BROADBAND BITS & BYTES

BROADBAND INDIA FORUM
"Think Tank for Digital Transformation"

A BIF Bi-Annual Communique

Spectrum needs for a Digital India

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Mr. Parag Kar
Vice President, Broadband India Forum and
Chair – BIF's Spectrum & Regulatory Framework Committee

The vision of the National Digital Communications Policy of 2018 is to create a digital infrastructure that supports the next generation of digital services, allowing India to realise the true potential of the digital economy. Its 'Connect India' goal essentially requires sufficient spectrum if a broadband coverage at 50 Mbps to every citizen is to be achieved. The development of mobile technology from earlier generations to new generations like 4G and 5G has enabled new use-cases and applications, and generated rapid traffic growth. Demand for larger and contiguous bandwidths has led to focus on mid-bands and mmWave bands for meeting such requirements. No single frequency range satisfies all the capacity and coverage criteria required to deploy 4G/5G systems, particularly in a country like India with diverse geographic and population density.

Network coverage expansion, smartphone adoption and low tariffs have led to a surge in the use of mobile data in India. The pandemic has further accelerated the adoption of wireless connectivity for work, across both urban and rural areas. As per GSMA report-2018, consumption of video data content in India was 10% higher than global average, and further increased in the COVID era with a triple-digit jump in usage due to virtual meetings. Video content, video surveillance and video social communication, the new normal, result in higher spectrum requirement to meet consumer needs. India has over 400 million people already using social media and other digital services such as mobile banking, digital payments and accessing government services, and data traffic is now expected to grow further.

GSMA expects India to have 920 million unique mobile subscribers by 2025, including 88 million 5G connections. Indian subscribers will generate almost double the data per month by 2025 than presently, as estimated by the Ericsson Mobility Report 2021. The 5G High Level Forum's recommendations for 5G roll out in India provide important direction on the use of requisite spectrum bands. Typically, spectrum required per TSP in today's digital environment to provide 4G and 5G services are as follows -

(i) mmWave band: 800-1200 MHz

(ii) Mid-Band: 100-200 MHz

(iii) Sub 1 GHz Band: 25-30 MHz

Dedicated spectrum would also be required for private networks to meet Industry 4.0 connectivity requirements, which could be 100 MHz in mid-band and about 200-400 MHz in mmWave bands.

Affordability of spectrum is as important as its timely availability in sufficient quantity in a contiguous manner. Recent spectrum auctions saw very high reserve prices set for some frequency bands, resulting in them remaining unsold. Some frequency bands also need to be delicensed to meet the traffic demand, digital connectivity, and to benefit from globally aligned eco-systems. Though DoT has taken actions in this direction, we expect some more efforts will be required in ensuring that the right spectrum bands in the right quantity are made available at an affordable price to meet the Digital India requirements.

I hope you find this edition insightful and informative, and look forward to your suggestions on how we can collaborate further for enriching the development of India's broadband ecosystem.

Mr. T.V. Ramachandran
President,
Broadband India Forum

Dear Readers,

The significance of digital experience has multiplied manifold as the pandemic has widened the gap between the haves and the have-nots. Demand for wired and wireless broadband has hit an all-time high. Those who could afford smartphones, multiple broadband and Wi-Fi services are weathering the disruptions to work, school, and the procurement of essential goods. But those who didn't have access to quality broadband services, particularly in light of lockdowns and social distancing restrictions, were severely hit. Developing and upgrading the vital infrastructure required for providing quality coverage everywhere has become an urgent imperative for the nation. Spectrum being the most crucial resource for connectivity, its allocation to the sector assumes great significance in this regard.

The greatest value of radio spectrum lies in its usage. Idle or unused spectrum benefits no one-neither the government nor the economy, society or consumers, and results in an irretrievable loss. The opportunity cost of unused spectrum is tremendously large and far outweighs any short-term gains in upfront auction revenue. While the sale of spectrum results in both direct upfront revenue generation as well as the indirect long-term socio-economic gains, striking a prudent balance between the two is necessary to protect the integrity of the communications sector, as well as to secure a bright digital future. The price of radio spectrum is the key to any efforts that attempt to balance these priorities.

India's spectrum prices are one of the highest globally, and tariffs are one of the lowest. This constrains our telecom players from investing in direly-needed infrastructure, affecting both general quality of service and connectivity to unserved and underserved areas. Buying very high-priced spectrum and recuperating the amount by raising tariffs is also not a viable option in the cost-conscious Indian market.

These vital aspects of spectrum pricing methodology need to be urgently reconsidered, especially in view of the upcoming auctions for 5G. We cannot use clearing prices from previous auctions as a starting point to calculate the next Reserve Price (RP). The RPs should be a % of the spectrum valuation number. There are several methods of valuation possible, each with its own merits and demerits. TRAI uses 4 different methods and takes the mean of these for final valuation number. This could well be continued except that the weighted mean is more appropriate than the arithmetic mean followed by TRAI. Moreover, the Revenue Surplus method is, as per experts, more suited to Indian conditions.

Our nation's safety and growth lie in high-quality broadband penetration across the country. Spectrum being the lifeblood of digital connectivity, it is crucial to immediately release the chokehold on competitive price discovery in our spectrum auctions.

This edition of BIF's Bi-annual Communique – Broadband Bits & Bytes, deep-dives into various aspects of this vital issue, providing interesting and informative perspectives, insights and viewpoints from highly knowledgeable and experienced industry experts; besides providing a quick glance into the latest activities and updates of the Forum.

I would like to also take this opportunity to thank our esteemed members, valued associates and partners, honourable advisors, and the dedicated Directorate team, for their invaluable support and contributions in continually driving BIF's objectives towards a better, digitally connected India, and look forward to further progress in working productively ahead in this endeavour.

Mr. Rajat Mukarji
Director General,
Broadband India Forum

Dear All,

It gives me great pleasure to present to you the latest edition of Broadband Bits & Bytes – BIF's Bi-Annual Communique. This edition of the Communique is focused on one of the most critical elements of the entire communications ecosystem across all nations, technologies, legislations and geographies – Spectrum.

Spectrum, as we all know, is the basic, fundamental requirement for any radio communication technology to perform, and hence the adequate availability, and optimal utilisation of this scarce resource is imperative to deliver quality communications services – both voice and data based. Especially in a country like India, which is predominantly served by Mobile Broadband, to the tune of almost 97%, the capacity and efficient utilisation of spectrum holds great significance. Irrespective of the generation of technology being deployed, whether it be 2G, 3G, 4G, 5G or even the future 6G, the demand for spectrum continues to grow and its utilisation will continue to increase.

The spectrum requirements though, cannot be met merely with capacity additions, but need to be made feasible to suit the business case and sustenance of the industry as well. Unreasonably high reserve prices and limited availability of contiguous spectrum blocks are major hurdles in this regard. The Connect India Mission of the National Digital Communications Policy (NDCP 2018) also highlights the importance of optimal spectrum pricing, and sets out a clear strategy to recognize and realize the potential of radio spectrum as a key natural resource for public benefit, to achieve India's socio-economic goals, and ensure transparency in the allocation, availability and utilization of modern communications services. Optimal pricing of spectrum features as an important metric that allows for the rollout of ubiquitous, reliable and affordable communications services.

As we move towards the rollout of 5G in the country, the need for such reforms is further enforced, given that this would be the first generation of mobile communications technology that would transcend mere personal communications use cases, and is expected to have a significant and profound impact on the modernization of virtually every sector of the economy. Energy, mobility, healthcare, finance and other numerous sectors are eagerly awaiting the benefits offered by 5G technology. Without sufficient spectrum put to use in the most effective manner, the benefits of such wonderful technological advancements may not be realised, and the Indian citizens would be deprived of the benefits of this essential and inevitable march of technology.

These are but a few thoughts on this vast topic, wherein we have collated various insights, perspectives and viewpoints of our leading experts, advisors and members. My sincere thanks and compliments to each of the participants for their invaluable contributions and support.

I would also like to take this opportunity to thank the BIF leadership, especially the President, for his dynamic leadership and guidance in driving the Forum's progress and many achievements. My compliments and thanks also to our most efficient Directorate team, for their unfettered dedication, consistent efforts and the gradual but marked success in establishing BIF as the leading Think Tank for the Digital Communications ecosystem in the country.

The Current and Potential Economic Value of Wi-Fi in the Existing, V Band and Wi-Fi 6E Unlicensed Bands in India

Prof. Rekha Jain
Principal Advisor, BIF

Wi-Fi as the underlying infrastructure technology for broadband access and complementary technology for leveraging LTE, IOT, etc., is a major driver of growth envisaged in the Digital India initiative. It would also spur new business models and innovation, due to its low cost and standardized deployment and equipment ecosystem. A liberal wireless regime focusing on Wi-Fi access is even more critical in India, as like many other countries, India is a mobile dominant country and Wi-Fi provides high bandwidths and speeds that may not be possible on the mobile network. In India, where Telecom Service Providers (TSPs) have far less spectrum for mobile services than those in other countries, the importance of a facilitating spectrum regime is greatly accentuated. Additionally, in comparison to several other countries, the quantum of unlicensed spectrum in India is far lower, despite the greater importance of it for the Digital India initiative. India has around 689 MHz of spectrum available for unlicensed use, spread across various spectrum bands. This is very low in comparison to other countries USA - 15403 MHz, UK - 15404 MHz, China - 15360 MHz, Japan - 15377 MHz, Brazil - 15360 MHz.

Wi-Fi, has traditionally been provided in the unlicensed 2.4 GHz and 5.8 GHz bands, and now has standards in the 6 GHz (Wi-Fi 6E) and 60 GHz band (a variant of Wi-Fi called Wi-Gig). This allows for higher bandwidth channels, greater number of channels and higher speeds. Both the 6 GHz and the 60 GHz bands have been unlicensed in several countries, giving rise to faster Internet speeds and allowing for higher bandwidth channels.

However, there appears to be a fair degree of policy reluctance in India for making more Unlicensed Spectrum available. The perspective of policy makers

has been that unlicensed spectrum does not provide direct revenues to the government, as auctions do for licensed spectrum. This is a limiting perspective as unlicensed bands, while not generating direct revenues through licensee fee, auction, etc., have huge economic value. The current and potential economic value of the key unlicensed existing Wi-Fi bands, the potential economic value for V band (60 GHz) and 6 GHz band in India, which we hope will get unlicensed in 2021 are estimated through the present economic value generated by various uses and applications of these bands for Wi-Fi Access and their potential for the future.

Economic Value

Since unlicensed spectrum is "free" to use, the components for measuring its economic value are considered to consist of Economic Surplus (Consumer Surplus + Producer Surplus) and GDP contributions for Wi-Fi, V band and Wi-Fi 6E.

Economic Value of Existing Wi-Fi Bands

The Economic Value of Wi-Fi is calculated in terms of the Economic Surplus (both Consumer and Producer) and GDP Contributions due to the higher Internet speeds made possible on the band and the Device/ Equipment Ecosystem.

Consumer Surplus: Consumer Surplus measures the difference between the price that consumers pay and the price that they are willing to pay for a specified quality of service. Consumer Surplus on Wi-Fi arises due to mobile data offloading (MDO) consequent to the better consumer experience in having faster access available on Wi-Fi for the same price as mobile data. Another component of Consumer Surplus arises due to higher speeds available on Wi-Fi networks in comparison to a mobile network, while paying the mobile data rates.

Producer Surplus: Producer surplus measures the difference between what producers are willing and able to supply a good for, and the price they actually receive. In Wi-Fi, Producer Surplus arises in MDO for the service provider in reduction of network costs (capex + opex) that would otherwise be required to accommodate the increased data usage on mobile networks.

GDP Contributions: Studies indicate that higher data speeds, adoption and availability of the underlying equipment and Internet penetration contribute to higher GDP.

The **Economic Value of Wi-Fi Access in V band** is calculated in terms of the:

a. Consumer Surplus and Producer Surplus on Wi-Gig and

b. GDP Contributions due to:
   i. Higher Internet Speeds made possible on this band,
   ii. Device/Equipment Ecosystem, and
   iii. Short-Range Device Contributions.

The **Economic Value of Wi-Fi 6E** is calculated in terms of the:

a. Economic Surplus (both Consumer and Producer) on Standard Power and Low Power Indoor (LPI) Device, and Very Low Power (VLP), and

b. GDP Contributions due to:
   i. Higher Internet Speeds
   ii. Device/Equipment Ecosystem, and
   iii. Growth in IOT Penetration

Analysis

- The Economic Value of Wi-Fi in the considered unlicensed spectrum bands in India would be significant for 2025, at INR 12,69,998 crores (for GDP at current prices). This is nearly 6% of the projected GDP in 2025.
- The Economic Value rises significantly from 2020 to 2025, showing almost a four-fold increase.
- The average Economic Value of key applications in existing unlicensed bands for Wi-Fi in 2020 would be significantly more than the telecom sector's expected revenue as per the 2020-21 budget at INR 1.33 lakh crores.

- MDO would account for nearly 81% of the total Economic Surplus of Wi-Fi by 2025. This reflects the limited deployment of applications in the other unlicensed bands. In comparison, in USA, MDO accounted for around 56.5% and 63.56% of the Economic Value of the unlicensed spectrum in 2017 (actual) and 2020 (projections) respectively, reflecting the greater variety of applications in the unlicensed bands present there.

- Higher speeds on Wi-Fi in relation to mobile networks in the considered unlicensed bands can make a significant GDP contribution of INR 32, 715 crores to the GDP. The lower values from the potential bands arise as we expect introduction of these bands from 2023 only. The penetration is assumed to go from 10% of Wi-Fi in 2023 to 45% of its base value in 2025.

As Wi-Fi routers in the 5.8 GHz band provide greater speeds than those in 2.4 GHz, the contribution of GDP due to Wi-Fi offload on this band is higher. This should allay DOT's concern about the contribution of 5.8 GHz band that was recently unlicensed to the GDP. It should also build a logic for unlicensing higher bands, as they provide for higher speeds.

- GDP contributions due to V band Device/Equipment Ecosystem would be significant at INR 50,116 crores.

- V-Band would contribute nearly 11% of the Total Economic Value in 2025, assuming that it is unlicensed in 2023, and grows to 5% of its base value by 2025.

- The potential GDP contributions due to SRDs in this band is significant at INR 39,897 crores, constituting nearly 3% of the Total Economic Value in the considered bands.

- Wi-Fi 6E would present a significant contribution to the total Economic Value in 2025, contributing nearly 9.5% of the Total Economic Value.

- The GDP contributions due to increase in IoT penetration would amount to INR 17,609 crores in 2025, while that from the device ecosystem would be INR 18,602 crores. This constitutes nearly 30% of the Economic Value of Wi-Fi 6E. The Economic Value due to increased IoT penetration does not take into account the spillover effects due to higher quality user experience facilitated by higher speeds and bandwidth.

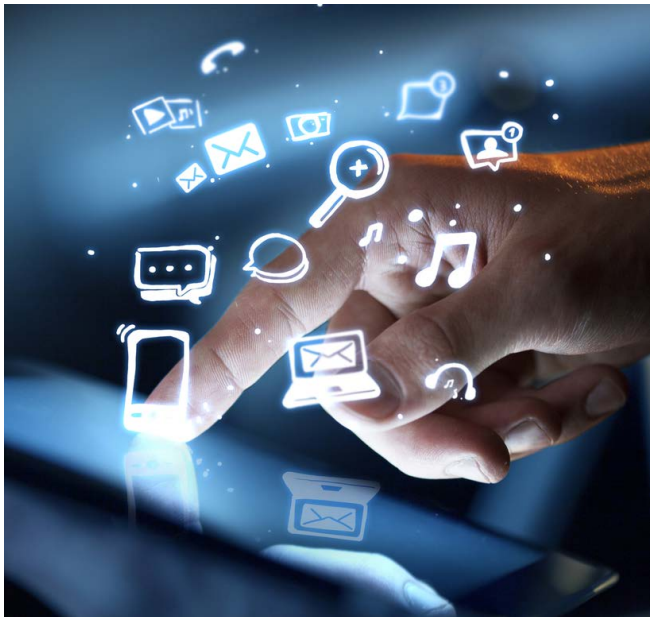
Recommendations for deriving optimal value from Wi-Fi spectrum:

Wi-Fi Penetration: Given the significant Economic Value associated with Wi-Fi across different bands, there is a need to proliferate them. The penetration of Wi-Fi hotspots in India is poor, at about one-fourth of that in U.S. and about half of China's. Globally the Wi-Fi penetration increased by 568% where as in India the growth was only 12%. Globally, there is one Wi-Fi hotspot per 150 people and India will need 80 lakh or 8 million additional hotspots to be at par.

In the absence of a roadmap for Wi-Fi, a huge Economic Value is not being leveraged. The Government's PM-WANI Public Wi-Fi Policy is worth exploring after several aspects related to it are ironed out for fast tracking implementation.

Unlicensing More Spectrum Bands: In comparison to global availability of unlicensed spectrum, India still has very little unlicensed spectrum available for use. Government must speed up the decision-making process to be in line with the global initiatives and make more spectrum available.

V band and Wi-Fi 6E characteristics and their deployments elsewhere indicate a high potential scenario for India. SRDs and IOT not only create a huge economic surplus, but will give rise to new business models and strengthen the Industry 4.0 ecosystem and the Digital India initiative.



Need to Unlicense Higher Bands: DoT should unlicense more higher frequency bands, as has been done elsewhere. Higher speeds (on these bands) would contribute significantly to increased GDP.

Last Mile Connectivity: India has a major issue of last mile connectivity, especially in the case of high-speed data. Public Wi-Fi could be used for this. Companies like Tikona, AirJaldi, etc. are already using unlicensed spectrum to provide last mile broadband connectivity. Unlicensed spectrum could also be a cost-effective mechanism for providing rural connectivity.

Satellite Spectrum for Enhanced Digital Connectivity & 5G

Brig. Anil Tandan (retd.)
Principal Advisor, BIF

Introduction

Certain frequency bands have been dedicated for satellite use for many decades by the body responsible for managing radio spectrum - the International Telecommunications Union (ITU).

Lower frequencies are good at serving large areas of the globe, providing reliable international connectivity from high rainfall areas to the rest of the world. Higher frequencies (Ku, Ka and Q/V bands) allow smaller antennas to be used and more focused footprints on regions or sub-regional areas.

A satellite is constructed from the outset to transmit via a clearly identified frequency band(s) and this cannot be changed after launch! The table below shows the different satellite bands and their uses.

S-DAB	L-BAND	S-BAND	C-BAND	Ku-BAND	Ka-BAND	Q/V-Bands
1.467 GHz to 1.492 GHz	1.518 GHz to 1.675 GHz	1.97 GHz to 2.69 GHz	3.4 GHz to 7.025 GHz	10.7 GHz to 14.5 GHz	17.3 GHz to 30 GHz	37.5 GHz to 51.4 GHz
Satellite Audio Broadcasting to fixed & mobile units	Civilian Mobile-Satellite Services (two-way)	Satellite television & radio broadcasting and mobile BB services including in-flight connectivity	Fixed-Satellite television & data services (including broadcasting)	Fixed-Satellite television & data services (including broadcasting)	Fixed-Satellite television & data services including fixed and mobile two-way broadband services	Fixed and mobile high-speed broadband services including in-flight connectivity

Inclusion of Satellites in 3GPP Specifications

3GPP studies on 5G integration of non-terrestrial network solutions providing backhaul service as well as direct access to 3GPP Class 3 UE began in March 2017, involving both cellular and satellite stakeholders. The specifications are expected to be included as part of the 3GPP Release 17. The vision is to deploy non-terrestrial networks as part of 5G by 2025, to meet the challenges of providing 5G to remote areas of the world in terms of reachability, availability and resiliency. This encompasses all deployment options like GEO, MEO, LEO, as well as HAPS.

With the advent of 5G, the requirements of backhaul have also changed. As we all know, there are three main categories of use cases for 5G, as given below:

1. Enhanced Mobile Broad Band (eMBB) – requires high download speeds of multi Gbps

2. Massive Machine Type Communications (mMTC) – requires connectivity to millions of devices, which need to use extreme low power, low cost and deep coverage, though the amount of data throughput required may be relatively much lower

3. Ultra-Reliable and Low Latency Communications (uRLLC) - As the name implies, these applications require ultra-low latency of the order of less than 5 msec with very high reliability. This is for applications like driverless cars, remote surgery, etc.

From a satellite perspective there will be different solutions for meeting each of the above requirements.

Satellite technology has evolved from the traditional fixed satellite service (FSS) to High Throughput Satellites (HTS), which provide more capabilities and services by using techniques like Spot Beams with Frequency Reuse, Multicast, using higher spectrum band like Ka band. HTS satellite backhaul to base stations or individual small cells can support eMBB where no cost-effective terrestrial backhaul exists. Generally, this is in underdeveloped and underserved regions of the globe with little cellular infrastructure and wireless access. These satellites are in the GEO category, but should preferably use the higher spectrum bands like Ka bands. Going forward, as the demand for higher throughput increases in coming years, the need for switching over to Q/V bands would arise. The higher spectrum band of 37 to 54 GHz allows large channel bandwidths thus allowing feeder links to be able to aggregate more user traffic and split the coverage into thousands of spot beams with throughput speeds of Gbps levels.

To support mMTC services, both FSS and LEO satellite constellations can be used. Where the use case of mMTC requires connectivity across the entire world, then the LEO constellations would only be useful once they have launched enough satellites to provide ubiquitous coverage. However, if the use case is to provide connectivity to large number of IOT devices like smart farming in a limited area, then FSS and limited LEO constellations may be adequate. The spectrum to be used would depend on the throughput required and the number of IOT devices that may require spot beams.

For uRLLC, the key requirement is reliable communications with very low latency. The one-way delay for a GEO satellite is 135.3 msec, while for a LEO at 300 Km it is a mere 3.5 msec. Since some of the applications in 5G require a latency of 5 msec, obviously, even with very low orbit satellites, this level of latency would not be achievable. Hence, LEO satellites may be able to support use cases where the latency requirement is of the order of around 15-20 msec, and I am sure there would be many use cases where 15-20 msec latency would be acceptable even under the uRLLC category. For reliability, each end of the backhaul must be served by multiple satellites. For use cases that require very reliable communications but are not so critical in terms of latency, lower spectrum bands like L band would be the preferred band.

Spectrum for 5G IMT and Satellite

With newer generations of mobile technology being introduced, there has been a sharp increase in demand for additional spectrum bands for mobile communications. Some of the bands required for mobile communications were earlier earmarked for Satellites. ITU has, over the years changed the use category of spectrum to make additional spectrum available for terrestrial mobile communications. Currently, for 5G, the mobile industry is seeking spectrum in two bands which were earlier allocated and used for satellites. These are 3300–4200 MHz in mid band, and the mm wave band 26/28 GHz in high band.

While, the debate for mid band seems to have been generally resolved with 3300-3600 MHz band, less some 30 MHz, likely to be made available for 5G in India, the debate on 27.5–28.5 GHz part of 28 GHz also being earmarked for 5G continues and the final decision is yet to be taken by DoT.

The Salience of Spectrum: Spectrum Pricing and Auction Methodology

Dr. Rajat Kathuria,
Dean, School of Humanities and Social Sciences,
Shiv Nadar University and Professor of Economics

It is by now a truism that economic growth is a necessary condition for the alleviation of human misery, the pandemic reinforcing this somber reality in no uncertain terms. The strong correlation between economic growth and ability to communicate over long distances using modern technology is beyond dispute and the case for causation has also been established using robust econometric techniques. Development is multidimensional, the ability to communicate efficiently across space and over time being one of several instruments. When scarce public resources are involved, the need to spend on services with the greatest public benefit is therefore paramount.

The public benefits of telecom are substantial. There are several estimates that capture the growth dividend due to increased mobile penetration, expanding Internet penetration, growing data usage and more telecom investment. The multipliers vary in magnitude but not in direction, which are positive everywhere and every time. The positive correlation between national income and telecom investment indicates the presence of network externalities that drive growth of other sectors in the economy along with growth in the sector itself. For example, one estimate shows that a 10% increase in India's investment in telecommunications has the potential to deliver on average a 3.3% increase in India's GDP.

> ***Effective management of spectrum requires government to play an enabling and perhaps a much more demanding role compared with plain wire-based telephony. Balancing the legitimate objectives of transparency and government revenue via auction needs sophistication all around***

Globally too, the relative magnitudes of growth dividends of different communication technologies have been positive and establish a hierarchy of impacts, with fixed being the lowest and broadband being the highest. The compulsive use of telecom networks during the pandemic must have surely scaled these impressive impacts. And most of these are likely to endure. The fact that broadband investment has significant positive externalities including for social welfare is a critical underlying reason for government intervention to support its roll out as evidenced by the 'Bharat Net' initiative.

In developed countries, mobile communications added value to legacy communication systems, while in emerging markets such as India, progress has been unambiguously and conspicuously led by mobile and is growing through the added firepower of the applications software implanted in mobile devices. Thus, greater access for unserved or underserved people will, for the most part, be actualized by wireless, making spectrum assignment fundamental to the future growth of the sector.

Spectrum is the lifeblood of modern ICT infrastructures, and its management is vital. It is however not something that is preordained and cannot be simply dropped in to yield magical results as India imbibed to its disadvantage during its early tryst with mobile telephony. The year 2010 marked a watershed in the life of Indian telecoms. Until then spectrum was administratively assigned, and thereafter by auctions. The pre 2010 administrative assignment of spectrum suffered from lack of transparency, favouritism, avoidable scandals and caused immense damage to the sector. The Hon'ble Supreme Court ordered the government to auction access spectrum for 'all times to come'.

Consider the counterfactual. If the pre 2010 scams related to spectrum assignment had been avoided, who knows, India would have been an even stronger telecom market with more competition, better rural connectivity and greater vibrancy. It is hard to quantify the financial loss due to the scandal although as part of its inquiry into irregularities in the 2008 assignment of second-generation (2G) telecom licences, the

Comptroller and Auditor General (CAG) estimated a loss of Rs. 1.76 lakh crores to the exchequer.

The first comprehensive auction of 3G spectrum in 2010 resulted in revenue that even the most optimistic auctioneer could not have imagined. The government mopped up Rs 1.06 lakh crores and this whetted its appetite from future auctions. Spectrum began to be treated as a golden goose, and auctions the route for income without carefully drawing the link between the underlying services for which spectrum is sought. Auctions necessitate a reserve price and this has often been inexplicably high even though substantial spectrum went unsold over the years. If spectrum is unused or unsold, revenue is lost, since it is not a depletable resource. What has never been estimated is the loss to the exchequer due to high reserve price and we suspect that it will not permeate the social consciousness as much as the fiction of Rs. 1.76 lakh crore has. The latter chilled the establishment into setting impossibly high reserve prices and inaction, and is also the reason of lackadaisical interest in 5G spectrum auctions to be held shortly.

Spectrum auctions unquestionably have their advantages. It frees the regulator from having to assign spectrum based on a subjective 'beauty contest' that is constantly contestable especially in a vitiated institutional atmosphere. Further, use becomes efficient and government generates substantial revenue. In India, when auction proceeds are combined with other fees such as for the license and Spectrum Usage Charges (SUC is a percentage of sector revenue and is over and above auction proceeds), the government has collected Rs. 4,84,198 crores since 2010-11. This amounts to over 28% of the cumulative non-tax revenue receipts of the government during this period. But here is the rub.

> ***Lowering spectrum costs will allow the sector to grow, and also contribute to government revenues indirectly because of the growth dividends mentioned in the beginning. The Combinatorial Clock Auction has become a popular alternative that has been tried elsewhere for 5G spectrum to reduce risks and improve efficiency***

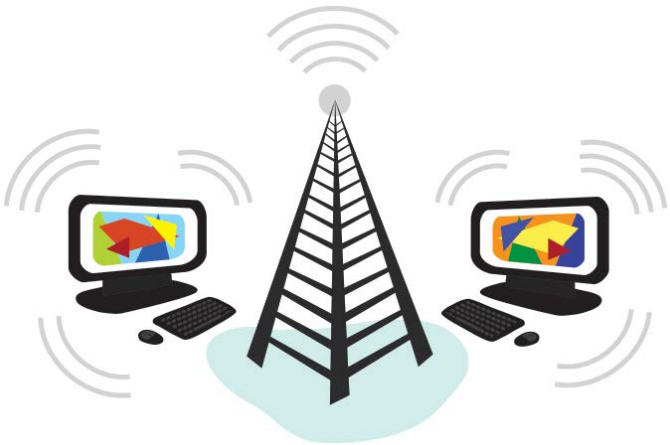
Auctions are also risky and outcomes depend upon its design. The over reliance on reserve prices, as has been the case in India, may not necessarily yield successful market outcomes or even government collections. The results so far in this regard have been mixed. There have been auctions where spectrum has gone unsold, thereby resulting in a permanent loss of revenue for government. In other instances, when revenue collections have been high, operators have struggled to pay, asking for deferment and postponing much needed investments thereby affecting quality of services.

Effective management of spectrum requires government to play an enabling and perhaps a much more demanding role compared with plain wire-based telephony. Balancing the legitimate objectives of transparency and government revenue via auction needs sophistication all around.

Auction design is crucial. India currently follows a Simultaneous Multi-Round Ascending Auction (SMRA) which, while providing the option of price discovery, also poses an aggregation risk as there is no package bidding. Combinatorial Clock Auctions (CCA), are a popular alternative as

they avoid aggregation risks and are arguably more efficient. However, they require sophisticated bidder participation and are also fraught with risks. There are several other factors that influence auction outcomes such as bidder turnouts, market conditions and choice of auctioning agent. A cookie cutter approach may not always work. In addition to the design, governments must also consider market conditions and help operators minimise costs, including rationalization of usage charges. The government continues to impose spectrum usage fees (between 3 to 5%), which is traditionally charged as a resource rent to ensure that the users of spectrum utilize the resources efficiently. This objective is already met by the auction process which achieves economic and technical efficiency through competitive bidding. The current regime results in additional burden. The usage fee must therefore be brought down to a minimum, to only cover management expenses.

If the Hon'ble Supreme Court's diktat endures for 'all times to come', we must learn to conduct access spectrum auctions that balance transparency in allocation and revenue expectations for government. The latter has been a prime motivation and must be eschewed in favour of a regime that recognises telecom as an enabler for the rest of the economy. Lowering spectrum costs, will allow the sector to grow, and also contribute to government revenues indirectly because of the growth dividends mentioned in the beginning. The Combinatorial Clock Auction has become a popular alternative that has been



tried elsewhere for 5G spectrum to reduce risks and improve efficiency.

We must also recognize that spectrum is the new entry barrier and confers market power to the holder. No operator should be allowed to hoard or capture it. However, large amounts of this scarce natural resource are needed to be assigned on reasonable terms for 5G services to maximize the technology's vast potential. We need to do this concurrently with the rest of the developed telecom markets, else we will always be playing catch up, like we did for 2G, 3G and 4G - there will be no next time.

Can't Auction Satellite Spectrum: Terrestrial concept of exclusivity doesn't apply, hence auctioning is not applicable

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The world over, satellite spectrum is authorised for 'right-to-use' by all administrations and is allocated only by administrative process, at charges that essentially cover the cost of administration.

In India, the so-called Radio Spectrum for Mobile Services is an emotive subject, and needless confusion has recently arisen over the allocation of spectrum for satellite communications, including broadcasting.

First, one must understand that spectrum is not a single commodity. Many types are involved—the several varieties of terrestrial spectrum for mobile access or for backhaul or for WiFi, etc., and the non-terrestrial or satellite spectrum. These involve completely differing treatments. It is also understandable that, by its very nature, satellite spectrum has no national territorial limits and is international in character and is therefore coordinated and managed by the UN agency, International Telecommunications Union (ITU), Geneva. There is, in fact, a specific treaty in place for spectrum cooperation, and India is a signatory to it.

The satellite systems have to be internationally coordinated as per relevant ITU Regulations, for

the satellite networks to operate without harmful interference. Satellite-network operations require bilateral/multilateral coordination and cooperation. It is incumbent on the potential satellite operator (or operating agency) to obtain access to frequency assignments and suitable orbital position.

ITU's Radio Regulations are based on the principles of 'efficient and rational use of the RF spectrum' and 'equitable access' to spectrum/orbit resources for countries, laid down in No. 196 (Article 44) of the ITU Constitution. Resolution 2 of the Radio Regulations provides that "all countries have equal rights in the use of both the radio frequencies allocated to various space radio-communication services and the geostationary-satellite orbit and other satellite orbits for these services." Resolve 1 of Resolution 2 states that the registration with the Radio-Communication Bureau of frequency assignments for space radio-communication services and their use does not provide any permanent priority to any individual country or groups of countries and does not create an obstacle to the establishment of space systems by other countries. To use a commercial analogy, countries should not see the ITU as a wholesaler of spectrum rights granted in perpetuity, which countries can then market at retail to satellite operators.

The world over, satellite spectrum is authorised for 'right-to-use' by all administrations and is allocated only by administrative process, at charges that essentially cover the cost of administration.

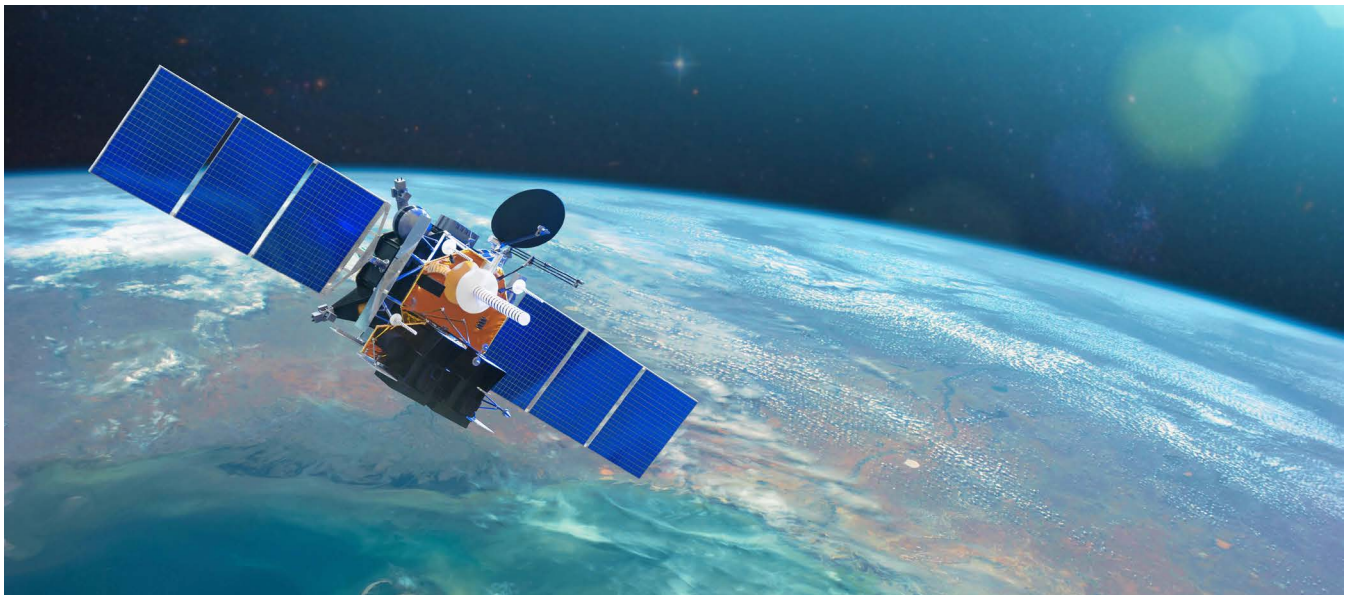
Unlike terrestrial spectrum, satellite spectrum is never exclusively assigned to the operator but coordinated internationally and shared among multiple operators for different orbital slots and all types of satellites. ***Thus, the terrestrial concept of exclusivity does not apply and auctioning therefore is not applicable.*** Moreover, any commodity to be auctioned has, obviously, to be free from any encumbrances. Satellite spectrum has international encumbrances.

Since inception, in every nation, microwave backhaul spectrum has never been auctioned. If satellite spectrum were to be auctioned, by the same logic and for level playing field, it would entail the taking back of all backhaul microwave spectrum from mobile operators and auctioning them. Similarly, Wi-Fi spectrum which is delicensed the world over and in India, would have to be taken back from operators and the public, and auctioned.

It is interesting that the other camp seeks to invoke level playing field conditions promised by Article14 of the Constitution and also the famous judgement of the SC in the 2G spectrum matter, to demand auction of satellite spectrum. Unfortunately, this is a grossly flawed argument and confirms the opposite. In the cited 2G Spectrum case, there was a Presidential Reference No.1 of 2012, wherein the Supreme Court, opined, in its advisory jurisdiction, that *"Auction, as a method of disposal of natural resources, cannot be declared to be a Constitutional mandate under Article 14 of the Constitution of India."* The SC further stated that *"Auction may be the best way of maximising revenue, but revenue maximisation may not always be the best way to serve public good."* India has only one-third of its Asian peers' satellite connectivity per capita and only one-twentieth or even lower than that of Europe and the US. A very poor position for our digital ambitions. We must expeditiously move ahead, in tune with global trends and practices which definitely preclude auction of satellite spectrum.. Policymakers should not allow the commercial vested interests of a few terrestrial incumbents to stall or block the massive potential contributions of the satellite sector.

With research inputs from Debashish Bhattacharya

Note: This article first appeared in The Financial Express on 8th July 2021 - https://www.financialexpress.com/opinion/cant-auction-satellite-spectrum-terrestrial-concept-of-exclusivity-doesnt-apply-hence-auctioning-is-not-applicable/2285993/



Delicensing V Band for Broadband Proliferation

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Thanks to wireless telecommunications, India has seen unprecedented growth in use of telephony and internet. Indeed, India leads the world in use of wireless data services. However, it is yet to exploit the massive data capacity of high frequency millimeter wave spectrum, such as the V band. India's peers and competitors have liberalized the use of this spectrum through forward-looking rules. India too must act to ensure that this powerful and abundant resource does not remain idle.

A brief introduction to the V band is in order. The band refers to frequencies between 57 GHz and 71 GHz. V band spectrum offers high bandwidth data transfer at multi-gigabit speeds over short range. The V band enables low latency personal communications in-room and on-body. It also enables fixed network links over short distances up to a kilometre, which makes the V band useful for 5G fronthaul and backhaul. The limited range reflects the fact that V band frequencies lie in spectrum where atmospheric oxygen can absorb and attenuate them. Ironically, the short range is also an advantage in certain circumstances since it reduces the risks of interference. Short range personal communications equipment and fixed networks can readily coexist without the need for complex coordination.

V band spectrum is ideally suited for speedy connectivity across several busy streets and tough terrains where digging, trenches for underground

fibre is difficult, time consuming, or expensive. The band offers what has often been called “wireless fibre”. It enables data speeds comparable to optical fibre without the time and cost involved in deploying physical fibre.

V band can be invaluable in densely populated areas where large scale sharing of spectrum often erodes quality of service and user experience. Similarly, V band can significantly improve user experience in AR/VR (Augmented Reality/ Virtual Reality) applications. The multi-gigabit throughputs of data can boost resolution and reduce latency, both of which are critical to effective and comfortable use of AR/VR.

V band spectrum offers vast improvement in sensing and radar applications including proximity detection, gesture detection and robotic vision. The spectrum can thus help improve existing services and expedite new ones, especially those that are bandwidth hungry.

The new WiGig standards - IEEE 802.11ad and 802.11ay - are especially useful for short-range broadband transmission using Wi-Fi. Inexpensive modems supporting the standard are already in wide use.

Despite its manifest value and the ease of deployment, the band is underutilised in India. The TRAI (Telecom Regulatory Authority of India) conducted an elaborate consultation on allocation and pricing of the spectrum in 2014. In 2015, it recommended that the government delicense the use of V band for access.

Yet, the government’s decision on V band spectrum is pending for over 6 years. This leaves valuable spectrum idle and unavailable for use by potential users including mobile network operators, access service providers, ISPs (Internet Service Providers), and innovators.

TRAI’s recommendations on delicensing of V band are progressive and in line with global best practices. Over 60 countries already allow unlicensed use of V band frequencies. The list is diverse. It includes US, Canada, UK, Switzerland as well as Asian countries such as Japan, Korea, China, Malaysia, and the Philippines.[1,2]

There appear to be two main concerns in India relating to delicensing the V band spectrum viz. could it affect the rights of licensed telecom operators or whether this would be in line with the Supreme Court mandate that, in future, spectrum be allocated through auctions. The TRAI addressed most of these concerns in its recommendations. Also, the Court has clarified[3] that its mandate for auctions is not a constitutional principle; it only seeks to prevent private interests receiving preferential treatment in acquiring rights to a scarce resource. Delicensing the V band does not *a priori* pose such risks since it places all potential users at par and promotes optimal use of the resource.

However, there is every reason to address any remaining concerns of stakeholders. The government must not hesitate to offer incentives, if necessary, to ensure that a powerful set of frequencies can be deployed without any further delay.

Some of the most vibrant markets have liberal wireless frequency regimes which allow easy deployment of diverse wireless solutions. Spectrum is typical licensed only if it is allocated for exclusive use. This is clearly not the case when V band is made available for shared use and is therefore a massive opportunity to expand the depth and range of wireless services in India. Unlicensed V band spectrum will enhance competition. It will help deliver a wider range of innovative technologies, services and business models offering innovative technologies and services, at lower prices and of superior quality. This is the primary duty for telecommunication regulators across the world.

1 https://www.etsi.org/images/files/ETSIWhitePapers/etsi_wp9_e_band_and_v_band_survey_20150629.pdf
2 https://www.linkedin.com/pulse/60-ghz-v-band-why-should-delicensed-parag-kar
3 Supreme Court response to the presidential reference on Spectrum auctions Special Reference No 1 of 2012 [Under Article 143(1)]

Evaluating Spectrum Usage Efficiency for India

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Radio spectrum is a national resource, so every country has sovereign control over how it is used. The world has become increasingly dependent on an evolving array of services using these scarce supply of usable radio waves. Spectrum is a key resource to develop 'Sustainable Digital Infrastructure' for India as a nation. It is important for the government to encourage spectrum efficiency so that the scarce resource can be maximized, ensuring that there is sufficient spectrum for the services which need it the most, and provide the greatest socio-economic benefits. Several developed countries have positioned spectrum as a strategic tool to reap investments in technologies and innovation.

As the spectrum becomes more intensively used, the competition as well as risk of interference between different wireless services grows. This challenge has an important international dimension because radio waves do not respect national borders, so services in one country can interfere with those in neighboring territories. Radiocommunication division of International Telecommunication Union (ITU-R) coordinates and harmonizes frequencies at global levels to achieve an interference free operational environment amongst countries and wireless services. Harmonized spectrum results in lower cost equipment, such as mobile phones, and better economies of scale because the same products can be sold internationally. Given that mobile devices can only support a limited number of frequency bands, harmonization makes it easier to build devices which consumers can use when they travel abroad.

Just a few years ago, it was perceived that voice will be the dominant mobile service in India for a long time. But with 65% population below age of 35 years, and with the advent of smartphones along with the increasing popularity of applications (on-demand audio/video, social media, web browsing, etc.) mobile data usage has been increasing steadily over last five years. Today, India is among the global leaders in data consumption. Even though the technology continues to advance with regular improvement in spectral efficiency, the spectrum available with the telecom operators is apparently not enough to keep up with the quality and pace of mobile data usage and more and more spectrum is required to meet the mobile data demand.

In the past, the availability of spectrum was a minor issue for government agencies like Defense, Railways, Doordarshan, ISRO, law and order agencies, etc., as there was ample spectrum access to meet their needs. However, today, new technologies, the needs of other users, and the proliferation of wireless technologies worldwide have made maintaining even current spectrum allocations difficult. New, exciting wireless communication products are creating a large demand for spectrum. Wireless subscriber services are growing rapidly worldwide.

India was a late comer in adoption of mobile technology. Historically, the key spectrum bands have been occupied by various government agencies. As some of these spectrum bands get identified and harmonized globally for mobile technologies, the conflict with usage of these spectrum bands by incumbents increase. It has been noted that many incumbents are using technologies which are not as spectrum efficient as the newer ones. The processes adopted by these government agencies to switch over to newer spectrum efficient technologies is extremely slow as compared to the evolution and adoption of mobile technologies, e.g., 5G technologies started in 2020 and work on 6G has already started. The process of re-farming the spectrum bands used by these incumbent government agencies is a long-drawn process and government needs to set up a procedure to make it faster.

Earlier, depending on the availability of the spectrum, frequencies were assigned to telecom service providers in small chunks of 200 kHz for GSM and 1.23 MHz for CDMA. The spectrum assignment amongst operators was completely fragmented, forcing them to limit their services to GSM/CDMA. Subsequently, harmonization efforts resulted in larger contiguous chunks of spectrum bands with each operator. With mergers and acquisitions in recent years, and harmonization exercise becoming a permanent fixture post every auction, the quality of existing spectrum with the current telecom service providers has improved to such an extent that these operators are able to use this spectrum for 4G and can even plan 5G in these bands (see https://paragkar.com/).

The future communication systems are expected to synchronize and integrate the physical, digital and human worlds, so that moving between these worlds would be seamless. There are new bands which are required for deploying these future technologies and a process of harmonizing those spectrum bands at ITU-R level is in progress. India should also follow the work of ITU-R on spectrum for next generation of technologies and should become part of global spectrum harmonization activities. It should be an endeavor of the government to work with the incumbent government agencies for initiation of re-farming process so that these globally harmonized bands become available at the right time for India to take lead in developing and deploying next generation technologies.

Some bands (viz. mmWave spectrum bands) have recently been identified for 5G by ITU-R. For India to be a leader, it is pertinent to open up these frequency bands with minimum or no restrictions. India saw some efforts when 5G-High Level Forum (5G-HLF) was created. Overall planning was commendable, however, necessary actions for re-farming incumbents in those spectrum bands was not initiated in a timely manner which has led to a situation that in spite of all planning, clarity on availability of 5G spectrum is still awaited. One of the key reasons for this is lack of transparency of spectrum assignment to various government agencies. There is a requirement to have a periodic audit of such spectrum allocations and spectrum efficiency should be measured. Incumbents should be encouraged to use spectral efficient equipment to meet their technical and tactical requirements. Dependency on alternate means should also be encouraged where-ever possible.

Spectrum is a natural resource, which if not used effectively for public good, is wasted. Transparency in spectrum assignments and its usage is an essential part of future planning, which will ensure availability of right spectrum at right time for public use at most affordable prices. Participation and accountability of the national spectrum manager is essential for the Government to ensure Digital India's dream of having digital infrastructure as a core utility to maximize socio-economic benefits towards building the next generation digital infrastructure.

How to optimize spectrum use to realise the true Digital India?

Digital connectivity has been the lifeline for individuals, industry, and governments to survive during the Covid-19 pandemic. Several reports have indicated the quantum jump in demand for broadband services and data usage to cater to needs like work from home, online education, telemedicine, home entertainment, et al. The current infrastructure does meet the surge in demand but there continue to be challenges in network congestion and possible deterioration of internet speeds.

Wi-Fi already plays an integral role in off-loading a large portion of the data traffic from cellular 4G networks, and this role is expected to continue to grow for 5G and future networks. Globally, Wi-Fi is expected to carry 51% of the total global Internet Protocol (IP) traffic by 2022. Wi-Fi and 5G are expected to play complementary roles in the design and rollout of next generation networks. The existing Wi-Fi spectrum footprint across 2.4 GHz and 5 GHz may not be able to adequately cater to growing demand and future generation Wi-Fi like Wi-Fi 6.

The 6 GHz band is uniquely suited for the expansion of Wi-Fi 6 technology. Therefore, opening the full 6 GHz band for license-exempt use will have tremendous benefits for connectivity in India. 6 GHz Wi-Fi will support popular 5G use cases. By making the full 6 GHz band license-exempt, India would reap the economic benefits of license-exempt spectrum, enhanced connectivity, and a building ecosystem of innovative use cases and broadband technologies in the band.

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5G wireless technology is revolutionizing all industry sectors with the power of speed and volume of data transmitted over the network, enabling innovative services to be rolled out. Given the pandemic across the world, and particularly in India, most businesses are leaning on digital communications for effective operations and service delivery. For India's 750 million (and counting) internet users, mostly connected over mobile devices, wireless communication is of vital importance. India needs to focus on network infrastructure and wireless technologies to address the challenges of spectrum availability alongside conducive spectrum policies.

In the technology aspect, there are several solutions to enable optimal use of the spectrum. Technologies like carrier aggregation, higher order modulation & advanced coding rate, better scheduling mechanism with varying timeslots, and advanced antenna systems like spatial multiplexing (beam forming, MU-MIMO) features are paving the way for efficient spectrum usage leading to a higher data transmission rate.

Enhancement in Radio Access Network (RAN) deployment architecture like C-RAN is also enabling cost-effective solutions for operators, centralizing the base station unit for multiple cell sites. The natural progression is to move to V-RAN and O-RAN. V-RAN enables virtualization of the base station functions, providing flexibility in programmability, and helping to allocate network resources effectively, while O-RAN enables innovative solutions from ecosystem partners with Open Interfaces across different components of RAN removing entry barrier for new players. In addition, RIC (RAN Intelligent Controller) introduces AI-based intelligence into the RAN system to deliver optimal network performance based on spectrum utilization and network traffic patterns.

The right combination of infrastructure, technology and policy, is crucial to facilitating wireless growth and ultimately, economic growth and societal inclusion for our citizens. That is the dream of a true Digital India.

Spectrum being the real-estate to India's future 5G success, a prudent strategy to ensure its optimal usage is crucial.

A predictable and long-term roadmap covering the industry needs for the next 10-15 years, including pricing, availability, allocation and usage, should be designed in line with global standards and benchmarking, and updated along with technology evolution from time to time.

Affordable spectrum pricing will drive investments and competition, enabling affordable services, while harmonized spectrum allocation will allow wider contiguous bandwidth to be available for optimum network performance, and reduced service cost. It will stimulate faster ecosystem build-up for the digital society as well. Also, forward-looking, albeit light-touch regulations to accelerate the pace of adoption of 5G, both through public and private networks, should be ensured.

NFAP 2018 has earmarked part of C-band (3300-3600MHz) for 5G operations. But it will take a mix of spectrum across low, mid and high bands to realize the full 5G potential.

Some of the popular techniques that can help create more value out of the spectrum assets include:

- Massive MIMO with beamforming using multiple antenna elements to provide higher data rates and capacity
- Carrier aggregation for providing higher data volume and data rates by combining contiguous/non-contiguous bands into a logical wider channel, and increasing reach of higher bands by combining them with lower bands
- Dynamic spectrum sharing between two technologies (e.g., 4G-5G) based on the radio conditions, without need for refarming or buying new spectrum
- Network slicing, AI/ML to reconfigure and reallocate radio resources to suit network requirements and optimize network performance.

As India progresses towards digital transformation with 5G as the corner stone, it would be imperative to develop a long-term spectrum availability roadmap, while leveraging modern techniques for efficient spectrum utilization, largely in the interests of the country's industry and the society.

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Mr. Rahul Vatts
Director,
OneWeb India

The entire bedrock of Digital India platform is 'connectivity': enabled by 4G and soon with 5G. This in turn depends upon reforms that ensure adequate and affordable spectrum for both, Mobile Broadband (MBB) and Satellite. In effect, true Digital India means better connectivity for all, in both urban and rural areas, leaving no one behind.

In urban or rural areas, where there is already mobile broadband coverage, it is critical to increase supply of access spectrum and backhaul (microwave and fibre), in order to have sustainable and economical capacity increase to address consumer demands. The mobile industry spectrum needs for present and future can be addressed and secured using globally harmonised bands, and by allocating spectrum in E and V bands for backhaul.

Improved (lower) latency through LEO satellites offers fresh opportunities for broadband penetration and usage. In addition, in rural and remote areas (e.g., India still has 10,000 villages uncovered), the challenges to cover remain due to costly backhaul, economic challenges. This is where OneWeb can offer high speed broadband at low latency and allow its capacity as backhaul to MNOs, to bring fibre like performance everywhere.

Critical that satellite and mobile spectrum requirements should be carefully managed to enable balanced growth for both the technologies.

With this harmonious approach towards spectrum allocation, the vision of Digital India can be achieved in the fastest and a cost efficient way, bringing broadband connectivity to all.

Indian telecom network consists largely of wireless based systems – for access as well as backhaul & long distance, comprising of both terrestrial and satellite based services. We have come a long way from the scenario of 20th century, when one had to wait for years to get a phone connection. Still, to achieve a true 'Digital India', we have to cover many more milestones for effective broadband connectivity across the country.

Large scale connectivity of cellular towers and satellite gateways through Optical Fiber Cable (OFC) is necessary for effective broadband availability for customers. OFC coverage is growing but slowly, due to various reasons. Satellite based services should be enhanced manifold to take effective broadband to unconnected areas. Also, a judicious mix of wireless services (both terrestrial & satellite) and wireline (OFC) is essential, presently and for future. Suitable enhancement of 4G, besides upcoming 5G systems, is required. Ongoing R&D in satellite and terrestrial cellular systems need to be utilized to enhance efficiency of spectrum usage.

Larger availability of RF spectrum as well as optimal use of the available spectrum is essential. It is possible to meet the genuine and essential spectrum requirements of all. The national spectrum management organisation, WPC Wing, needs to be strengthened so that they can carry out required studies. Spectrum Research Unit in WPC Wing, which had been approved, should be operationalised immediately. They need to carry out sharing studies among different radiocommunication services, for more efficient spectrum use.

Mr. PK Garg
Honorary Principal Advisor, BIF

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Honorary Principal Advisor, BIF

Radio Regulations (RR), in accordance with No.31[1] of ITU's Constitution, is a binding international treaty document. It identifies over 40 Radio Services to which the spectrum - 8.3 kHz to 275 GHz - is allocated.

India uses most of these Radio Services for terrestrial, maritime, aeronautical and space applications. Publications by ITU - Handbooks and ITU-R Reports/ Recommendations - focus on optimizing & providing guidelines for spectrum use by 193 member administrations of the ITU.

However, one way to optimize and legitimize the spectrum use, is to have no departure from the Radio Regulation provisions while formulating the NFAP and the conditions for the use of spectrum by national stakeholders. Radio Regulations after all, is a *'binding treaty document' ratified by India.*

Optimized use of spectrum, works also, on the principle of accommodation, equitable access, use of latest technologies and protection of incumbent services and applications. Article 5, 21, 22, Rules of Procedures (RoP), Appendix 5, 7 and 8 of the RR aim towards that.

True digital India would be realized when every nook and corner of the country is well connected using terrestrial/space technologies to cater to national stakeholders representing agriculture, smart farming, deep-water applications, mission-critical services, oil and gas, fisheries, forestry, logistics, mining, industrial logistics, railways, remote utilities, disaster preparedness and above all, the common man.

1 *PP-98 (Plenipotentiary Conference 1998)*

The provisions of both this Constitution and the Convention are further complemented by those of the

Administrative Regulations, enumerated below, which regulate the use of telecommunications and shall be binding on all Member States:
– International Telecommunication Regulations,
– Radio Regulations.

Membership & Associates:

- **Capgemini Engineering** (formerly Altran India), **Atria Convergence Technologies Limited (ACT)** and **InterDigital Inc.** joined the BIF family as Corporate Members.
- **Shri SK Gupta, Former Secretary, TRAI** has joined BIF's Advisory Council as Honorary Principal Advisor.

New Projects:

- **Project RoW Action Group (PRoWAG)** chaired by Shri JS Deepak, Former Ambassador, WTO & Former Secretary (Telecom) has been set up.
- **India Internet Governance Forum (IIGF) Engagement Group** set up to work towards the National IGF being organised in India in 2021.

Partnerships & Engagements:

- **BIF has signed a Memorandum of Understanding (MoU) with the Telecom Sector Skill Council (TSSC)** to facilitate enhanced skilling in the Indian Broadband ecosystem.

Awards & Recognitions:

- **TMT Law Practice, led by Abhishek Malhotra, Principal Advisor, BIF,** recognized as a top law firm in two prominent categories - Media & Entertainment, as well as Sports & Gaming - at the prestigious 2021 Indian Law Firm Awards by the India Business Law Journal.
- **Nivruti Rai, Country Head of Intel India and VP, Intel Foundry Services** featured by Leading Edge as one of the five visionary Women Business Leaders in the world whose work significantly impacts their countries' economies.

White Papers/Reports:

- ***The Economic value of Wi-Fi Spectrum for India -*** The report, authored by Prof. Rekha Jain, was jointly released by Shri K Ramchand, former DG Telecom and Member (T), DoT; Shri R Shakya, DDG, Satellite, DoT; and Ms. Nivruti Rai, Country Head, Intel India, at The Digital Dialogues session held in celebration of WTISD 2021 on 17th May 2021.
- ***Atmanirbharta in Telecom Manufacturing -*** The Industry White Paper was released at a special session of The Digital Dialogues held on 9th June 2021, by the Chief Guest Shri Amitabh Kant, CEO, NITI Aayog, Government of India, and Shri TK Paul, Member (T), Department of Telecommunications (DoT), who joined as the Special Guest of Honour.
- ***Role and Importance of Next Generation Wi-Fi technologies in Acceleration of Digital Transformation -*** Authored by Dr. Rajkumar Upadhyay, Chairman, BIF's New Technologies Committee and Executive Director, C-DOT, the Industry White Paper, was released by Dr. PD Vaghela, Chairman, TRAI during The Digital Dialogues session held on 18th June 2021, on the occasion of World Wi-Fi Day. Also present on the occasion were Ms. Dorothy Stanley, Chair 802.11 (Wi-Fi), IEEE; Mr. JR Wilson, Chairman, Wireless Broadband Alliance; and Prof. Abhay Karandikar, Director, IIT Kanpur & Former Chairperson, TSDSI.

The Digital Dialogues & Key Events:

- An Interactive workshop was held by **BIF in association with Ministry of Housing and Urban Affairs (MoHUA),** on **"Connect India: In-building Solutions"** on 19th February 2021. Curated by BIF's FTTX Committee, the session focused on the various possibilities of improving In-Building Solutions in India and had participation from Shri Durga Shankar Mishra, IAS, Secretary, MoHUA as Chief Guest of Inaugural Session; Shri S K Gupta, Secretary, TRAI as Chief Guest and Chair for the Interactive Session - wherein Shri Sushil Kumar Narnoli, former DDG (Civil), DoT; Shri Asit Kadayan, Advisor (QoS), TRAI; Shri R Srinivas, Advisor - Town and Country Planning Organization (TCPO), MoHUA; and Shri Sanjay Pant, Head of Civil Engineering, BIS participated as Guest Speakers.
- BIF celebrated the tenth **Global Accessibility Awareness Day (GAAD 2021)** with a special session of The Digital Dialogues on 20th May 2021 with participation from Dr. Malcolm Johnson, Deputy Secretary-General, ITU; Shri B K Jog, DG (Telecom) & Member (S), DoT; Dr. Rajendra Kumar, AS, MeitY; Dr. Prabodh Seth, JS, DEPwD, Ministry of Social Justice & Empowerment; amongst other eminent speakers.
- BIF's **Cyber Trust and Safety Working Group** held two sessions with the members of Dignity Foundation's NCR Chapter, to address their queries and create awareness about cyber fraud and safety.
- 24th – 26th June 2021: Amity University Uttar Pradesh (AUUP) organized a three-day International Conference on Student Progression 2021 (ICSP'21) in virtual mode on the theme **"Re-engineering Higher Education for Students' Progression: Skillsets That Will Dominate in The Knowledge & Digital Economy".** Mr. Debashish Bhattacharya, Sr. Deputy Director General, BIF participated as Session Chair in the session on 24th June 2021 and Mr. Rajat Mukarji, Director General, BIF participated in the Valedictory Function as Guest of Honour on 26th June, 2021.

Accessibility:

In keeping with our commitment to the cause of ICT Accessibility and Digital Inclusion for all, including the differently abled, the BIF Website has been made Accessible for Persons with Disabilities. Further, all of BIF's Digital Dialogues are now presented with Sign Language Interpreters, and we are using the best possible accessible platforms for the same to benefit all participants and attendees.

Major Policy Developments:

- According to DoT's new directive, from June 15, those holding UL licenses with Access, ISP, NLD, ILD, VNO, VSAT, and other authorisations can only install equipment from the trusted products list and would need to take permission from the National Cyber Security Coordinator (NCSC) for upgrading existing network utilizing telecom equipment which is not designated as a trusted product. A 'trusted telecom' portal has been launched by the government for this mandate.
- MeitY notified the new Information Technology (Intermediary Guidelines and Digital Media Ethics Code) Rules 2021, and sought information from all significant social media intermediaries regarding the app/website falling within their scope, details of chief compliance officer, nodal contact person, resident grievance officer and physical contact address in India, to ensure compliance with the new rules at the earliest.
- The Union Cabinet approved an INR 12,195 crore PLI scheme for telecom equipment manufacturing in the country.
- Department of Science and Technology (DST) released "Guidelines for acquiring and producing Geospatial Data and Geospatial Data Services including Maps" that apply to acquisition and production of geospatial data and services.
- DoT amended the unified access service licence (UASL) rules, widening the scope of active infrastructure sharing to give a boost to public Wi-Fi services and drive broadband penetration.
- The Maharashtra Government set up district level telecommunication committees across the state to address problems faced by companies in right of way, erecting towers and other infrastructure.
- TEC released new specifications/standard for Interface Requirements for Communication & Broadcast Networks for FSS/BSS removing erstwhile restrictions which inhibited the use of modern Satcom technologies.
- The DCC approved a report of the experimental spectrum committee on 'spectrum regulatory sandbox'. This will ease outdoor testing of new products, especially in the case of 5G technology.
- DoT issued an amendment to the Captive VSAT License Agreements, enabling - Liberalised permission of user data rates/speed according to system capabilities, Reduction of One-Time Entry Fee from INR 30 lakhs to INR 15 lakhs, and amending the License Fee to INR 10,000 for total number of terminals, irrespective of number of hubs.
- DoT approved conducting trials for use and applications of 5G for a duration of 6 months, with experimental spectrum allocated in mid-band (3.2 GHz to 3.67 GHz), millimeter wave band (24.25 GHz to 28.5 GHz) and Sub-Gigahertz band (700 GHz), besides permitting TSPs to use the existing spectrum owned by them.

Major Developments in ICT Accessibility for Persons with Disabilities (PwDs):

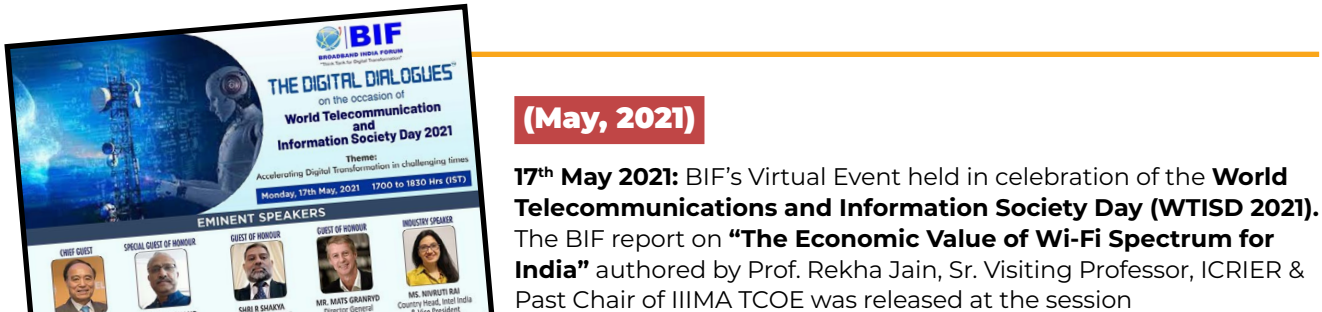
- BIF, among other stakeholders, had made various submissions to the Registrar of Copyrights for Amendment of the Copyrights Act to tag India as a Marrakesh Treaty (2013) compliant country. Recently, with a clarification letter issued by the Government of India to WIPO, international exchange of copyrighted accessible works is now clearly permitted under the Indian Copyright Act. India now has access to 6,50,000 titles under the same.
- The Chair and Co-Chair of BIF's Specialist Committee on ICT for Inclusive Ability are part of the LITD35 TC Committee at BIS responsible for Active Assisted Living. A review report was submitted to MeitY by this Committee and subsequently, MEITY has granted BIS to work with CDAC for framing an Indian Standard based on EN 301 549 in line with the review report.

Major Update on Standards:

- Advanced Television Systems Committee (ATSC) and Telecommunications Standards Development Society, India (TSDSI) have signed an agreement to enable adoption of ATSC standards by TSDSI, thus promoting global harmonization of digital broadcasting standards, and making broadcast services available on mobile devices in India.

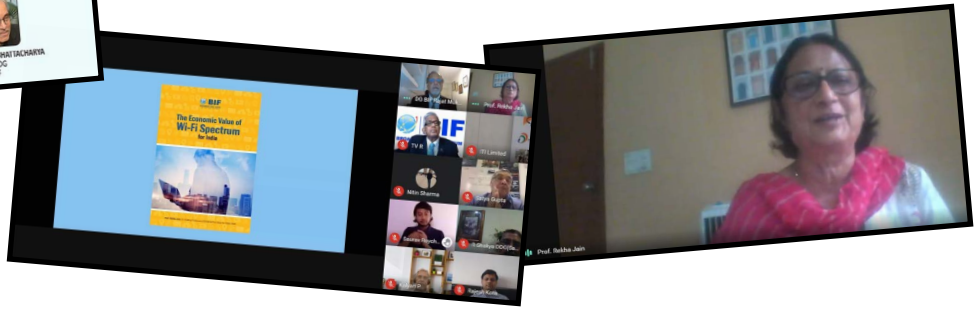
(February, 2021)

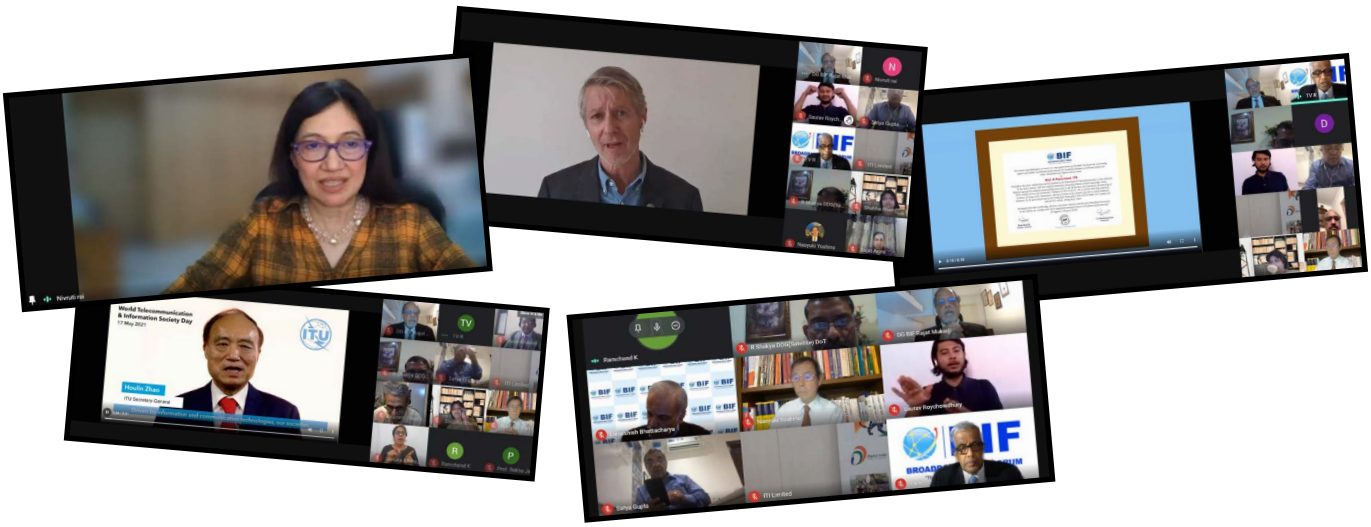
19th February 2021: BIF's **Interactive Workshop on "Connect India: In-building Solutions" organised in association with the Ministry of Housing and Urban Affairs (MoHUA),** with participation from **Shri Durga Shankar Mishra, IAS, Secretary, MoHUA** as Chief Guest of Inaugural Session; **Shri S K Gupta, Secretary, TRAI** as Chief Guest and Chair for the Interactive Session; and **Shri Sushil Kumar Narnoli, DDG (Civil), DoT; Shri Asit Kadayan, Advisor (QoS), TRAI; Shri R Srinivas, Advisor - Town and Country Planning Organization (TCPO), MoHUA; and Shri Sanjay Pant, Head of Civil Engineering, BIS** as Guest Speakers



(May, 2021)

17th May 2021: BIF's Virtual Event held in celebration of the **World Telecommunications and Information Society Day (WTISD 2021).** The BIF report on **"The Economic Value of Wi-Fi Spectrum for India"** authored by Prof. Rekha Jain, Sr. Visiting Professor, ICRIER & Past Chair of IIIMA TCOE was released at the session





20th May 2021: BIF celebrated the tenth **Global Accessibility Awareness Day (GAAD 2021)** with a special session of The Digital Dialogues

(June, 2021)

9th June 2021: The Digital Dialogues and release of BIF White Paper on **"Atmanirbharta in Telecom Manufacturing"** held with **Shri Amitabh Kant, CEO, NITI Aayog as Chief Guest and Shri TK Paul, Member (T), DoT as Special Guest of Honour**

18th June 2021: The Digital Dialogues in celebration of World Wi-Fi Day held and Industry White Paper on **"Role and Importance of Next Generation Wi-Fi Technologies in Acceleration of Digital Transformation"** released during the session by **Chief Guest Dr. PD Vaghela, Chairman, TRAI.** Also present on the occasion as **Special Guests of Honour were Ms. Dorothy Stanley, Chair 802.11 (Wi-Fi), IEEE (USA); Mr. JR Wilson, Chairman, Wireless Broadband Alliance; Prof. Abhay Karandikar, Director, IIT Kanpur & Former Chairperson, TSDSI; and Dr. Rajkumar Upadhyay, Executive Director, C-DOT**

BIF @ EVENTS (January 2021 – June 2021)

(February, 2021)

15th February 2021: Mr. Rajat Mukarji, DG, BIF, participated in a webinar on **'The Future of the Telecoms Industry in the New Digital Age'** organised by Regenesys Business School.

(March, 2021)

18th-19th March 2021: BIF participated in two key sessions on Public Wi-Fi – represented by **Mr. T.V. Ramachandran, President and Mr. Debashish Bhattacharya, DDG;** and In-Building Solutions – represented by **Mr. Sanjeev Bedekar, Chair of BIF's FTTX Committee** at the **15th annual conference on "Telecom Infrastructure in India"**, organised by tele.net

https://www.youtube.com/watch?v=tVaDYXncHJo

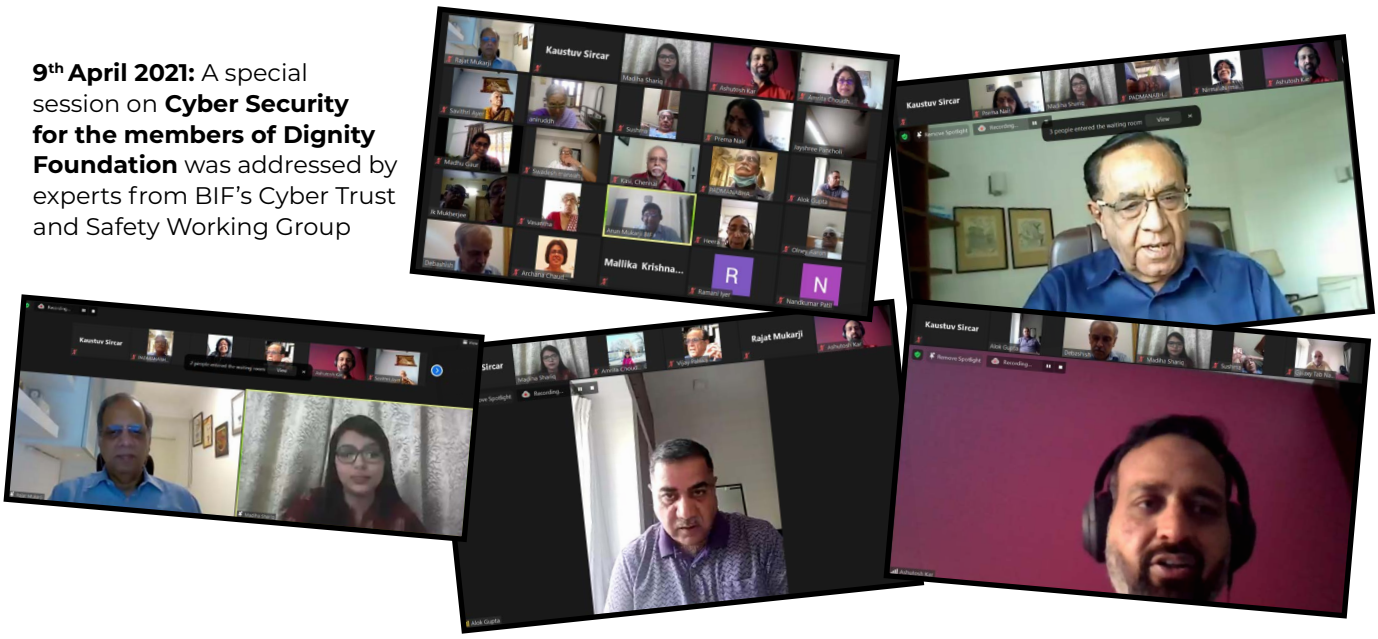
24th March 2021: Voice & Data's **TLF Event on 'Bedrock of Digital Economy',** supported by BIF wherein Mr. T.V. Ramachandran, President, BIF participated in a Fireside Chat session on **"Creating the 5G Balance for Human, Machine and Data"**

https://www.youtube.com/watch?v=ww1Jzt2Dd5A&t=4s

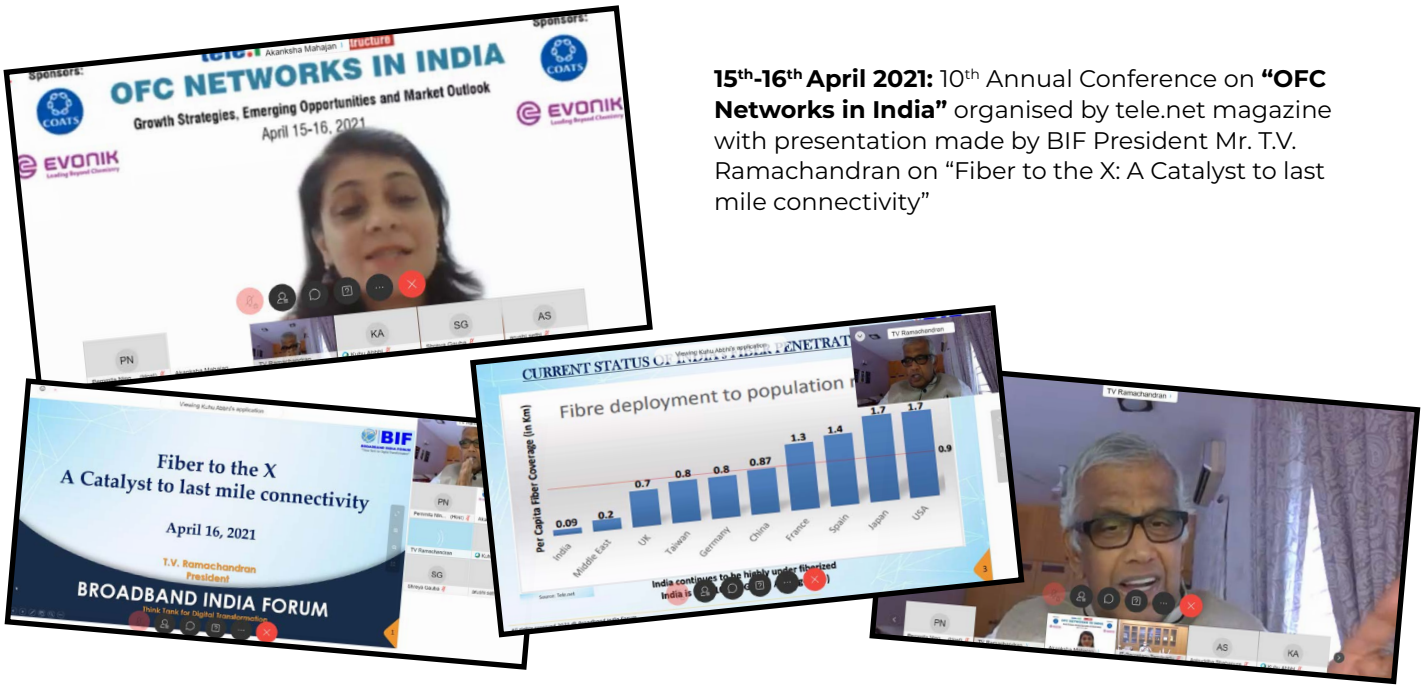
(April, 2021)

8th April 2021: 4th **FTTH India Summit 2021** organised by BE with BIF as Knowledge Partner

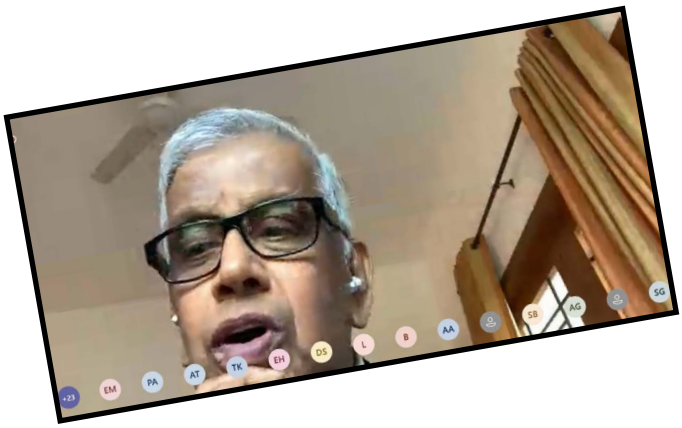
9th April 2021: A special session on **Cyber Security for the members of Dignity Foundation** was addressed by experts from BIF's Cyber Trust and Safety Working Group



15th-16th April 2021: 10th Annual Conference on **"OFC Networks in India"** organised by tele.net magazine with presentation made by BIF President Mr. T.V. Ramachandran on "Fiber to the X: A Catalyst to last mile connectivity"



16th April 2021: A **Presentation on FSOC** was made by ERNET to BIF Members



26th April 2021: Mr. T.V. Ramachandran, President, BIF, participated as an Expert Speaker at a Virtual Workshop on **'Advanced Digital Communication Technologies Toolkit for India'** organised by the European Union, in association with NITI Aayog

29th April 2021: "Future of Video India" conference organised by AVIA, supported by BIF

29th April 2021: BIF President Mr. T.V. Ramachandran participated as a Speaker in the **5G India Hackathon Phase 2** organised by TCOE (DoT)

(June, 2021)

4th June 2021: BIF's Cyber Trust and Safety Working Group addressed members of Dignity Foundation's NCR Chapter, on awareness about cyber fraud

17th June 2021: BIF was Co-Organiser for the **Open Ran India 2021** virtual conference organised by Bharat Exhibitions, wherein Mr. T.V. Ramachandran, President, BIF delivered the welcome address

19th June 2021: NIXI celebrated its 18th Foundation Day with a webinar on **"Digital Economy – expanding footprints"** wherein Mr. T.V. Ramachandran, President, BIF participated along with other esteemed Speakers. The Webinar was chaired by Mr. Ajay Prakash Sawhney, Secretary, MeitY, and moderated by Mr. Anil Kumar Jain, CEO NIXI

24th – 26th June 2021: Amity University Uttar Pradesh (AUUP) organized a three-day International Conference on Student Progression 2021 (ICSP'21) in on the theme **"Re-engineering Higher Education for Students' Progression: Skillsets That Will Dominate in The Knowledge & Digital Economy".** Mr. Debashish Bhattacharya, Sr. DDG, BIF participated as Session Chair in the session held on 24th June 2021 and Mr. Rajat Mukarji, DG, BIF participated in the Valedictory Function on 26th June, 2021 as a Guest of Honour

Mediascape

Snapshots of some prominent Media Coverage received by BIF during January-June 2021


[BROADBAND BYTES]
DIGITAL SOCIETY
TV RAMACHANDRAN
5G AND BEYOND:
THE DIGITAL FUTURE
Discussion around higher speed and performance of 5G over its predecessors tend to miss the forest for the trees. Studies reveal greater RoI over short term from private networks
tele.net
STL recognized amongst BCG's 100 Tech Challengers
TELECOM TALK
OVERALL NETWORK SPEED WORKED WHEN VIDEO-STREAMING WAS NOT AS UBIQUITOUS, AND NOT AS CENTRAL TO THE RIGHT TO WORK AND RIGHT TO EDUCATION AS IT IS NOW
India needs a new metric to judge network quality
TV RAMACHANDRAN
It would be beneficial for India to develop a set of connectivity standards for all buildings that enables them to work towards improved in-building internet connectivity
FINANCIAL EXPRESS
Outlook
THE NEWS SCROLL
Intermediary rules: Social media cos welcome regulations that address challenges of internet
teletalk
Broadband boost: The V-Band opportunity
Striking the Balance: Fixed and Mobile Infrastructure
Competitive private and public services, both mobile and fixed have ensured that Indian citizens have access to broadband services, though the speed and quality, are well below international standards.
Rekha Jain
Principal Advisor, Broadband India Forum
BW BUSINESSWORLD
WiFi In Unlicensed Frequency Bands Can Generate Rs 12.7 Lah Cr Economic Value: BIF
BIF seeks reversal of hike in import duties on components, PCBAs; writes to DoT, finance ministry
Industry body Broadband India Forum (BIF) has approached the telecom department and the finance ministry seeking reversal of hike in import duties on components and PCBAs effected in recent Budget, saying the move will drive up the cost of making telecom products and may offset benefits of PLI scheme. The BIF has written to the government urging withdrawal of the said duties and pushed for continuation of the duty exemption on telecom components.
"Certain exemptions were given under customs notification since 2017 covering various items. But on February 1, some exemptions were withdrawn for customs duty on various components. Due to this, it is estimated that the cost of Make-in-India products will go up 5-6 per cent because many of the components are imported, they are not made here," BIF President TV
BIF seeks reversal of hike in import duties on components, PCBAs; writes to DoT, finance ministry
Industry body Broadband India Forum (BIF) has approached the telecom department and the finance ministry seeking reversal of hike in import duties on components and PCBAs effected in recent Budget, saying the move will drive up the cost of making telecom products and may offset benefits of PLI scheme.
By: PTI April 19, 2021 3:55 PM
World Telecom Day 2021: BIF President TV Ramachandran on role of digital communication services
BIF: WiFi in Unlicensed Bands Can Generate 12.7 Lakh Crore Value
BusinessLine
Opinion
Gauging the quality of OTT platforms
TV Ramachandran | Updated on April 30, 2021
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Telefónica builds an automated network with Blue Planet
Doctors unveiled a secret of weight loss upto 5 kg per week
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udChalo
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Mediascape

Snapshots of some prominent Media Coverage received by BIF during January-June 2021

[BROADBAND BYTES]
DIGITAL SOCIETY

TV RAMACHANDRAN

PRIORITISING ICT ACCESSIBILITY FOR PERSONS WITH DISABILITIES

Critical implementation measures are required to enable India march towards inclusive digital prosperity, and to safeguard and empower vulnerable citizens against adversities

Almost 80 million Indians, according to a World Bank report, struggle every day with some level of disability. That number is the entire population of Germany. In an age where internet access is a fundamental right for all, many Indians suffer without accessible information and communications technology (ICT). While India has commendably approved well-defined Acts and policies to promote the welfare of persons with disabilities, on-ground execution has been slow – at a high cost to millions of lives. The unprecedented global pandemic further exacerbated the situation for persons with disabilities and shone a spotlight on the urgent need for better ICT accessibility. While requisite policies and other legal and regulatory

Think about the panic we may have felt without the ability to access technology or the internet in 2020. Most of us went online to access basic amenities, communicate with loved ones, stay employed, get an education, conduct financial transactions, and even healthcare. But as per an NCPEDP 2020 report, many persons with disabilities and our elderly could not avail of financial assistance, necessities of daily living, resources, and accessible technology.

A report by the Disability Legislation Unit of Eastern India and Centre for Advocacy and Research (CFAR) highlighted that 77% of differently-abled students, teachers, and their parents could also in learning as

Wi-Fi: The next giant leap for India

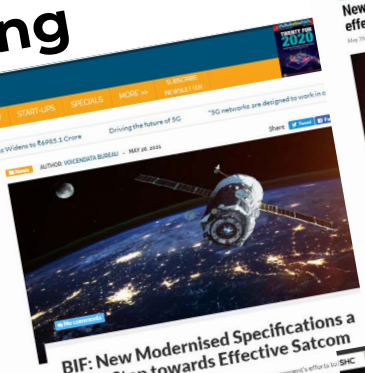
The proliferation of Wi-Fi hotspots will not only help realise the Digital Bharat dream but also boost the rural economy and drive the AatmaNirbhar Bharat mission.

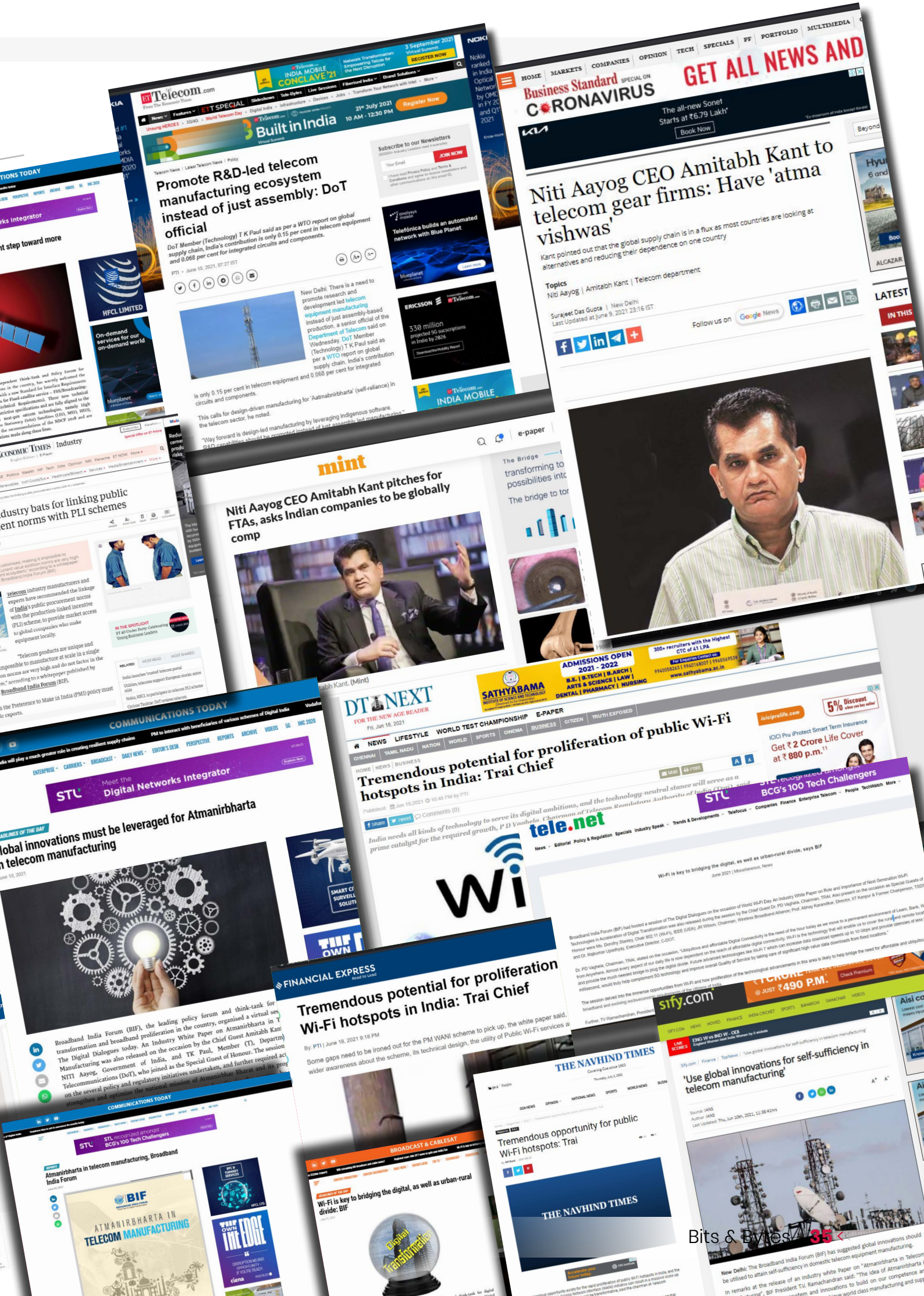
TV Ramachandran

The data revolution in India has only just begun. The voracious appetite displayed by the Indian netizens, to the tune of almost 12 GB per subscriber per month, seems to keep rising northwards. While affordable mobile broadband tariffs have been the progenitor for this remarkable uptake and consumption across both the urban and rural markets, the growing demand for quality and reliability in performance demands focus on the critical aspect of broadband for the Indian consumer – quality of experience (QoE), simply defined as internet speed.

Given this rising demand and uptake of high-quality data content, the price sensitivity of the Indian market, and the growing work-from-home and -anywhere culture, Wi-Fi emerges as the most practical solution for catering to the needs of fast-transforming Digital India. As per an industry study and analysis of QoE requirements for distinct use cases, a minimum threshold speed of 14Mbps (upload and download) is desirable for ensuring reliable video-streaming and -conferencing. This constitutes a significant proportion of the Indian internet traffic today – to the tune of 60-70%, the proportion being higher in the rural areas.

Industry estimates also reveal that most of the data usage and high-capacity downloads (approximately 80%) happen while the consumer is static/indoors, in areas with good Wi-Fi. Moreover, since our mobile broadband speeds are barely 30% of the global speed, it is high time the same is complemented with high quality and affordable Wi-Fi services, for better performance, greater outreach, and critical digital inclusion.




Promote R&D-led telecom manufacturing ecosystem instead of just assembly: DoT official
Niti Aayog CEO Amitabh Kant to telecom gear firms: Have 'atma vishwas'
Niti Aayog CEO Amitabh Kant pitches for FTAs, asks Indian companies to be globally comp
Tremendous potential for proliferation of public Wi-Fi hotspots in India: Trai Chief
Tremendous potential for proliferation Wi-Fi hotspots in India: Trai Chief
'Use global innovations for self-sufficiency in telecom manufacturing'
Tremendous opportunity for public Wi-Fi hotspots: Trai
Wi-Fi is key to bridging the digital, as well as urban-rural divide: BIF
Atmanirbharta in telecom manufacturing, Broadband India Forum
Global innovations must be leveraged for Atmanirbharta in telecom manufacturing
dustry bats for linking public ent norms with PLI schemes
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HI LEVEL COMMITTEES
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BROADBAND INDIA FORUM

"Think Tank for Digital Transformation"

ORIGIN

Formed in 2015

PROFILE

An Independent Policy Forum and Think Tank for Digital Transformation

VISION

Empowering Consumers with Efficient and Economical Broadband

MISSION

Proliferation of high quality broadband in the country in a technology-neutral, service-neutral and all-inclusive manner

OBJECTIVE

Promote, Support and Enhance all policy, regulatory & standards initiatives for the development & enhancement of the entire broadband ecosystem in the country

BIF

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"Think Tank for Digital Transformation"

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