

WIRELESS & NETWORKING TECHNOLOGIES



**CURRENT STATE:
A CLOSER LOOK AT 5G AND 6G**



Introduction

Wireless and Networking technology has revolutionized the way we interact and stay in touch with our families and friends over years, and with Wi-Fi, Bluetooth and 3G/4G/5G technologies, our interactions with our ecosystem have changed for good. India has seen unprecedented growth in its wireless subscription over the years. As per the Telecom Regulatory Authority of India (TRAI) report, India now has about 1.1bn telecom subscribers (March 2020)¹. Reliance Jio, Bharti Airtel and Vodafone Idea are the top 3 players in terms of market share (33.4%, 28.3% and 27.6% respectively). BSNL and MTNL combined have a market share of about 10.6% as of March 2020.

Key factors behind the growth of Wireless and Networking technology consumption are robust demands in terms of telecom subscriber base (especially in rural sector in India) and increasing investments in India.

The Government of India released “National Digital Communication policy” in 2018. The policy focusses on 3 missions:

- Connect India – Creating robust digital communication infrastructure, i.e. broadband for all
- Propel India – Having capabilities to utilize emerging technologies such as AI/ML, AR/VR, IoT, Big data etc.
- Secure India – Ensuring the security of digital communication in India through data privacy and ownership

As outlined in the policy document, the Government of India aims to provide broadband connectivity at 50 Mbps to every citizen and 10Gbps connectivity to Gram Panchayats by 2022.

When we talk about Wireless and Networking technology, 5G is something that comes to everyone’s mind, as 5G technology promises to change the way we interact with technology. The use-cases for 5G are well documented in public domain- improved mobile experience, improved customer services, and overall communication. Experts have been categorizing the application areas of 5G under 3 categories:

- eMBB: Enhanced Mobile Broadband
- URLLC: Ultra Reliable Low Latency Communication
- mMTC: Massive Machine type Communications

Our overall mobile broadband experience, that is the way we interact with our phones will change forever – media downloads and uploads, transferring heavy files, AR/VR applications, and ultraHD video streaming on mobiles will improve significantly. It will also boost our adoption of IoT devices for personal or business purposes. Automotive, E-commerce, Manufacturing, Public services (such as smart city applications) and Banking are some of the sectors that will ultimately benefit from the wide adoption of 5G technology.

5G – Understanding India’s context

India Inc. understands the benefits of 5G technology and has already laid out a strategy for rolling out 5G. Indian Government formed a special committee chaired by Dr. (Prof.) AJ Paulraj, who is Professor Emeritus at Stanford University, in 2017. The committee members included dignitaries from ministries of

¹ TRAI report, July 2020 - https://www.trai.gov.in/sites/default/files/PR_No.49of2020_1.pdf

communication, IT, Science & Technology, and from academia and industry. This committee submitted the recommendations on the roll-out of 5G in India to the Government in March 2019.

According to the report², 3 priorities for India in 5G are:

1. Deployment – Recommendation was to begin the deployment early
2. Technology – Focused on creating India's industrial and R&D capacity
3. Manufacturing – Expanding the manufacturing base in 5G, around semiconductor fabrication, as well as assembly and test plants

In terms of deployment, TRAI has recommended that spectrum 3300-3400MHz and 3425-3600MHz band be made available in India. Indian Government is planning to auction 5G spectrum soon.

In terms of technology and manufacturing, we have seen so many start-ups and enterprises that are working on 5G already. Some of the examples are – Reliance Jio, Mymo wireless, Niral networks, VVDN, Tejas networks, Acliv, Cadence India and Qualcomm India are some of the leading names in the 5G technology space. The Department of Telecommunications (DoT) is also funding a large scale 5G testbed project to encourage Indian startups. Top Indian academic institutes such as IIT-Delhi, IIT-Hyderabad, IIT-Kanpur, IIT-Bangalore, Indian Institute of Science - IISc, are all involved in 5G development.

According to WEF³, for India to emerge as a manufacturing hub of a global scale, a collaborative effort is required to build a secure and scalable national 5G infrastructure. Indian companies have taken note of this message:

- Reliance⁴ Jio has developed its own 5G technology, to reduce the dependence on foreign vendors. Jio has about 370mn⁵ subscribers
- Mymo wireless, Bangalore based start-up, is already working on developing 5G chipsets
- Indian-based VVDN offers expertise across 5G domains including 5G RAN, 5G RF, 5G Cloud/Digital
- Niral Network offers cell site router with deep-inspection capabilities for 5G access network⁶

Wireless and Networking technologies – TechSagar Context

TechSagar is supported by the Office of National Cyber Security Coordinator, and it is a platform to discover India's cybertech capability through a portal that lists business and research capabilities of various entities from the IT industry, start-ups, academia and R&D institutes. TechSagar also lists individual researchers with scope of their past and future research. The portal can be accessed at: www.techsagar.in.

Wireless and Networking technologies is one of the 25 technology areas featured on TechSagar platform. DSCI has identified 505 capabilities within Wireless and networking technologies. Some of the notable ones are 1G/2G/3G/4G/5G, ALOHA, CDMA, CSMA and Direct Sequence Spread Spectrum (DSSS). Below

² Making India 5G ready – Report by DoT, 2018 - <https://dot.gov.in/sites/default/files/5G%20Steering%20Committee%20report%20v%2026.pdf>

³ <https://www.weforum.org/agenda/2019/10/5g-technology-in-india/>

⁴ <https://telecom.economictimes.indiatimes.com/news/reliance-jio-builds-in-house-5g-iot-tech-to-reduce-dependence-on-foreign-gear-replaces-nokia-oracle-tech-with-own-tech/74534777>

⁵ <https://yourstory.com/2020/03/reliance-jio-5g-trials-government-nod-mukesh-ambani>

⁶ <https://www.startupindia.gov.in/content/sih/en/profile.Startup.5e13799ce4b0ea02f54c9617.html>

table 1 provides the directional representation of the capabilities defined in TechSagar. All the 505 capabilities are listed on TechSagar platform.

Wireless and Networking Technologies						
Core Tech. wireless	Support for Wireless and Networking	Types of Wireless networks	Wireless and Networking applications	Wireless and Networking Architecture	Wireless communication	Wireless protocols
Channels	DLP	Attributable NW	NaaS	Computer network Architecture	Cellular NW Evolution	Access Tech.
Edge computing for CSPs	Network (NW) integration	Cognitive NW	Remote systems	DTN	Cellular NW	Appl. Layer protocol
ICSA	NW log analysis	Computer NW	Signal-Noise Ratio	Network function virtualization	FHSS	Comm. protocol
MIMO	NW Switch sub-sys	Optical NW			Gateway	Mgmt. protocol
Modulation technique	NW testing	Passive Optical NW			Mobile comm.	Mobile comm.
Open source cellular infra	NW traffic mgmt.	Radio Access NW			Signal Processing	NW layer protocol
Radio resource mgmt	Server Mgmt.	Space NW			SISO Comm.	Transport layer protocol
Routing protocol	SSL VPN Soln.	Storage NW			SW defined Radio	
Spectrum sharing	VPN	Wireless ad-hoc NW			Switching tech.	
Uplink-downlink decoupling	WAN Accelerator	Wireless LAN/MAN/PAN			Unified Comm.	
Wireless HW Equip.		Wireless Sensor NW			VSAT	
Wireless Interface		Wireless WAN			WiFi/Wi-Max	
					Wireless Backhaul	

Table.1: Representation of the capabilities defined in TechSagar

An aggregated view of companies including start-ups, R&D centers, Academic institutes and Researchers across India, that have contributed to the development of this field in the country are also captured in TechSagar. Following figure, Fig. 1, provides a snapshot (as on July 2020) of demographics of various entities on TechSagar:

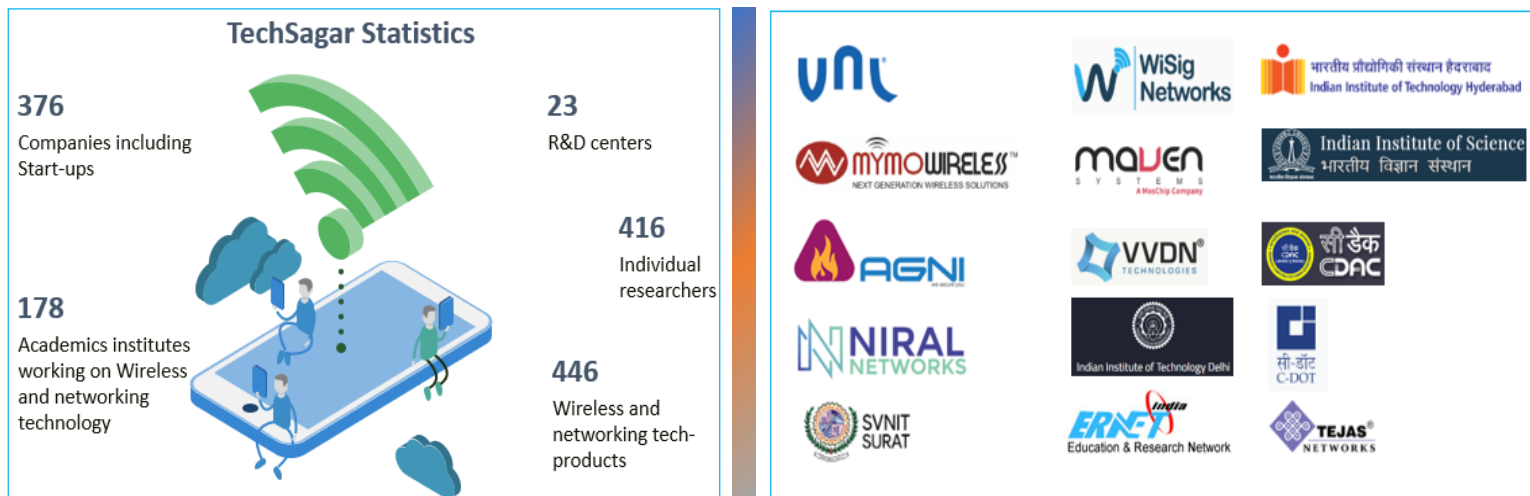


Fig.1: Demographics of various entities on TechSagar

Road ahead – Closer look at 6G

On one hand, 6G seems to be a far-fetched idea, but on the other hand, China, Finland, Japan, South Korea and Taiwan have already begun investments in 6G R&D activities⁷:

- LG Electronics and Korea Advanced Institute of Science and Technology (KAIST) have opened 6G research center
- University of Oulu to begin 6G research as part of the flagship program at Academy of Finland
- Taiwan’s Ministry of Science and Technology (MOST) is actively seeking research projects in B5G (Beyond 5G) and 6G

According to the recent report published by Samsung⁸, the 4 major trends leading to 6G are – connected machines, use of AI in wireless communication, openness of mobile communication and increased contributions for achieving social goals.

Cisco estimates that there will be close to 500bn connected machines in the World by 2030, and 6G will provide capabilities to address the need of this volume. Early research suggests that 6G will further enhance the capabilities of 5G. 3 key services of 6G will include truly immersive XR, high-fidelity mobile hologram and digital replica.

⁷ International Telecommunication Union (ITU) – Beyond 5G - https://www.itu.int/en/ITU-T/Workshops-and-Seminars/20200113/Documents/Bernard_Barani.pdf

⁸ Samsung – The vision of 6G - <https://cdn.codeground.org/nsr/downloads/researchareas/6G%20Vision.pdf>

Summary

India's adoption of 5G technology is still a work-in-progress, like in many other countries. However, there are clear goals that Government should set up in order to boost Wireless and Networking technologies. According to one of the Webinars hosted by NASSCOM on this topic, India must aim for the following by 2030:

- 5% global market share
- At least 5 companies out of 100 Global companies must be headquartered in India
- At least 5% of essential/enforceable global IP must be developed in India

In order to achieve the above goals, Indian Government has significant role to play. This includes, but not limited to, attracting venture capital/funding, leveraging imports and attract experienced talent.



ABOUT TECHSAGAR

TechSagar – India's Cybertech Repository was conceptualized by the Office of National Cyber Security Coordinator, Government of India, in partnership with Data Security Council of India (DSCI). It provides information about 25 technology areas, 5000+ products & solutions, and 3500+ services from start-ups and large enterprises. The repository facilitates several opportunities to collaborate, connect and innovate, and endeavors to provide direction for a strategic cyber roadmap of the country in R&D, industry development, and strengthening the preparedness of National Security.

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