

# 5G Huddle Being Held In New Delhi

February 5-6, 2020

Hosted by the Wireless World Research Forum (WWRF) in partnership with Broadband India Forum (BIF), ITU-APT Foundation of India and Telecommunications Standards Development Society, India (TSDSI), the 7th 5G Huddle is being held in New Delhi,. It was a two day event, February 5 and 6, 2020.

In a recent study of industrial and telecom company executives from around the world, when asked which technologies will be the most integral to their digital transformation over the next five years, 75% of respondents answered 5G.

As the 5G journey around the world continues, this year's 5G Huddle is looking at the progress that has been made, and more importantly the challenges that still remain in order for the long-term benefits of this truly transformational technology to be felt across all areas of society.

## Day One

### 5G as catalyst for digital transformation

The theme of the conference is *5G as a Catalyst for Digital Transformation*.

Nigel Jefferies, Chairman, WWRF, said: "We will see at the outcomes of 5G networks, and also look at its future. We will also study the case studies of 5G for rural and urban environments. WWRF has been at the forefront since 2001. We have a long engagement with India."

### Accelerating maturity of 5G apps

Ashwani Kumar, VP Standards & Industry, Huawei read a presentation by Zukang Shen, Head of Huawei Wireless Standards Department. The industry did Rel 15 with 3GPP. Rel 16 has some enhancements like massive MIMO enhancement, network slicing, etc. Rel 17 has broadcasting through 5G NR. There are NR IoT devices types. The coverage enhancement is also supported, besides side-link relay.

China established the IMT-2020 (5G) Promotion Group in 2013. There were operators, network vendors, chipset and terminal vendors, etc. 5G technology trials were started in early 2016, in phases 1-4. Phased 5G trials accelerated the maturity of network equipment and materials. Phase 1 was meant to carry out test and verification for potential key technologies for 5G. The development of key technologies was promoted. The RAN had massive MIMO, new multiple access, new waveform, channel slicing, etc.

In phase 2, the solutions were evaluated. Parameters were developed to benchmark the solutions. In phase 3, there was end-to-end system integration. A central lab was created in the China Academy of Information and Communications Technology (CAICT), besides the MTNet Lab and HuaiRou Field Lab. In phase 3, there was system integration of core networks. The base stations now supported Standalone (SA) vs Non-Standalone (NSA), as did the chipsets. Phase 4 saw interoperability testing. There were 4 chipset vendors, 6 vendors, 2 network architectures, and 2 bands, etc. The testing was done in the lab and field.

Next, the focus was on accelerating the maturity of 5G applications. Smart life, smart industry and digital governance were considered. Industrial Internet, smart grid, etc. were developed.

Many of the concepts are now part of 3GPP. There is a need to promote technology enhancements through global specifications, promote a healthy 5G ecosystem, and accelerate the maturity of 5G apps.

### **India has unique challenges**

Pamela Kumar, DG, TSDSI added that India has unique challenges. We need to leapfrog and embrace the emerging technologies. There is a Smart City Mission that has taken up 99 cities. There are challenges such as rural broadband for fiber-to-panchayat, diversity, greenfield deployment, and leapfrog technology solutions. We need to think uniquely and try to solve these challenges. We want a good quality of life. Technology is the answer! We need to develop the relevant technology for the rural areas. We also need to address the last-mile diversity. We have a unique opportunity to use new technology. There is a dilemma for the smart city Special Purpose Vehicle (SPV) today — network, device, business, etc.

India is probably the world's most fertile market for 5G adoption. Most of the BTSs in India are operating at 80-90% capacity, for Reliance Jio, BSNL, Airtel, etc. Internet penetration in India should be 829 million or maybe 1 billion by 2021.

So far, 99 smart cities have been selected and are to be allocated Rs 2.04 lakh crores. There is a quest for standards-driven development based on an interoperable common services platform. Is oneM2M an answer? TSDSI has proposed this solution.

The purpose and goal of oneM2M is to develop technical specifications, which address the need for a common M2M Service Layer that can be readily embedded within various hardware and software, and relied upon to connect multiple devices in the field with M2M application servers worldwide.

She added: "There is a huge, latent demand out there. We want to deploy 5G and do trials, do use cases, etc. We need to influence the direction of the new technology. We need to understand our own use cases, and take those requirements to standards, etc."

The NDCP 2018 has specific goals to connect, propel and secure India. There is a 5G India 2020 High-level Forum. The Use Case Lab has already been set up. \$35 million has been ear-marked for India's collaborative testbed. LMLC is a mandatory test configuration for IMT-2020 technical performance requirements. LMLC is the ITU-R WP5D for rural broadband.

Bharat Bhatia, President ITU-APT Foundation of India, noted that people have come from all over the world to attend the 5G Huddle conference in Delhi. India is now moving from being an importer to a nation that is now trying to develop some technology. India can learn a lot from China in 5G. He added that Pamela Kumar had set the stage for 5G Huddle.

### **5G deployment: State of play and early lessons**

In the session titled **5G deployment: State of play and early lessons**, Bharat Bhatia, President ITU-APT Foundation of India, noted that the ITU has set goals for IMT-2020, such as 100 times higher system capacity, etc. We are nearly at the final stage to define 5G. So far, 34 countries have already launched 5G. It will also support a large number of use cases.

### **5G deployment in EC**

Tonnie de Koster, Adviser for Digital Single Market International Outreach EC, DG CNECT, spoke about the deployment in the EU digital single market. He said: "We need to take a holistic view of 5G. It is global, and means that everybody is confronted by policy challenges. We are at the start of all this. 5G can be a game changer. It will take care of the

factories of the future, lead media and entertainment, automotive, energy, etc. EU's 5G strategy is at the heart of its digital single market strategy. Europe is well prepared for 5G rollout. Having a comprehensive approach is very important.”

5G will be present in all urban areas and along the main transport paths by 2025. There will be commercial launch of 5G services in at least one major city in each country within the EU. There is a connected and automated mobility to work in the cross-border concept. We need a global, interoperable standard to succeed in the global market. There is also a major overhaul of EU's telecom legislation, merged into a single code. It is updated notably to foster 5G roll-out.

There are a series of key measures: firm common deadlines in the EU for licensing, commitments for 5G pioneer bands, certainty of long-duration licenses, lightweight regime for small cells, etc. 5G cybersecurity is changing the nature of networks towards critical infrastructure.

The 5GObservatory.eu has indicated the main 5G market developments in the EU and internationally. It looks at 5G precommercial and commercial launches.

As 5G is gearing up for market deployment, the European 5G Observatory provides updates on all of the latest market developments, including, actions being undertaken by the private and public sectors, in the field of 5G. The 5G Observatory also delivers an analysis of the strategic implications of the 5G Action Plan and other public policy objectives.

The Observatory focuses on 5G developments in Europe, along with major international developments (USA, Japan, China, South Korea) that could impact the European market.

## **5G deployments in USA**

Sudhir Dixit, Vice Chair for Americas, WWRF added that there are 5G deployments in the USA. The key to 5G is to have a compact antenna. The mm wave signals are best for high bandwidth, short-range apps. Qualcomm has chipsets such as 855 for LTE and 5G, and 865 and 765. Apple plans to announce a 5G device this year.

Verizon Wireless, AT&T Mobility, T-Mobile US, Sprint and US Cellular are the 5G operators in the USA. They plan to evolve the CDMA networks to GSM. Verizon plans to use 28GHz 5G NR, while AT&T plans to use 39GHz 5G NR. T-Mobile will use 600MHz and 28GHz for more capacity. It has announced 99% coverage of the country. Sprint has gone with 2500MHz 5G NR. That is the preferred range for most mobile operators in the world.

Verizon has also rolled out 5G. Now, it is present in 21 cities. AT&T Mobility launched 5G mobile hotspot in 2018. It has launched 5G in 20 more cities in 2019. It also opened a new 5G Lab. T-Mobile has launched 5G in 5,000 cities in sub-600GHz network in parts of 7 cities, mm wave in 6 cities, and 600MHz for nationwide network.

In mm wave, the cell deployments have to be dense. The real impact of 5G will be felt by 2025. The operators have a dilemma of capacity/coverage/cost, especially, to make 5G commercially viable. There are challenges for ultra-dense networks (UDNs) mm wave and macro cellular, and how to build, focus on performance, develop 5G capable handsets, radiation and espionage fears, and cost of service and business cases.

Andreas Sommer, Team Leader and Senior Technical Adviser, Project, India-EU Co-operation on ICT-related Standardization, Policy and Legislation, added that spectrum is very rare in South Africa. Spectrum may not be allocated within this year. There is a high demand

for spectrum from the industries. Bosch received two spectrum licenses from regulator in Germany, for industrial use.

In South Africa, the infrastructure costs are a problem. There are not many policies in place. There are also issues regarding laying out fiber-optic cables. There are also areas such as deserts and mountains in South Africa. We are in discussions with the government. India has similar challenges, especially, with the rural areas. In North Macedonia, there is a broadband plan for the next decade. We are discussing how this rollout problem can be sorted out and infrastructure costs can be brought down.

In Pacific Islands, there are projects to connect the islands using fiber-optic cable. They have huge expectations from 5G. India may have similar connectivity problems with its own islands.

### **WRC-19 delivering spectrum to power 5G future**

Yi Shen Chan, Director, Plum Consulting moderated a session on WRC-19 — delivering the spectrum to power 5G future.

Bharat Bhatia, president, ITU-APT Foundation of India remarked that WRC 2019 was attended by 3,540 delegates from 165 countries in Sharm El-Sheikh, Egypt. 5G spectrum was the key agenda of WRC-19. Over 22 agenda items and 11 issues were discussed. WRC-19 identified the following bands for IMT.

- \* 24.25-27.5 GHz (26GHz)
- \* 37-43.5GHz (40 GHz)
- \* 45.5-47GHz and 47.2-48.2 (50GHz)
- \* 66-71 GHz for IMT (70GHz).

The main issue for 5G spectrum in 26GHz at WRC-19 was the protection of the earth exploration satellites (EES) in adjacent band (in 23.6-24GHz) and fixed satellite in 24.5-27GHz. The limits proposed by India were the most reasonable and quite adjacent to what was finally approved. WRC also agreed for very light conditions to protect fixed satellites (FSS) in 24.5-27GHz.

The WRC-19 also decided only on mm wave bands (above 6GHz). 5G will require access to multiple bands of spectrum. The C-band and the Group 30/40a are the first global 5G bands. WRC-19 decisions were also made on the high-altitude platform stations (HAPS) and GSO. WRC-23 will look at mid-band spectrum for 5G, as well as a new mm wave band for 5G.

### **Price and quantum key for India**

Rajan Mathews, DG, COAI, said that we now have an ability from the government side to be involved in the technical side. When we look at 5G, we are looking at the outcoming spectrum auction. There are two things — price and quantum, for the operators. With 175MHz of spectrum left over, there was not much to do. Besides pricing, we now have a quantum issue to deal with.

The Philippines is giving away spectrum for free to its operators. Can India learn from this? Who is going to put up their hands regarding the utilization of the spectrum? These are the matters that need to be resolved.

### **Satellite industry achieved a lot**

Rajesh Mehrotra, Global Spectrum Policy, of the EMEA Satellite Operator's Association (ESOA), added that looking at the satellite industry's considerations, 5G is not just the next G. It is an amalgamation of a number of satellites. Satellite industry has achieved a lot at WRC-19. There are outcomes in C-, Ku-, Ka, Q-V bands, etc.

The Ka band is now available for the GSO ESIMs (earth stations in motion). A new agenda item will consider the future use of Ka band by the NGSO ESIMs. HAPS did not enter the 28GHz band. 5G is a network of networks that pools the strengths of other networks. We would like to make mobile a path to also use our network.

MPS Alawa, Senior Deputy Wireless Advisor to Gol, DoT, said that the new band will take advantage of MIMO. In WRC-19, there were the additional bands for IMT-2000. WRC-19 has given the protection to the satellite. However, it has not given the angle of satellite to the earth so far. On identified bands, it has two ~ 33BS/~29 UE (dBW/200MHz) and ~ 39BS/~35 UE (dBW/200MHz). A third band was also identified.

HAPS can be used to serve communities, remote and rural areas, disaster management, as an additional platform for broadband, and HAPS as IMT BS (HBS). WRC-19 also had the outcome for the non-GSO system. WRC-23 agenda items are about the sharing and compatibility studies.

### **Issues with 5G licensing**

On the topic of issues with 5G licensing, Bharat Bhatia said that countries are looking at different licensing approaches. For mm wave bands, you need smaller coverage areas. Smaller-sized licence areas may be easier to implement.

Rajan Mathews noted that India has to address the licensing conditions concerning 5G. We are on the LSA basis. The emerging Licensed Shared Access (LSA) regulatory framework enables flexible spectrum sharing between a limited number of users that access the same frequency bands, while guaranteeing better interference mitigation. How 5G will be implemented in India is going to be critical? The configurations in standalone and non-standalone cores (SA and NSA) are also going to be important.

MPS Alawa added that there is an angle for positioning the satellite over India, that has to be notified by WPC. Right now, technical things are not in the reckoning.

### **Regulatory and cybersecurity challenges of 5G**

In the session on the regulatory and cybersecurity challenges of 5G, Henrik Berndt, Vice Chair for Europe, Middle East, Africa, WWRF, said that there are three Qs that need to be addressed for 5G. They are:

- 1) How can the new security challenges and requirements can be met in 5G?
- 2) How fast are regulators willing to ensure necessary framework exists for the success of 5G?
- 3) User privacy and using cross-border evidence and what it means for data privacy?

Samiran Gupta, Head of India, Internet Consortium for Assigned Names and Numbers (ICANN), said that ICANN co-ordinates the unique identifiers for the Internet. We see 5G as an important step forward in the telecom space. It is a network of networks. The Internet has increasingly become mobile. It also includes M2M communications.

In 2018, ITU had a paper on setting the scene for 5G. Some of these challenges are deployment of small cells, cost for attaching small cell sites, high cost of network equipment,

spectrum allocation, etc. We have had an issue in Korea where there was simultaneous 4G and 5G network play on the handsets. 5G and IoT have also posed unintended challenges.

There is a case for one unified Internet — the Internet has 4.5 billion users. There may be a future where there is no longer the case. The IETF is working on quick transport protocols. Till that happens, we want to ensure there is no disruption to any transport protocol. 5G has two unintended challenges. One, network slicing. It could end up changing the way the Internet works. It could become a major challenge if another identifier system is put in place. Each app could even have an Internet of its own! These could also pose security challenges.

With 5G, phone numbers may not be relevant. Will there be new identifiers? The E.164 numbers are used within the cellular networks. They have also used IMSI or international mobile subscriber identity. There is no need for a new numbering system. However, within IoT, there could be a case for a new numbering system. These can easily create unintended challenges.

Narendra Nath, Joint Secretary, NIC, GoI, felt that cybersecurity challenges in 5G networks are there. In the UK, they came out with guidelines for consumer IoT. There will be a big jump in IoT devices with 5G. There may not be retrofitting of the IoT devices, which can be a challenge. We need to classify IoT devices and have the minimum security requirements in place. With 5G, there will be some disaggregation in applications. Is the security level mature for these? The general security aspects are quite common worldwide.

Debabrata Nayak, Chief Security Officer, Huawei, said that many of the security areas have been addressed in 5G. Network slicing is set to be the biggest benefit for apps. We can take appropriate measures.

### **5G threat agents**

Samant Khajuria, Senior Specialist, Cybersecurity, Terma A/S, said that the defense has been looking at 5G for a very long time. We want to put sensors in homes, factories, and everywhere, to protect against cyber attacks. We need to ask and find out: What is the 5G landscape? Who are the threat agents? What will it take to bring trust and confidence?

There are 5G assets and security properties. E. g. cloud services. My data should be very secure and viewed by authorized personnel. The threat taxonomy is vast. As for threats, there is ransomware, hackers, cyber warfare, etc. E.g., the secret surveillance of Norway's leaders was detected. Hackers may develop new tools and methods.

P Balaji, Chief Regulatory and Corporate Affairs Officer, Vodafone Idea, said that the march of technology and digital consumption has been massive. 5G will also transform the way businesses are conducted. There will be enhanced mobile broadband, mission-critical communications, and massive IoT, such as connected cars, remote surgery, etc. 5G use cases will span across many industry verticals.

There is a need to create a sustainable investment climate. Network slicing will be needed for critical, priority communications. There are cybersecurity challenges as well, so there is a need to improve standards, technologies, identify risks, etc. We need to protect the network infrastructure and devices, consumers and multi-stakeholders.

Andreas Sommer, Team Leader and Senior Technical Advisor, Project India-EU Co-operation added that there have been a lot of cable thefts, and equipment have also been stolen. Will these change in the 5G era? The European companies don't even trust these systems. They rather want the private players to come in.

## Delivering long-term and sustainable future for 5G

The final session on Day 1 was on delivering the long-term and sustainable future for 5G.

Simon Fletcher, CTO, Real Wireless, said that 5G has to be helpful to businesses. 3G and 4G were helpful in the growth of the wireless industry. We made a number of recommendations to the EC. We have focused on large infrastructure requirements. At the Commission level, there was a push for healthcare. We recently completed a study of ports. There were about 120 base stations installed at a port. We need to get emerging business models, stick with them, and make them sustainable.

Adrian Scrase, CTO, ETSI spoke about beyond mobile broadband. 3GPP continues to expand the LTE platform to improve its efficiency to meet the mobile broadband demand. Phase 2 (Rel 16) completes the IMT-2020 submission and addresses the identified use cases and requirements. 5G has already been launched in many countries, including USA and China. These are exclusively in the non-standalone mode. They are delivering mobile broadband. The operators are taking a low-risk approach to 5G, perhaps.

The question that arises is: when will the standalone mode be deployed? When will services, other than the mobile broadband, be delivered? Rel 15 NR is delivered to meet the market needs. Rel 16 involves huge work from the 5G community. Rel 17 is IoT driven. There will be more 5G support for verticals.

There are new enhancements for the radio and the system in Rel 17. The overall RAN timeline for Rel 17 has a 15-month gap. We have only launched 5G NR (new radio). Standardization is a long way ahead of deployment. There is a major push to add more use cases and accelerate releases, which are driven by the demand side. A corresponding response is needed from the supply side. Scale will be essential to close the gap.

Kishore Babu, Deputy DG, DoT, said that 5G may open up whole, new opportunities. However, there are certain doubts regarding 5G. There are a lot of new capabilities in latency, throughput, etc., that have been added. But, are we using 4G fully?

There may be frugal 5G deployments. What is in 5G that will alter our living styles? From the policy perspective, there may be attractive pricing for building backhaul. What are the rights of way that need to be addressed? 5G will bring a new era in the service delivery mechanism. It needs to be revenue churning for the operator as well.

On sustainability, Adrian Scrase asked how can more engagements from users will happen? It is a matter of expectation. Evangelization by the governments has so far seen 5G networks in 34 countries. The industry has done well to have 5G NR up. The core network is the key, as it will bring network slicing in 5G. The operators need to think: how do I evolve from 4G to 5G? It is back to the expectations.

On the question whether private networks as a theme are emerging in India, Kishore Babu said that it is sought after, looking at the SMEs, campuses and the enterprises in India. It may be a value to them, if there is a need. There are lot of such service requirements.—*CT Bureau*

## Day 2

In the opening session, TR Dua, Chairman ITU-APT Foundation of India and DG TAIPA, said: “As the journey of 5G continues, this year’s Huddle looks at monitoring the progress, and also looks at the challenges faced by the stakeholders, and so on. India’s data consumption at 10GB is among the highest in the world. 5G is different than 4G. It promises

data at speeds of 100 times more. As per Ericsson, there were 13 million [5G subscribers](#) by the end of December 2019. The NDCP 2018 has set ambitious goals.

“Some of the popular 5G use cases are worth looking at. TSPs are already providing 5G services in select cities. The use cases are likely to emerge in Industry 4.0, that is agriculture, smart cities, etc. Event organizers can offer VR, etc., in the future. 5G also promises low latency. Telecom operators can provide customized cases with network slicing. 5G technologies enables NFV, enabling multiple virtual networks.

The recently concluded WRC-19 identified additional spectrum for 5G. Some of the other key releases are the allocation of spectrum for microwave access, etc. The achievements of WRC-19 have been welcomed by satellite and mobile industries. 5G enablement would need specific infrastructure. Fiberization also needs to be done, and move up to 60%, from 20-25% recently.

Sameer Sharma, Regional Director, ITU Regional Office, Asia Pacific, said, digital transformation is the key to achieving the SDGs. ICT will play a catalytical role. We are sitting on the cusp of transformation. How do we define 5G? It was initially called as IMT. There is IMT-2000, IMT-Advanced and IMT-2020. 5G has an approximate deployment time of the 2020s. At the WRC-19, there were three identifiers — eMBB, mMTC, and URLLC. These are key for establishing a smart society.

WRC-19 identified frequency bands for 5G, such as 66-71GHz, 47.2-48.2GHz, 45.5-47GHz and so on. The future spectrum needs are 24.25-88GHz and the others. 5G will act as a catalyst by enabling intelligent connectivity. 5G will also bring us closer to achieving the SDG by 2030. The ITU recommends the M.2083. This relates to the level of unwanted emissions of mobile-satellite service feeder links operating in the bands 1,390-1,392 MHz (earth-to-space) and 1,430-1,432 MHz (space-to-earth).

5G can directly increase GDP, faster and informed decision making, boosts labor productivity, etc. There are many use cases that can be demonstrated. However, 5G backers are also skeptical about their commercial deployments. There will be some challenges in small cell deployment.

The scope of IMT-2020 is more than previous generations of mobile broadband communication systems. IMT-2020 will be a key catalyst for achieving the sustainable development goal.

### **Telecom infrastructure**

Later, TR Dua spoke on the telecom infrastructure. There is a need to ensure the availability of the critical telecom infrastructure. There are some regulatory challenges regarding the enablement of 5G. There are benefits of passive sharing. With time, it was realized that sharing is an important factor. It reduces the entry barriers, capex, opex, cost and energy efficiencies, etc. The tower and BTS have also grown from Dec. 2016 to Dec. 2019. Rapid expansion on the connectivity infrastructure has now catalyzed digital adoption.

Some of the government initiatives include, the Indian Telegraph Right of Way rules 2016, NDCP 2018, etc. 5G trials were initiated by the Government in January 2020. A robust telecom infrastructure is the bedrock for achieving the vision. The National Broadband Mission was launched in December 2019.

There are challenges with small cell deployment. 5G network can enable new apps to connected cars/devices if the 5G coverage is ubiquitous. There is a fibre backhaul challenge. There should be some policy. In active infrastructure, this needs to be implemented. Network

sharing can also reduce costs by up to 40%. Fiberization is critical to implement 5G. There is need to overcome challenges, such as common duct policy, etc.

Subodh Kumar Gupta, Member Technology, Digital Communications Commission, India, added that this year's focus is on 5G. The pace at which the people are taking mobile technology is very fast. There are new, emerging trends. 5G is the next generation of mobile broadband. 5G will enable a seamlessly connected society in the future.

Digital connectivity is a key factor to enable holistic growth. Universal access to broadband should be affordable. Growth of data usage has further increased. The number of broadband connections have to be nearly doubled.

The NDCP 2018 recognized digital communications policy as the key and provisioned broadband for all. Here, 5G will play an important role. The government is investing over \$30 million in a 5G test bed featuring domestic companies.

Bharat Bhatia, President, ITU-APT Foundation of India noted that the ITU-APT had signed an MoU with WWRF in the last Huddle. Now, WWRF and TSDSI will sign an MoU. Nigel Jefferies said that WWRF will work with TSDSI on various issues. Pamela Kumar added that we need to take this beyond discussions. Every year, we revisit the annual plan.

## **Who determines spectrum pricing for 5G in India?**

There was a panel discussion on spectrum pricing for 5G.

Yi Shen Chan, Director, Plum Consulting, UK, spoke on [spectrum pricing on 5G](#) from a global perspective. The primary objective is to maximize the benefit to the society so there is an efficient distribution of resources, resulting in maximum benefits to the society. Pricing principles include:

- \* Spectrum should be allocated to the highest value use or users to ensure maximum benefit to society.
- \* Prices can be determined by market-based mechanisms or administratively by the regulatory authority.
- \* Transparency.
- \* In the absence of scarcity, prices should be set to recover costs.

5G is a steep change from the previous generations. It will get deployed over a range of bands — low (sub 1GHz), mid (1-6GHz), and high (over 6GHz). Main focus today is on C-band (3.3-3.8GHz) and mm Wave bands (26-28 GHz) use.

### **Different approach for mmwave**

C-band auctions see the wide recognition of the 5G economics and investment needed for network rollout. These are generally, lower auction reserve pricing, and so on. 5G goes beyond enhanced mobile broadband. The mm Wave may require different approaches. The mm wave spectrum is likely to merit a different approach. One is the uncertainty over its usage.

There are alternative forms of spectrum access. Wholesale network, dynamic sharing, involving geo-location databases, club model, eg., in Italy, spectrum brokerage, light licensing, etc. The objectives and principles of spectrum management and pricing are still relevant in the 5G era.

### **In pricing, everyone is right!**

PK Sinha, Member Finance, Digital Communications Commission, spoke about the

national perspective on 5G pricing in India. In pricing, everyone is right! The seller wants the maximum price. Some may want the maximization of revenue. Spectrum pricing is absolutely in your hands.

In India, the 5G spectrum is in 3300-3600 MHz band. It has been identified as the preferred band for roll out of 5G services in India. TRAI has a valuation methodology for the 5G band. TRAI has recommended that the reserve price of 3300-3600 MHz band should be 30% of the reserve price of 1800 MHz band.

The 1800 MHz band has been used as a reference point. Also, the 3300-3600 MHz band is unpaired. The reserve price is further halved. ICRIER has said that Indian reserve price for 5G spectrum by TRAI is much above the international standards. At the end of the day, the market will decide what is the best price. The economic value is dependent on scarcity.

### **Huge quantum of spectrum required**

Parag Kar, VP Government Affairs, Qualcomm, asked what is it that we are trying to do with 5G? New services need a huge quantum of spectrum. On comparing the earlier auctions, it appears the price is at par. However, we won't get any efficiency benefit with 5G! It is similar to the existing technology. You need 100 MHz of spectrum. You needed lower quantum of technology for providing services in the earlier generations.

Vikram Tiwathia, DDG, COAI added that we need to be clear about what we want to do. A lot of brain went into NDCP 2018. The onus is on the government to provide the resource. India should leverage technology to rise in the global context. Spectrum has to be provided.

In terms of spectrum pricing, we need to review and come up with a fresh approach. 5G is supposed to catalyze the country to a higher plane. Those who have adopted 5G are countries that are already developed. What do the users really require out of 5G? That needs to be discussed as well.

Rajiv Prakash, Deputy DG, DoT, added that the background of spectrum pricing has evolved. People who take decisions on spectrum pricing are very conservative. The governance of the country has realized that spectrum is a valuable resource.

Rajat Mukarji, DG, BIF, noted that the Indian telecom industry is not doing really well. There are opportunities. 1300 MHz of radio spectrum remains unsold in Oct. 2016 auctions. That's 60% of what has been sold so far. It also means, we are not serving 21% of the population. The estimated cost of unsold spectrum is Rs 5.4 lakh crores in GDP.

### **Implementation-based innovation should be led by academia**

There was a panel discussion on the role to be played by the academia in the 5G regime.

Vipin Tyagi, Executive Director, C-DoT, said there are such large academic institutions in India. On the other hand, there is expectation that they will be working on cutting-edge technology. How are people solving problems through their research? We need to do this. As for R&D, 5G is fundamental. We also need to think big.

Kishore Babu, DDG, DoT spoke about the [innovations in 5G](#). The 2025 market projections by 4IR Technologies are 5G, AI, quantum computing. There are opportunities for collaborations among the stakeholders — academia, industry and government. There can be collaborations among the islands of excellence, linkages between humanities and technology, new era of mission-oriented STI policy, and KPIs similar to the knowledge exchange framework.

The academia can do more by building collaboration. There is lot of capacity available in the industry. The academia should identify areas, and have the students and the industry working on those. Start-ups today are doing much more work.

### **Academia and LMLC**

Pamela Kumar, DG, TSDSI, said that the role of the academia is in building competency and capability. They also play a role in setting direction. We need engineering and technology to solve problems. We proposed LMLC at ITU. We also released it at 3GPP. It was all done from the academia, and less than 5 people. Rural broadband needs to connect differently and focused on an India-specific problem. India has 3,500+ engineering colleges, with 14 lakh students graduating each year. The core strategy and product development has not been the focus so far. All about innovation is all about getting competitive.

Preetham Uthaiyah, EVP, Marketing & Strategy, Saankhya Labs, added that we look at the academia as a supporting role for the industry for technology development. We see there are multiple roles academia can play in building use cases. 5G gives you an opportunity to follow a 3GPP waveform. Everyone is looking at 5G as an enterprise app. Can we leverage it as a beneficial technology for India? Can we use satellite, along with 5G? Academia can play a role here. Implementation-based innovation should be led by academia.

We are today talking about the role of academia in 5G! It should have been done several years ago. The role of academia should be in looking at implementation roles. We have enough problems to solve, so, we should work on 6G or even 7G.

Brejesh Lal, NCC Coordinator, IIT Delhi, cleared the air, saying that the academia plays two roles — HR generation and training. We are also doing specialized training for students.

The IITs were made for producing world-class students. As for the academia's role, making research a primary, is an interesting point. A lot of faculty is publishing such reports. Faculty today does research. On cutting-edge research, it is looking to handhold the industry, and develop new products. Hand-holding does not make us innovators and leaders. We need to find ways of rewarding them.

Unless a professor is learning every day, he cannot teach new things every day. We have to look at the inorganic and the organic. We also have to put faith in people so that they move from solving problems to providing solutions for tomorrow. Publishing low-hanging fruits is the easiest thing to do! Then, why do we need to work harder? This thought needs to change!

We have some of the most intelligent people. We are caught up in solving recent problems. We have to use our capability and rise up to show the world what we can do.

### **Implementation-based innovation should be led by academia**

There was a panel discussion on the role to be played by the academia in the 5G regime.

Vipin Tyagi, Executive Director, C-DoT, said there are such large academic institutions in India. On the other hand, there is expectation that they will be working on cutting-edge technology. How are people solving problems through their research? We need to do this. As for R&D, 5G is fundamental. We also need to think big.

Kishore Babu, DDG, DoT spoke about the [innovations in 5G](#). The 2025 market projections by 4IR Technologies are 5G, AI, quantum computing. There are opportunities for collaborations among the stakeholders — academia, industry and government. There can be collaborations among the islands of excellence, linkages between humanities and technology, new era of mission-oriented STI policy, and KPIs similar to the knowledge exchange framework.

The academia can do more by building collaboration. There is lot of capacity available in the industry. The academia should identify areas, and have the students and the industry working on those. Start-ups today are doing much more work.

### **Academia and LMLC**

Pamela Kumar, DG, TSDSI, said that the role of the academia is in building competency and capability. They also play a role in setting direction. We need engineering and technology to solve problems. We proposed LMLC at ITU. We also released it at 3GPP. It was all done from the academia, and less than 5 people. Rural broadband needs to connect differently and focused on an India-specific problem. India has 3,500+ engineering colleges, with 14 lakh students graduating each year. The core strategy and product development has not been the focus so far. All about innovation is all about getting competitive.

Preetham Uthaiyah, EVP, Marketing & Strategy, Saankhya Labs, added that we look at the academia as a supporting role for the industry for technology development. We see there are multiple roles academia can play in building use cases. 5G gives you an opportunity to follow a 3GPP waveform. Everyone is looking at 5G as an enterprise app. Can we leverage it as a beneficial technology for India? Can we use satellite, along with 5G? Academia can play a role here. Implementation-based innovation should be led by academia.

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## **5G can enhance existing features of smart cities**

There was another panel discussion on 5G and smart cities as well.

Sushil Kumar, DDG, TEC spoke on 5G and smart cities. He said that we have a list of smart solutions that are both IoT and non-IoT solutions. There are other services like waste management, energy management, urban mobility, etc. There are proposed services, such as integrating with all proposed and future services. E.g., smart governance, city network, etc. There are challenges, such as robust connectivity, privacy and security, etc.

Smart cities are a super application domain of IoT. The [IoT4SDGs or Sustainable Development Goals \(SDGs\)](#) considers the importance of IoT to contribute for achieving the desired result. There is a common service layer architecture. Also, oneM2M will interwork with the other standards, as an example. There are 13-digit numbering system, as well as an embedded SIM. The BIS has also mandated IPv6 for smart meters.

In smart cities, 5G will enhance the existing features. There will be enhanced broadband, mission-critical services, and massive machine-to-machine type communications. Beamforming is also a beautiful feature of 5G. It is the utilization of antenna techniques such as massive MIMO. There is the URLLC design as well. Further, the C-V2X is gaining support from automotive and telecom verticals.

Seshadri Mohan, Prof. Systems Engineering, UA Little Rock discussed driving the digital transformation in urban environments. Connected vehicles are a component in the transformation to smart vehicles. We are witnessing an era of explosive growth of multimedia apps and services. There is the onset of autonomous vehicular technology. Communication establishment among the vehicles can be difficult, with limited navigation system, especially in remote places. In Rel 16, 5G addresses the C-V2X.

The PCS-based USIM-less communication allows for critical safety services when LTE coverage is unavailable. Two new functions were added — the V2X control function and the V2X application server. In 5G, it is based on new radio. In Rel 16, at least the CP-OFDM can be supported by the side link. Rel 15 details the use cases such as vehicle platooning, etc.

Benoit Sauveroche, First Counsellor at the Delegation of EU to India and Nepal said that there is value in exchanging relations between the EU and India. Europe has a three-pronged strategy: transparency, collaboration and development. Technical solutions start from the concept. Deadlines have been set. All major cities and road networks will be fully covered by 5G in 2025. There is strong policy strategy as well.

There are some constraints in development. For example, the availability of spectrum and the availability of equipment for doing full-scale trials. The regulatory framework

in the EU is strong. There is the European electronic regulation code as well. There are many regulatory innovative elements. There will be a 20-year contract for those who invest in the EU. The regulator can also intervene and allow the minimal level of competition. There will also be the civil engineering access. Security is also key. We have developed a certification for products and processes, as well as technical and support services.

Kishore K. Narang, CEO, Narnix Technolab, added that standardization is now the way to grow productively. In India, we are not yet having smart utilities. We have a unified ICT architecture. It also brings down the carbon footprint of those using it. We tried to create a smooth migration path to 5G within the smart city paradigm.

What's the standardization level of apps to generate cost-effective deployments? 5G is a core infrastructure. We decided to create a standardized platform in a secured, structured manner, above 5G. You can configure your network slices, based on the use cases. Right now, the apps cannot be plugged! To leverage the open APIs, you need to be telecom domain experts.

Debashish Bhattacharya, DDG, BIF, moderated the session.

## **Frugal 5G and broadband from the sky**

The concluding session of the 5G Huddle was on the role of 5G in tackling the digital divide. If harnessed in the right way, 5G has the potential to help transform the lives of citizens in rural areas and developing regions, as well as in cities and urban hubs. For this to happen, there is a need to think creatively when developing connectivity technologies and solutions, and to ensure that the connectivity requirements of individual regions and communities are fully understood.

Adrian Scrase, CTO, ETSI, said that we are all looking at connectivity for everything, and not everyone.

### **Frugal 5G**

Pranav Jha, Senior Research Scientist, IIT Bombay, spoke on the [frugal 5G network](#). Cellular is the primary broadband platform today. At present, there are no real commercial reason for operators to target rural areas. High speed mobility is not that important for rural areas. The key is to provide fixed broadband.

There are challenges such as local content generation and storage. Some areas may also be too remote and difficult to access. There is scarcity of power from the grid as well. Ease of manageability is quite important.

In BharatNet, 130,000 villages have been connected with fibre till date, with the remaining offices to get connected by 2020. But, how do you connect the villages to the GP? The frugal 5G network architecture is now under development. Large coverage area cell will provide ubiquitous connectivity. Small cells or Wi-Fi hotspots can be access points for high-speed data connectivity.

### **Broadband from sky**

Vipin Tyagi, Executive Director, C-DoT, spoke about how broadband falls from the skies. There are several high throughput satellites (HTS). The cost per GHz are coming down. Trials have been done for Harishtal village near Nainital, Talli Sethi village, and also in Tripura. We have the C-Sat-fi.

C-Sat-Fi is an innovative integration of VSAT with C-DoT BBWT Wi-Fi terminals. Satellite connectivity is used as the backhaul. The C-Sat-Fi (C-DoT satellite WiFi) will provide connectivity to unserved areas, including remote islands and difficult terrains based on the optimal utilization of wireless and satellite communication. The solution is suited to address disasters and emergencies. It does not require expensive satellite phones, but can work on any WiFi-enabled phone.

We have done a balloon Wi-Fi, and also inside a bamboo. There is 5GHz spectrum available in India. Deliberation will need to happen in 6GHz. That brings us to M2M communication. Matching appropriate connectivity to the use case adds to the complexity.

OneM2M standard is necessary. A lot of people have contributed to the standard. Horizontal IoT silos are meant for applications. There are details of common service functions. How do you do monetization, regulation, security and compliance of IoT M2M? [5G is the network](#), and not only core and RAN. Let us convert 5G into reality.

### **Basic Internet, pay for video**

Sudhir Dixit, Co-founder, Basic Internet Foundation, Oslo, spoke about the Project Internet Lite. The Basic Internet Foundation looks to make digital inclusion happen to improve the life of every single human. There is a need for free and premium models. Static content is delivered for free, but, you need to pay for video.

There are forgotten needs of the developing world and the digitally disadvantaged. "Connectivity for all should be the pillar. 50% of connections in the world are still dependent on 2G. We have to worry about these people as we await the 5G bus. We are also looking at 6G for digital inclusion. In Norway, 8% don't use the Internet, and 26% have no mobile broadband. Community involvement has to happen to make all this connectivity happen."

For Basic Internet, there is long-term solution aligned with 5G network slicing. We have developed the Internet Light. 6G ought to be about the digitization of the society. We have rolled out this application in Tanzania, as well as some other parts of Africa.

### **5G in healthcare**

Zainul Charbiwala, Co-founder and CTO, Tricog Health, spoke about how 5G can fit in healthcare. He said we are looking at AI in healthcare. We are looking at cardiovascular diseases. Lives have been saved by intervening within the golden hour. Now, ECG needs a specialist.

We have the Tricog Insta ECG solution. Data is processed in the cloud. We have a team of dedicated medical professionals who look at the data in real time, 24/7. In case there is an emergency, we connect to a remote center and a hospital, all of whom reach within 10 minutes. We also have a Tricog center and co-ordinator app. We have an AI app in Tricog, as well.

The cellular connectivity is very erratic. We want to go all out in remote cardiac care. 5G can help collect more data, and deliver better healthcare.

### **M-Pesa in Kenya**

Knud Erik Skouby, Prof. Center for Communication, Media and IT, Aalborg University, Copenhagen, presented on beyond the Kenyan success story with mobile money. There are lessons to learn for Ghana, Africa. Ghana had unsuccessfully tried introducing the e-zwich or the e/m payment. The Gates Foundation said in 2013 that

mobile money services are perhaps the most promising way to deliver financial services profitably and at scale to the poor.

M-Pesa is a success in Kenya. M-Pesa services target low-income earners without access to banking. Safaricom has helped M-Pesa. Now, a major part of the population has financial access. The interactions and dynamics of co-operation between the social and material players have shaped the enactment of mobile money.