenges of extending the network beyond Smartphone users?

- **Cyber security**
  The deployment of 5G networks implies millions of devices coming online. These connected devices could be sensors, machines, or humans. Operators must be ready to tackle the potential rise of cybersecurity attacks via this diverse device ecosystem for 5G networks.

- **Network slicing and differentiated services**
  At the recent 5G India Leadership Summit 2022, COAI director general SP Kochhar said that the uniqueness of 5G networks tailoring to specific use cases will be in direct contradiction to net neutrality laws in India, if network slicing and differentiated experiences are offered on the network.

- **Lack of access to dedicated spectrum for industries**
  The VoICE team has asked for support in identifying spectrum bands for allocation to enterprises directly. This will support private networks, which would expedite the $ 5 Trillion economy ambitions. A request on this was made by the Indigenous Suppliers Group to the Minister directly and to the senior Officials of the Ministry. The request is to identify specific bands (in sub GHz, Mid-band and Millmetre bands) or coexistence bands (along with other Radio services). National specifications need to be prepared for such networks that will create an enabling ecosystem.

S. Krishna is a Tech Enthusiast and Industry Analyst. (Engineering from India & UK, Over 19 years of telecom industry experience, ex-Reliance and a writer of many Technology Capsules for industry).
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[INTERVIEW]

ZOOM

Sameer Raje
General Manager and Head,
India & SAARC Region, Zoom

"We have IoT interfaces built into our Zoom Room systems — where you can monitor the carbon dioxide levels in the room, you can check the air conditioner temperatures, you can even manage the blinds of the conference room using the zoom interface"

Zoom is a byword, almost a generic term for online, video-based meetings, conferences, classes, get togethers, parties with friends scattered in distant places, family get togethers, marriages, break ups and live shows. Its Q1 revenues globally, announced in May, touched over $1 billion, a growth of 12% over the previous year.

It launched the Zoom Contact Center, a large part of which is supported from its technology centre in Chennai – set up recently.

India is one of the critical markets for Zoom. Growth over the last two years has been strong with an increasing number of Indian Startups integrating Zoom as a default Collaboration platform into their applications. With the option of payment gateways APIs and SDKs, Zoom is set to open up new vistas for its channels and partners in India.

In an interesting and open conversation with Voice&Data, Editor, Gajendra Upadhyay, Sameer Raje, General Manager and Head, India & SAARC Region shares insights into this market – the new realities of the remote workplace, the changing landscape of Generation Z and data privacy laws and his own experiences in the Collaboration industry over the last two decades. Excerpts:

Zoom is synonymous with Work from Home. What do you see as the trend, with the hybrid work environment? People are back into offices. Is it impacting Zoom?

Well, thank you for asking that question. My view is a bit different. Let me elaborate. I have been working in the collaboration industry for almost two decades. I have seen this industry transformed. There was a time when we used to go and talk about audio conferencing. This was the early 2000s. People asked: Why do I need audio conferencing? Then came a phase where people asked, why do I need to share my screen? Then came a phase, "why do I need video on this"?

I have been through those levels of transformation where users felt they didn't need technology. Some felt it was better to travel. Might as well make one to one phone call. Today, we are still in the collaboration industry but a different phase. I'm one of the few lucky ones to be in the right place at the right time.

We are witnessing another transformation which got fast tracked due to COVID. The video collaboration suite of services was adopted very fast, as there was no option. People got used to it. Even traditional organisations with doubts about work from home were forced into it and they saw the benefits.

On the other side, adoption of digital tools by companies shot up because they wanted to reach customers during the lockdown. There was no other touch point. Customers also preferred to purchase using digital tools like apps and social media. They wanted customer support online. We chose to go to social media (Twitter, Facebook or Linkedin) rather than make a toll-free call. Overlapping all of this, is the completely new generation of kids, children who missed school for two years in a row. The New Age generation didn't even use notebooks. Laptops, iPads, tablets and mobile was used for education.

Collaboration is in the middle of all of this – each and every workflow within the organization or outside. It is getting integrated in every format – from factories to e-commerce – into various dimensions of business.

For things like shopping online and activities that you mentioned, is Zoom now also pre-integrated directly with payment gateways to facilitate easier commerce?

So, that is what we are empowering. We are not integrated with a payment gateway, but we are offering you the ability to integrate zoom into a payment gateway of your choice or application of your choice and take it forward from there.

How this works is: we offer our platform in the format of APIs or SDKs. It gives you the ability to integrate Zoom into your applications.

You can also import an application (that is yours) into the Zoom platform. Both options are available. More than 1000 plus apps are listed on our marketplace, which are readily downloadable applications.

Let's say industry standard applications such as mailbox or Okta or Salesforce for CRM. Zoom integrations with these are available. Those are industry standards.

But beyond that, one might have custom Learning Management System or some attendance management system or even customized tools. We have the ability to bring in Zoom into these or you can do it yourself.

What is the response from India specifically on this? We see so many startups in e-commerce, social commerce etc.

Absolutely. You hit the nail on its head. India is a huge startup ecosystem and that is one of our key focus areas. The digital-native organisations, the Gen Z organisations which are coming up. You'd be surprised at the kind of requests we get, the integrations they are looking for. They don't even want to fire up multiple applications for different uses. Their demand is to have applications within applications.

I was just talking to a CIO yesterday, in one of the roundtable conversations. He shared how his employees want everything automated. The entire dashboard should be ready as soon as they start their laptops. It should throw up reports and flag the big items for attention for the day.

I'm trying to develop something like that and it is really futuristic. Our younger generation is already there in many ways. They're firing up applications after applications on their digital devices – such that we get flummoxed sometimes.

The Government's push towards the startup ecosystem is also helping. With digital payments, far off remote locations and cities are now connected and online.

Are there any specific programmes you have for startups in India?

We have dedicated teams who work with digital native organisations, we have a dedicated team focused purely on New Age organizations. Be it, Edutech, Pharmatech or other startups. We understand their challenges. This team is sensitized about, how we can grow with these organisations rather than selling them something.

So, we look at investing in forms of growing with them, allowing them that space where they can leverage our services for initial period and then build on it. Not only that, but we also have our investment programs, which are global again. We have a global investment program where we invest in companies and organisations which are focused on collaboration.

You can read more about that on our website. And that's definitely available here. In that global program, we definitely get a lot of interest from India. But we don't divide that into country specific applications. We select based on the selection criteria.

What is Zoom's channel strategy for India to grow your integrations and new applications?

We have multiple options. Our first team is the direct team which goes to the market. Then we keep on advocating into various marketing channels about what we do on the API.

Recently, we concluded a developer forum interaction where we addressed close to 170 odd developers on what APIs and SDKs do.

We hosted a forum for one of the media houses and we continue to do such education programs about our solutions and SDKs. Of course, we have an entire partner ecosystem. For this, we got strong partners, we got a distributor called Savex, who has a huge number of partners with them. We got partnerships with Tata Teleservices (TTSL), they are again one of the large partners for us with their core strength in small and medium enterprises (SME) segment.

> Data privacy is not something any organisation can afford to ignore. It is always dynamic and keeps on evolving. Cybercrime has gone up to a massive extent. As collaboration and cloud services went through the roof so did hacking worldwide.

TTSL offers a lot of bundled solutions along with their fibre. We also got multiple options for payments. And of course, our online engine is very powerful as well. These are our core go to market strategies in the country.

With the launch of 5G networks in future, are there any new or specific areas that Zoom could foray into?

Well, I think 5G is going to boost video consumption even further.

We spoke about learning management systems for schools and colleges, IITs, IIMs. I'm sure you must have read recently about our Education Minister speaking about the need for hybrid learning in higher education. A lot of higher education institutes are working on it.

On the other end I think even our Health Minister recently spoke about the need for a hybrid healthcare environment. Just imagine being able to provide health care to remote villages where connectivity is an issue. Integration of primary healthcare workers like anganwadis on the ground, enabling them to be in touch with doctors and experts far away, capturing information into hospital management systems and providing diagnosis. That is the future. 5G is just going to push this even further. I see Zoom playing a big role and doing excellent in that area.

Zoom is ideally placed for the Metaverse and the IOT world.

Well on AR / VR and IoT, we have some form of it already. I'll give you some examples of IoT in our Zoom Room systems -- where you can post conferencing or you can collaborate from large video meeting rooms or huddle rooms. We have IoT bundled into it. You can monitor the carbon dioxide levels in the room, you can monitor or check the air conditioner temperatures, you can even manage the blinds of the conference room, using the zoom interface itself, you don't have to log into multiple applications.

That is a format of IoT that we're bringing in. Similarly, we have a format of AR. And this is working excellently in the small startup segment, the question which you had asked me before.

In the startup environment the CEO or the founder usually starts operations from probably his own bedroom or a small room somewhere. We've seen three founding members sitting side by side, rubbing their elbows and presenting to a VC or investor, pitching their product. Just imagine one camera picking up that feed of three people in one room and splitting it into three different screens.

So that's the beauty that we are building into the platform. This gets more empowering as we progress. As far as meta is concerned, we already have launched our avatars. I can change my Avatar, you can tell you will be speaking to probably a cat head or a dog head. We invest a lot into research and development. We try to remain close to our customers from different segments, and we hear them.

What we hear from them is what we incorporate into our product as much as possible. So, as far as Meta or something along those lines, I'm sure we will look into it, as time goes by, and when's its the right time to launch.

You have a Tech Centre in Chennai. Is this a global development centre?

Yes, we have two tech centers. One in Bangalore and one in Chennai. Bangalore was announced in 2020-2021.

And the idea behind that was to be the engineering or the support to basically keep the zoom platform running for the global network. That was the theme behind the Bangalore tech centre.

Whereas the one in Chennai is research and development. And it is, again, global, and it's focused on new products and technologies. The recent

> We already have two data centres in India, Mumbai and Hyderabad. Those data centres cater to all the users of India who are paid subscribers of Zoom.

announcement is more focused on the new product that was recently announced in the US, which is the contact centre. And, they're starting up from there. And then of course, they will take on more and more for the for the global R&D.

There is one major issue on the Regulatory side that is occupying mind space, that's about data privacy. In the initial days, if you remember, there was a lot of talk about how data was not inside the country? How are you tackling this now?

Well, there are a couple of things, that happened in the past. There was a lot of misinformation in the media and wrong information being circulated. Because in the early days, the way the platform was being utilized was opening it up for all. For example, if I want to host a meeting and post that on social media saying, come and join my meeting I am going to invite anyone and everyone.

But Zoom was never meant for that. Zoom was always developed for corporate usage, where you have an IT team to set up your security parameters and tell you how to do stuff. We'd never developed it for consumers to use it on a daily basis. But the pandemic really made the consumer start using Zoom.

There were some mistakes from our side which exposed our platform, but then we fixed that. Data privacy is not something any organisation can afford to ignore. It is always dynamic and keeps on evolving. Cybercrime has gone up to a massive extent. As collaboration and cloud services went through the roof so did hacking worldwide. What we do now is to involve CIOs from various sectors. From pharma, banking, retail etc. We get them together. We brainstorm, what is good, what is bad, what should we improve. We also bring in bug bounty programs. We work closely with government agencies like CERT-IN and MEITY to understand their challenges and their initiatives and work with them in terms of the rules, regulations and how we can abide by that.

Our top priority is to ensure that we not only comply with the Indian rules and regulations but any rules and regulations of any country. We ensure that we share the right information with the agencies.

We work on multiple fronts. And we keep on developing our platform. We have now introduced a proactive monitoring system with tools that can detect if any Zoom meeting URL is published in a public domain and is getting unwanted attention. We flag this to the host. Either they change the URL or change the password or take it down from the public domain.

There was this recent circular just a few days ago from CERT-IN, which adds a couple of extra requirements from all intermediaries and data handlers, do you see that adding an extra layer of compliances and efforts?

We are evaluating that right now, the CERT-IN circular. We will work through whatever is required in terms of what is necessary to comply. At this stage it is a little bit early for me to comment on how far we are there. But, one thing is there definitely we will comply with whatever the guidelines from the Government of India, because in the past also industry has been compliant and rightfully, CERT-IN or any other agency is bringing in new rules and regulations for requisite checks and balances.

Connected to this, is one other question about data localization. There are requirements to have local data centres or store all interactions in a local cloud. How are you tackling this?

So, there are two things we already have two data centres in India, Mumbai and Hyderabad. Those data centres cater to all the users of India who are paid subscribers of Zoom.

And not only that, but we have a function where you can select a data centre or deselect a data centre where you don't want your data to move to. So we are ahead in that from a customer's perspective and have introduced that.

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Over the Top (OTT) – Streaming Video on Demand (SVOD) Market In India

Streaming service providers in India have experimented with different models, such as investments in local and regional content, bundled offerings, tiered pricing, and hybrid models with varying degrees of success

The India perspective - OTT

With a diverse population of more than 1.3 billion that speaks over 20 major languages and consumes a variety of domestic and international content, India is a market that plays by its own rules.

Affordable data and low-cost smartphones fueling customer demand, the Indian customer can purchase short-term subscriptions and switch service providers to get the preferred content across the calendar year. Therefore, a mere adoption of successful streaming strategies from other markets will not be sufficient for streaming service providers to win a wallet share in this high volume, low-ARPU (Average Revenue Per User) market. We explore some key themes and trends affecting the Indian streaming provider space.

The pricing war intensifies as regional players challenge the dominance of the Big 3 – Amazon, Netflix, Hotstar. The market for providing video streaming services in India is highly fragmented with more than 40 streaming players vying for the customer's wallet.

Global streaming service providers (such as Amazon, Disney-owned Hotstar, SonyLiv, and Netflix) compete with domestic service providers (such as

Average Internet Data Usage

In addition, due to the rise in popularity and accessibility of OTT and streaming platforms, India's average Internet data usage has climbed from 1.24 GB per month in 2018 to 14.1 GB in June 2021. As the volume of data grows, corporations, OTT players, cloud service providers, and global offshore centers will need more resilient digital infrastructure in the form of datacenters to meet consumer demand.

–Telecom Sector Skill Council (TSSC) Report – Overview: Indian Telecom Market 2022-23

> The Indian OTT market currently makes up only 7–9% of India's entertainment industry. However, the OTT space is expected to grow at a CAGR of more than 20% to reach US $13-15 billion over the next decade.

Zee5, Voot, and MX Player), as well as a host of regional and ultra-localized players. Demand for OTT streaming content based on geodemography is on the rise, both within India and internationally from the considerable Indian diaspora.

India is witnessing a boom in regional content and platforms created to address this demand. The share of regional language consumption on OTT platforms is expected to cross 50% by 2025 from 30% held in 2019, easing past Hindi at 45%.

The broadening of the traditional audience in the streaming space, the popularity of international content (such as Korean or Spanish content) in India, and the ability to attract a wider audience through subtitles and dubbed content have made established streaming service providers revise their strategy for the Indian market.

In December 2021, one large streaming player slashed prices by up to 60% for its monthly subscriptions (prices for its basic monthly plan dropped from INR 499 to INR 199).

On the other hand, two other global players also marginally hiked their monthly subscription rates, after finding a footing in the Indian market at highly competitive rates to attract a broader set of customers.

Most major streaming players have launched mobile-centric plans targeting price-sensitive millennials and Gen Z customers. These plans also capitalize on low data rates (US $0.09 per GB) and widespread smartphone user base (more than 600 million) in the country.

Pricing for streaming services will remain competitive as players attempt to stabilize and consolidate their customer base, while minimizing the risk of churn to other services.

Market consolidation

With more than 40 players operating in the streaming space, streaming service providers compete to ensure a continuous supply of exclusive yet affordable content. However, consolidation of service providers is expected as the market matures.

This trend has also been seen in the US, where the blurring of lines between tech and the different branches of media has made the entire space ripe for deal making.

The recent acquisition of MGM by Amazon, and the respective mergers of Warner Media and Discovery, and Viacom and CBS are expected to be just the beginning.

In India, the recent merger of Sony Pictures and Zee Entertainment, which will create an entertainment behemoth, may just be the first domino to fall in a chain reaction of consolidation. The recently released government guidelines for OTT content can further accelerate the market consolidation, requiring OTT platforms to adhere to the same content rules followed in the TV and print industry.

These new guidelines are expected to establish a level playing field for the entire media industry and could force niche platforms that rely on objectionable content to shut down. Other segments in the media industry are also expected to witness consolidation in the near future as they look to shore up their defences and strengthen and grow with the OTT-driven push in the space.

App Aggregation and Bundling

Each paying customer in India has, on an average, 2.4 subscriptions.

However, given the price sensitivity, Indian customers may not continue to pay for multiple OTT streaming services. App aggregation and bundling can play an important role in expanding the market by bringing considerable value to consumers in terms of affordability, useability (single sign-on, single window content discovery, etc.), and compatibility with existing devices.

It also helps DTH and Telcos remain relevant by capitalizing on this trend, with each major player launching aggregator platforms and partnering with smaller streaming services to help improve their reach and broaden the content availability for their customers.

Ad-based Video on Demand (AVOD) vs. Subscription Video on Demand (SVOD) debate

While the early stage of the Indian OTT scene was

Churn is Accelerating in the Streaming Video on Demand (SVOD) market globally. More choices, better pricing and varied content is driving this in all markets.

dominated by AVOD pricing structures to maximize consumer acquisition, bundling and pricing innovations and the availability of premium original content have driven increased SVOD adoption, especially during COVID-19.

India currently has about 102 million SVOD subscribers; this number is estimated to increase at a CAGR of ~17% to reach 224 million by 2026. However, AVOD is expected to continue to pull in more revenue than SVOD, increasing its current rate of US$1.1 billion in 2021 to US $ 2.4 billion in 2026. Over the same period, SVOD is expected to grow from its current US$ 0.8 billion to US $ 2.1 billion in 2026.

SVOD subscriptions may also be affected by the bring-forward effect of COVID-19 as the currently accelerated growth rate may taper with the pandemic subsiding.

The content arms race

OTT players across the spectrum are investing heavily and churning out content to attract a greater viewership and better penetrate the market in OTT's growth stage. The pandemic further acted as a boon for streamers as the closure of cinemas forced content owners to look at online distribution platforms. This led to a content acquisition spree as big budget Bollywood and regional films were snapped up by the highest OTT bidder, and marketed and released to much fanfare. OTT platforms invested an estimated US $ 665 million in content in 2021, with Netflix, Amazon Prime Video, and Disney+ Hotstar leading the pack with a combined spend of ~US$380 million.

Others, led by the Zee and Sony combo, are also gradually scaling their investments as they aim to catch up.

The linear TV dilemma and the way forward

The OTT market currently makes up only 7–9% of India's entertainment industry. However, the OTT space is expected to grow at a CAGR of more than 20% to reach US $13-15 billion over the next decade.

This growth will be driven by heavy investment in original content, pricing innovations, low data costs, and the rise of short-form content. However, this progression from the early stage to the mass stage might come at a cost to the broader media industry as subscribers, especially in tier 1 and tier 2 cities, may switch to streaming platforms from traditional linear TV.

OTT Regulation

In February 2021, a code of conducted was endorsed and agreed upon by 17 OTT platforms including Netflix, Amazon Prime Video, Disney+Hotstar, ZEE5 and Voot.

Although India has largely escaped cord cutting for now as TV viewership is on the rise, the industry cannot afford to become complacent. Linear TV players need to learn from OTT platforms, provide meaningful and quality content, and integrate the latest technology, such as connected TVs, to remain relevant in the new digital world.

The Bottom Line

Streaming service providers in India have experimented with different models, such as investments in local and regional content, bundled offerings, tiered pricing, and hybrid models with varying degrees of success.

With the streaming market expected to reach US$13-15 billion over the next decade, it is safe to say that "the rising tide lifts all boats." Streaming service providers are reaping the benefits of a continuing pandemic, shifting content consumption priorities of the customer, and disruption of linear TV services. In this rapidly evolving market, streaming players focus more on customer acquisition as opposed to customer churn. As prices stabilize and content libraries become nuanced and structured, the focus will shift to churn minimization.

Core to that effort will be the sustainability of the content pipeline and the ability to remain affordable as the market matures.

Extracts from Deloitte TMT Predictions 2022.

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Domestic Platform For 5G Networks – Private Networks On Indigenous Systems

Voice and Data communication will be peripheral use cases in 5G networks. It will accelerate digital transformation that would include IOT & M2M applications and data services

DEMONSTRATION AT SANCHAR BHAWAN

BY RAJESH TULI AND RAKESH KUMAR BHATNAGAR

"Voice", (Voice of Indian Comtech Enterprises), a society of indigenous telecom design companies recognised the need that customers do not want components of a network. They want an end to end solution to meet their requirements.

Customer wants a Common management of the network, Common provisioning of the network, Common facility for taking reports of the entire network, Common billing or voice logging mechanism. Customer needs a user experience that is simple and user friendly for all the subsystems and a dashboard from where the entire network can be managed from a central location.

VoICE took the initiative to integrate various subsystems developed by Indian Startups and SMEs to provide a complete end to end system that will open opportunities in Utility companies, Railways, Mines, Oil and Gas as well as Defense applications. Collectively, this would be a large market that can resurrect domestic telecom design & manufacturing industry.

VoICE successfully hosted live demonstrations of "end to end" Private 5G /4G networks from indigenous technology SMEs and Startups during 16-18th May, 2022.

> The technology companies, put on display an entire "end to end platform that included two Radio Access networks (RAN), one from Lekha Wireless and another from Signaltron both simultaneously supported using an open source EPC core tweaked by Coral.

T.S.Ramu, Founder Director, Lekha Wireless and R.K. Bhatnagar, Director General VOICE — with the Hon. Minister Ashwini Vaishnaw at Sanchar Bhawan

The technology companies, put on display an entire "end to end platform that included two Radio Access networks (RAN), one from Lekha Wireless and another from Signaltron both simultaneously supported using an open source EPC core tweaked by Coral where pointers of HSS & State engine were shifted to Coral's IP multimedia switching system (IMS). Coral also integrated all subsystems in the network on their Network management system (NMS) as well Billing package. All these subsystems were connected using switches from Nivetti another domestic company catering to requirements of Indian Défense forces, while solutions for Quno labs was used to support Quantum key based Encryption.

Cosgrid and Dyotis demonstrated the IOT devices. Apart from the live demo of Private 5G network, on display were standalone products, applications and chipsets from various domestic companies.

The value of this end to end network is that Indian companies own both hardware and software and so control resides with domestic players.

Live demo showcased seamless switching of voice calls not only between smart phones to smartphones but also between smartphones and legacy telephones and IP phones which are a part of the wired enterprise network. Call transfer, call forward and call barge in were shown seamlessly across various devices.

Demo also showcased broadcast calls and "push to talk" calls that can be a better substitute than imported Tetra radios used by utility companies. Seamless functioning of existing train control and communication system (TCCS) as well as emergency control system of Indian Railways working on Quad cable were also showcased where these legacy devices worked with smart phones using the 4G LTE network in the demonstration.

Private Networks

IoT devices were displayed & a model supported on the 4G radio network that was set up showcased anti collision avoidance system. Similarly private video conferencing solution hosted locally was also on display. The team claims that acting as a consortium, domestic companies can immediately deliver and meet requirements of setting up Enterprise / Private 4G networks immediately. With support from the Government, they would be able to commercially deliver 5G private networks in 12-18 months.

Spectrum Allocation

The VoICE team has asked for support in identifying spectrum allocation for enterprises directly to enable proliferation of private networks, which would enable accomplish $ 5 Trillion economy.

A request was made to the senior officials to identify specific bands (in sub GHz, Mid band and Millmetre bands) or coexistence bands (along with other Radio services) and asked for national specifications prepared for such networks that will create an enabling ecosystem.

Today Domestic technology companies are marching forward with all the ingredients such as design ownership, IPRs aptly supported by a robust equipment manufacturing and R&D ecosystem. Indigenous technology companies have made significant strides and have showcased "use cases" for applications in Mines, Railways, Defense as well as for utility companies like airports & metro projects. They claim they would

> Once high-speed low latency network is established, it would double up for IOT & M2M applications for plant monitoring maintenance and predictive alerts on impending fault.

deliver a perfect and better substitute to meet demands that are catered by imported Tetra radios used in these utility companies.

Use cases of Private Networks (both 4G and 5G)

- Campus deployment as an extension of the enterprise PABX where Private 5G can support mobility requirements within large campus, of an integrated factory with residential blocks, Hotels, Hospital & institutions where some staff is on the move. Offshore drilling rigs, construction and mining sites are potential customers. Once high-speed low latency network is established, it would double up for IOT & M2M applications for plant monitoring maintenance and predictive alerts on impending fault

- Ships / Islands and Forest guards need quick deployment of complete networks that may be backhauled on Satellite / UHF or VHF where such 5G based private networks would be an ideal choice for basic communication.

- Submarines would need it for communication as well as predictive fault alerts by use of appropriate sensors and AI algorithms. Time-Sensitive Networking (TSN) and real-time-based decision making is rapidly finding role in several mission-critical applications across many industries, including manufacturing, oil and gas, aerospace, and transportation that will require such 5G networks.

- Battery powered, Tactical Deployments mounted on vehicle in a compact single box for quick deployment of wired and wireless service could be an ideal communication box for Disaster management teams or for defense setups. These could be housed in jeeps or ships with onboard gensets and can cover 5 to 7 Kms radius. Deployment of half a Dozen such mobile communication systems can cover a larger area seamlessly communicating between each other as part of Tactical deployment. UN peacekeeping forces or troops stationed in any part of the word can be customers for such applications. IOT devices tightly intertwined on the 5G network will help identify, locate threats and protect critical assets as well as enhanced predictive preventive maintenance of critical equipment and services.

- Utility companies, Railway stations, Airports & Accident sites will need these private 5G network for support on all legacy communication including communication on Quad cable, E&M, BWT & even magneto trunks. Railway accident relief trains can provide immediate voice and data communication that will work seamlessly with their laid-out communication system. Railways could use it for specialized Train control and communication system (TCCS).

- It can be an effective replacement for imported Tetra based communication systems with 5G based high bandwidth low latency communication. Metro projects, Airports, Disaster management teams will find them cost effective and far more efficient. PTT and broadcast communication modes for the system shall address these requirements.

- Disaster Management is expected to cater to emergency services & rapid deployment of mobile network at sites where existing GSM network is destroyed due to natural calamity such as hurricane & earthquake. These private network can quickly set up reliable communication facilities that can be used by all agencies working on the site viz NGO, Red Cross, Paramilitary, Army, State departments, Fire service etc. Security agencies including Police & National Security groups will find many applications to extend emergency services during natural disasters or man-made crisis like terror strikes where need of the hour

> Greenfield deployments in Rural areas can be provided in a cost effective manner, Quick deployment with the help of local youth to manage and run these networks on commercial basis, will also generate employment.

would be to provide voice, video text and high-speed low latency data services.

- Construction sites & mining sites in far flung areas with no or limited existing telecom networks could deploy these private networks to cater for all type of reliable high-speed communication needs within the private campus. Oil rigs, Oil wells and large construction sites or mining areas could be ideal customer for such private network deployments. They would need high speed low latency 5G networks to use IOT devices for automated / robotic or remote managed applications that are sensitive & mission critical.

- In-building solution to enhance mobile coverage in the building thereby releasing load on the macro BTS network, local switching and intelligence will provide enhanced coverage & additional subscriber density. This would also help effective use of scarce spectrum as each private cell would reuse the same spectrum band.

- Greenfield deployments in Rural areas by providing cost effective & quick deployment methodology that can help local youth to manage and run these networks on commercial basis. This will create jobs and entrepreneurs who would ensure upkeep and maintenance at remote locations. These private networks can also be used for temporary deployment in a Games village or for a temporary holiday camp over a few kilometers that can be powered from solar energy.

State of the Art Demos from indigenous products

1. Smart phone to smart phone VoLTE call on Lekha & Signaltron- audio and video. VoNR can be demonstrated with CeWIT
2. Data network of Private 5G – Private video conference solution.
3. Voice Mail / Chat / Call transfer / Call back feature across wired and wireless subscribers of the private network.
4. Push to Talk (PTT) functionality required for Defense / Railway and noisy environments.
5. Broadcast calls simultaneously to multiple subscribers in less than 1 second as needed for disaster applications / Tetra deployments.
6. FXO / FXS / E&M devices in enterprise network to seamlessly call smart phones in the enterprise network- defense and Railway require.
7. Common NMS and alert / trigger / generation for the network.
8. IOT collision avoidance on 5G generate triggers

Market size

The global private 5G network market size is estimated to reach USD 14.28 billion by 2028, registering a CAGR of 39.7% from 2021 to 2028,

Enabling a higher order automation in enterprise activities is a critical step to inch towards USD 5 Trillion economy. First step to enable such enterprise level digitalization and ubiquitous connectivity is to democratize spectrum, at least in small quantities for enterprise use. There steps characterize towards ubiquitous enterprises:

- Identify enterprise spectrum for enterprises (generally operated at low powers).

- Proliferate spectrum (delicense for specific use / local licensing at nominal costs).

- Enable enterprises to deploy private networks in a big way without any regulatory burden.

	Entity	Numbers in the country
1	Factories	2.4 lakhs
2	Mining leases	3400
3	Airports	150 (33 international)
4	Ports	220
5	SEZs (Operational)	260

VOICE: Key asks from Government

- Reserve small chunks of IMT Band spectrum for setting up Private networks based on domestic technologies as was the case in IND footnotes 50 & 55 in NFAP 2011. Bands are required in High frequency as well as in low frequency. Both ends of spectrum are required for different use cases and that is what was addressed in NFAP 2011. Bands preferably should be the ones that are commonly available on smart phones costing around affordable costs of say under Rs. 5,000. Also identify coexistence bands for low power enterprise operations.

- 5G private networks to be included in PPP MII policy for preference in public procurement by the government agencies.

> Converged core will connect mobiles as well as wired devices offering common management and provisioning interface. These private 5G networks, would converge Voice, Data, IOT & M2M communication.

- Ensure that all 5G private networks / Network in a Box and such other products are procured that are TEC approved and specifications of products under procurement should not discriminate against technologies available with domestic manufacturers while they should meet functional requirements.

- Ensure that TEC makes specifications for 5G private networks are a sub-set of the 3GPP specifications and not full-blown specifications, considering the fact that these private networks will not be connected to PSTN / PLMN as per TRAI recommendations. These networks would also not need any interface with legacy RFCs / devices. Certification for all telecom products should be "Single -window and removal of certification requirements from procurement process that are not relevant to India such as FCC, CE etc

- Facilitate and fund ten Pilot projects under VoICE in consortium mode to be set up for Power Grid, DOT building, Mining, Railways, Defence sectors as per specifications and requirements of the customers. VoICE will ensure that these test beds are setup with systems and sub-systems that are completely Indian.

- USO fund to encourage funding of private network related to agriculture automation, mining and other use cases that generates jobs in rural areas.

- Indian telecom MSME's should be allowed to participate in Proof-of-Concept (POC) trials for all class of products by BSNL/ Railways so that they can qualify to bid in tenders. Currently restrictions are placed on Indian telecom MSME's for POC even though they fully meet the technical specifications defined for the trials.

- BSNL should host all the Radio technology companies to try their products to integrate as part its 4G trials for technology testing.

- BSNL should waive off Rs 20 Cr as the turnover requirement for empanelling in its recently launched EoI.

- Use USO funds to Incentivise the licensed mobile operators to reserve at least 10% of their network roll out for domestic player.

- Majority of the telecom Tenders are turnkey tenders. Policy framework should ensure applicability of PPP MII order on each telecom item that is earmarked for purchase from domestic companies as per PPP MII order, where domestic competence and competition exists, in purchases made as turnkey projects. There is a need to clarify regarding applicability of PMI policy even on turnkey tenders for all line items.

- Intellectual property (IP) developed in Government labs / academic institutions either fully or partly funded by the Government should be made available at affordable cost (with zero upfront cost) to industry from 5G testbed / C-DOT etc. A small royalty may be charged on commercialization of products. Entire details of drawings / technology and source code should be made available to domestic design companies on royalty basis that is a small percentage of revenue sales.

Enterprise communication, in future will require reliable, high performance, high bandwidth & low latency 5G networks that are device, media and protocol agnostic. Converged core will connect mobiles as well as wired devices offering common management and provisioning interface. These private 5G networks, would converge Voice, Data, IOT & M2M communication within the enterprise and will open a plethora of applications to address diverse customer requirements.

Private networks are already being deployed in a wide range of industries for indoor and outdoor applications but private 5G networks will accelerate the process as every industry including mining, ports, automotive, durable goods and chemicals would need them for their digital transformation that would include IOT & M2M applications. Voice and Data communication may be peripheral use cases.

Rajesh Tuli, MD, Coral Telecom Ltd.

Rakesh Kumar Bhatnagar, Director General, VoICE & Retired Advisor (Technology), DoT

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Metaverse & Healthcare

Implementation of technologies like blockchain in healthcare, which will ensure higher security and data integrity.

BY VISHAL GONDAL

COVID-19 changed our world. It also accelerated the adoption of digital health bringing a technology driven paradigm shift in healthcare. Digital healthcare has been rapidly scaling with new applications and new technologies.

Now, the health industry is set to get a boost using "blockchain" and Web3 technologies. Web3 will transform our 2D Internet experiences of today, into real immersive spaces (using AR and VR).

The result of this transformation is the 'Metaverse'. The Metaverse is a virtual three-dimensional (3D) space where fully immersed 3D replicas of people are possible using

the next version of the Internet based on technologies like Artificial Intelligence (AI), Augmented Reality (AR) and Virtual Reality (VR) and flowing on the new high speed mobile 5G networks

One way to understand this is through Ready Player One, a 2018 Sci-fi film directed by Steven Spielberg. The film is set in 2045 where much of humanity uses VR simulation to escape the real world. So, people live an unhealthy and lazy life in the real world. But they lead an alternative healthy life in the metaverse.

This is happening in the Web2 social media (Twitter, Facebook, Instagram etc) world. Everyone leads confident and happy lives. The reality could be diametrically opposite though.

Metaverse promises to combine the two worlds. It will be a combination of Preventive health + gaming + metaverse in 3D. The underlying technology for Metaverse is Blockchain which offers better security, privacy and accessibility to patients due to its inherent nature. Blockchain can be applied to the medical space in a variety of ways, to reduce costs and offer better access to healthcare.

Virtual reality (VR), Augmented reality (AR) and Mixed reality are already being used for medical training and surgical procedures. Routine consultations that don't

> The annual Indian private healthcare transactions market is valued at over $120 billion. A large part of this is controlled by around 1 million+ practising doctors. The elective surgery and procedure market is estimated at over $22 billion every year.

> Gamification and personalization will be key in the health metaverse to connect and bring healthcare providers and consumers together.

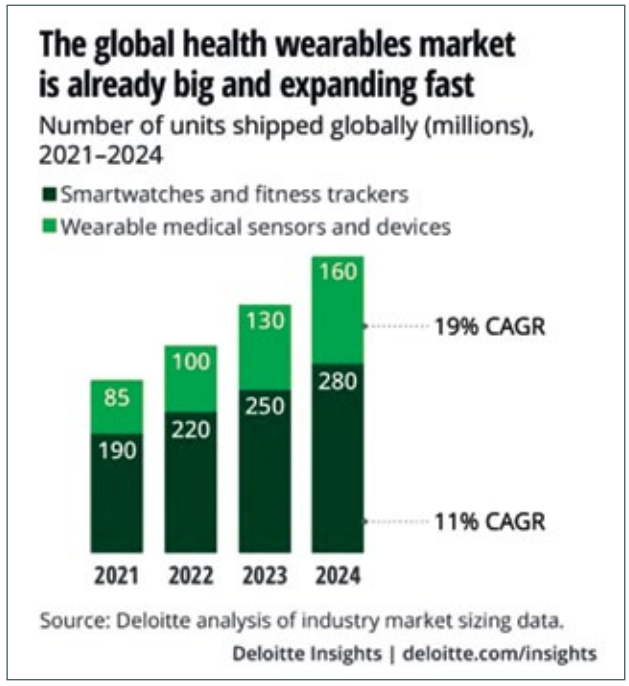
require a physical examination (those that can be carried out visually) will move to the Metaverse.

In this alternate digital reality world, you can create your own digital avatar on your headset and meet your doctor in an avatar form. AR glasses are a long awaited metaverse tool. Once connected to the internet, virtual images can be superimposed physically. It may not be long when we all wear AR devices and going about our day to day life.

You can describe your symptoms, possibly in conjunction with uploaded health data, and receive an evaluation – all from the home. If you want to review the session later, they could record it for playback on command. Payments can be done on using the blockchain platforms and innovative new payment models.

Data will be at the core of these connected networks. While sharing data, it would be the implementation of technologies like blockchain in healthcare, which will ensure higher security and data integrity.

Blockchain will enable accurate data sharing between healthcare providers, which simply means accuracy in diagnosis, and increase in treatment effectiveness.



In the healthcare metaverse, healthcare professionals will be able to deliver more collaborative treatment programs, not hindered by the current siloed nature of the existing healthcare system. It will also benefit in terms of swift information sharing between doctors and clinicians and that means that underlying causes of ill health could more quickly be established. Monitoring of patient activity in the metaverse means factors such as compliance could be tracked more easily, which would further assist with diagnosing and treating illness.

Gamification and personalization will be key in the health metaverse to connect and bring healthcare providers and consumers together. Delivering unique user experiences through fitness gamification and healthcare rewards will have an advantage in the health metaverse universe.

People who have more control and ownership of their health data will be able to use that data to power their NFTs (Non-Fungible Token's) and also using this tokenization people can exchange values.

Digital health metaverse startups are also setting a new parallel course by creating digital twins: which are replicas of bodies, organs, patient populations etc. in the virtual world. They are used for understanding and extracting insights for healthcare decision. Digital twins are modeled on real entities and remain connected to real-world sources of information on health, primarily the patient. According to Deloitte in its 2022 report on TMT predictions: "5G is believed to become the fastest-adopted mobile technology due its diverse applications, such as high-speed gaming and remote healthcare."

A report by Ericsson indicates that by 2030 metaverse will be able to enter virtual worlds that appear to be completely real. Another report by Citi indicates that the Metaverse economy is as large as $13T by the year 2030.

All of this will rub off on the health care status in the Indian eco-system using Blockchain and the Metaverse technologies.

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Deep-Tech Startups — Bedrock and Growth Engine of a nation's Future

Deep-Tech startups tend to create physical products rather than software. They are not interested in building an aggregator model but more concentrated on bringing physical products to life

BY ANURAG WASNIK

What does Deep-Tech mean?

Deep-Tech or Deep-Technology is a category of startups whose business model is based on making tangible engineering innovations or scientific advances and discoveries.

Though Deep-Tech startups having a promising future, they face difficulties in scaling up. It is a herculean task to take these deep-tech products from lab to market, startups need to first prove themselves by overcoming engineering and design challenges while meeting cost limitations.

Why backing Deep-Tech startups becomes so necessary?

Deep-Tech startups are extremely crucial for the national security of any nation. It has become increasingly evident globally that the governments are supporting, funding and promoting self-reliance in sectors like space infrastructure, semiconductors, 5G and defence. It is indispensable for any country to latch onto this fourth wave of innovation which utilizes technologies such as Biotechnology, Nanotech, or Quantum Computing and so on.

While the deep-tech trend is picking up around the globe – it is largely limited to Artificial Intelligence and Machine Learning (AI-ML) fields which are based on deep data analytics.

As of 2020, India had about 2100 Deep-Tech startups *(source: Nasscom)*. Unfortunately, unlike the US – where a lot of deep-tech ventures are being produced out of academic research, such ventures continue to be sparse in number in India.

What differentiates Deep-Tech startups from typical startups?

Many innovations in important societal sectors like healthcare, energy, environment, nutrition, agriculture etc., rely heavily on know-how, insights and foresight drawn from scientific research and development.

These innovations often need a different approach and strategy to advance them from the stage of developing ideas to investment readiness and market-ready products.

These innovations have different risk profiles, timelines, know-how and facility requirements, resourcing requirements etc.

These innovations often need a different approach and strategy to advance them from the stage of developing ideas to investment readiness and market-ready products.

This is one reason why typical investors or VC firms who expect a return on their investment in a shorter time frame of 3-5 years, are not able to appreciate Deep-Tech ventures – where it is difficult to realize returns in such a short timeframe.

Generally, Deep-Tech startups tend to create physical products rather than software. They are not interested in building an aggregator model but more concentrated on bringing physical products to life.

Their focus is generally on solving significant and fundamental issues. For example, a startup is developing a device which can bring cervical cancer screening to every woman's doorstep and ensure timely detection.

Deep-Tech Startups own patents and trademarks and generally work at the convergence of two or more technologies. Deep-Tech startups develop around research-based ecosystems such as Universities, research facilities etc.

What is the government of India doing to promote Deep-Tech Ecosystem?

The Government of India (GoI) is playing a significant role in the Indian Deep-Tech innovation ecosystem. In the very early stages GOI offers support to startups in deep tech space through bodies like, BIRAC (Biotechnology Industry Research Assistance Council), CSIR Labs, Department of Science and Technology (DST), Department of Biotechnology (DBT) and facilities such as C-CAMP that are building a superb conduit.

The Atal Innovation Mission (AIM), a flagship initiative for innovation and entrepreneurship from NITI Aayog, runs a number of programs to bolster the Deep-Tech Innovation cycle in India.

One such initiative was AIM-PRIME in collaboration with the Bill & Melinda Gates Foundation (BMGF). This is a nationwide programme implemented by Venture Centre - a non-profit technology business incubator based out of Pune and hosted by Council of Scientific and Industrial Research (CSIR) & National Chemical Laboratory (CSIR-NCL) and the Office of Principal Scientific Advisor (PSA).

AIM-PRIME program

AIM PRIME stands for Atal Innovation Mission Program for Researchers in Innovation, Market Readiness and Entrepreneurship.

The AIM PRIME program aimed to promote early-stage science-based, deep technology ideas to market through training and guidance over a period of 9 months. The AIM PRIME program was designed to nurture science-based innovations for society and the world. India's role in fostering such innovations is expected to be important in the global context, and the AIM PRIME program sets the stage for that contribution.

The program was focused on promoting Science-based, Deep-Tech Entrepreneurship, anchored around a technical invention or novelty. The knowledge and science intensity is high in this kind of product/ service.

Consequently, the entrepreneurial journey emphasizes different aspects and requires a different approach to resourcing and navigating the de-risking process. The first year of AIM PRIME also aimed to explore and demonstrate India-appropriate methods and create helpful content on an open-access model available to all innovators and entrepreneurs.

The cohort comprised three key stakeholders – Startup founders, Faculty entrepreneurs with spinout company candidates (from academia) and Incubator managers from incubators supporting science-based startups.

The cohort had 40 organisations and 64 participants and representation from 23 different cities across seven states. They represented science-based sectors like Industrial automation, IoT, electronics, robotics, energy and environment, health and rehabilitation, food, nutrition and agriculture.

> One example of "Shallow-Tech" is Uber/ Ola. Though these companies disrupted the taxi market ultimately, they don't qualify as Deep-Tech as they leveraged an already existing technology/ concept and built a platform around it.

In the last nine months, the cohort has raised ~ ₹ 20 Cr, climbed 1-2 levels in both technology & commercialization readiness levels (TRL / CRL); received ~ 18-20 expression of Interests from investors and 18 patents were filed. Six patents and two trademarks have been granted and they have received 25+ awards and recognitions.

The other critical components of the AIM-PRIME program were: AIM-PRIME Playbook, AIM-PRIME Library and AIM-PRIME Youtube collection (share some screenshots). The PRIME Playbook is a guide for science-based entrepreneurs and ventures to progress from the lab to the market or from inventions to innovations.

It covers essential concepts along the journey and essential templates, links to other resources, and video lectures on those topics.

The AIM-PRIME Library is a curated resource shared by the faculty and expert mentors associated with the program. The PRIME Videos is a video collection of the lectures delivered as part of the PRIME Classroom. The entire collection is hosted for access to the public on Youtube.

The AIM-PRIME Playbook was physically launched on 10th May at the Dr. Ambedkar International Center in New Delhi in the presence of Chief Guest, Mr Suman Bery Vice-Chair, NITI Aayog; Guest of Honor Dr. Bharati Pravin Pawar, Hon'ble Union Minister of State, Ministry of Health and Family Welfare (MoHFW); Dr V.K. Paul, Member, NITI Aayog; Dr. Chintan Vaishnav, Mission Director, Atal Innovation Mission; Dr. Premnath, Managing Director of Venture Centre and Mr. Hari Menon, India Head, BMGF.

Shallow Tech

What's the opposite of Deep-Tech, though this terminology is not used widely, the answer to the above question is "Shallow-Tech".

One such example of "Shallow-Tech" is Uber/ Ola. Though these companies disrupted the taxi market ultimately, they don't qualify as Deep-Tech as they

> Governments, universities, and startups all need to work together to propel the frontiers of science and translate technical capabilities into business applications.

leveraged an already existing technology/concept and built a platform around it.

A Deep-Tech firm would have to make the technology first, on which its physical product would work. For example: think of a Startup which manufactures a gun for spraying skin tissues on wounds for fast recovery or a startup which manufactures next-generation sodium-ion & lithium-sulfur batteries.

Such innovations emerging from deep-tech are radical and disruptive as they overcome the fundamental constraints and provide a significant improvement over the existing ways of solving the problem. Deep-Tech startups are in the minority, but their impact and reach are probably more significant than the run of the mill startups.

Governments, universities, and startups all need to work together to propel the frontiers of science and translate technical capabilities into business applications. India is blessed with world class engineering and science - based institutes and it would be a pity if we fail to convert the immense intellectual power of these institutes into machines for Deep-Tech solutions.

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5G Spectrum auction may get delayed

There is a tussle between Big Tech and Telecom Service Providers over participation

Private captive networks are turning out to be a bone of contention between Telecom Service Providers and Big-tech, causing delay in the auction process of the upcoming 5G Auctions.

Voicing the apprehensions of TSPs to the Minister of Communications in an 8 point letter dated June 8, 2022, the Cellular Operators Association of India (COAI), which represents telecom service providers (TSPs) Like Bharti Airtel, Reliance Jio and Vodafone-Idea, mentioned their concerns.

Highlighting the matter of private captive networks, The COAI letter said, "If this critical issue is not immediately addressed, there really will be no business case for roll out of 5G networks."

The letter stated that during interactions of TSPs with their corporate clients, it was learnt other entities (big-tech) were promising corporates the ability to meet their growing technological needs by setting up private 5G captive networks of their own by direct allotment of Spectrum by DoT.

Such a move, COAI said, would have devastating effects on the revenues of the TSPs, the letter continued. "wherever 5G has been rolled out, there is hardly any consequent revenue increment from the retail segment. The revenue and efficiency enhancement can happen only from the Enterprise segment."

On the other hand, big tech players like Amazon, Facebook, Cisco, Google, Intel, Microsoft, Qualcomm, and Indian tech companies like ITI Ltd, TCS, and RailTel have reportedly approached the government, through the Broadband India Forum (BIF), to 'keep overall digitisation aspirations and interests in mind."

COAI said in its letter, "the needs of voice and data of the entire nation is being adequately met by the TSPs through their 4G networks today. As such the revenues of TSPs are not going to increase from the retail segment despite very heavy capital investments for rollout of 5G networks. This is further accentuated because

India is a highly price sensitive market especially in the consumer segment."

Sources say, even though spectrum allocation to private network users in the upcoming auction has been ruled out, tech-giants have approached the Government through their representative bodies. They contend that excluding them could damage the digitisation process of the economy and the prospect of making Indian products competitive in the global market, they argue.

COAI on the other hand, argues that 'The new segment that would be benefitted by 5G services of the TSPs is the enterprise segment including manufacturing, logistics, education, hospitals, campuses, factories, etc.

The letter went on to say, TSP's have also conducted successful 5G trials for many of these use cases in the last one year. With 5G auction, the TSPs are targeting the enterprise segment for revenue enhancement and overall increase in productivity and efficiency. This is where TSPs 5G business case lies.

Telecom Regulatory Authority of India (TRAI), in its recommendations, had also said that non-telecom enterprises would be allocated a 5G spectrum for building their private networks.

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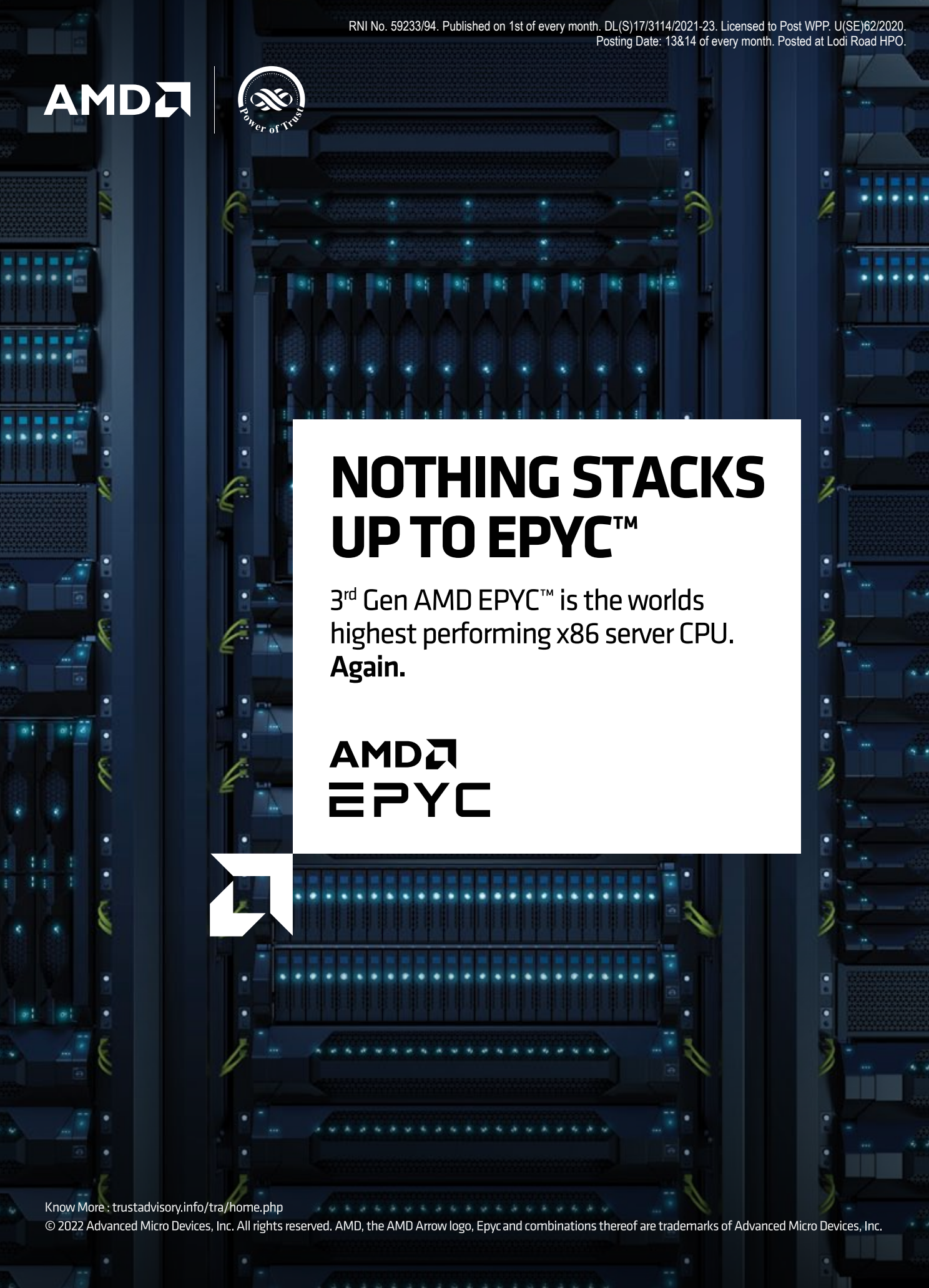

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