

5G: RSTV – In Depth

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What's in the news?

- China has officially marked its entry to the 5G era.
- On 5th June, 2019 the country's Ministry of Industry and Information Technology granted commercial licenses to four state-owned telecom giants.
- These companies can now go ahead with full commercial deployment of 5G networks across China, and allow users to subscribe to the faster data services.
- The high-speed 5G technology will transmit data at least 10 times faster than the current 4G system. This is going to be a significant step towards revolutionizing the tech world in the near future.
- China is hopeful that the technology will bring new opportunities and boost its digital economy.
- According to a research report by the China Academy of Information and Communications Technology, 5G is expected to generate 10.6 trillion yuan (about 1.54 trillion US dollars) worth of economic output and over three million jobs between 2020 and 2025.
- Incidentally, China's move to step up efforts in the global race for setting up the super-fast telecommunications system comes just days after Telecom Minister Ravi Shankar Prasad announced that the trials of fifth-generation airwaves will begin in 100 days and the first auction of 5G spectrum will be held in the year 2018 itself.
- This edition of In-Depth talks about the 5G technology, the rapid changes it will bring about in the communications system and how it will support the growing number of connected devices globally.

Analysis:

- By granting 5G licenses for commercial use, China has marked the beginning of a new era in the country's telecommunications industry. According to a forecast by the industry group, "Global System for Mobile Communication Association", China is expected to become the world's largest 5G market with 460 million users by the year 2025.
- China's Ministry of Industry and Information Technology, has granted 5G licenses for commercial use to its major state owned companies, marking the beginning of a new era in the country's telecommunications industry.
- The three major telecom carriers, i.e. **China Mobile, China Telecom, and China Unicom**, as well as the state-owned **China Broadcasting Network Corporation** are the first batch of companies that obtained the 5G licenses on the 5th of June, 2019.
- This means that these carriers can now start rolling out commercial 5G applications. The 5G technology will establish high speed, mobile, safe and widespread new generation information infrastructure.
- Chinese officials say that a comprehensive deployment of the network will help develop industrial manufacturing, internet connected cars, healthcare, smart city management, and artificial intelligence.
- The 5G stations are being installed in different parts of China, including Tibet as part of Chinese telecom giant, Huawei's plans to lead the 5G trials.
- China started tests for 5G technology back in 2016 with a total of 7 domestic and international companies, including Huawei, Tang Telecom and Ericsson.
- China is hopeful that the 5G technology, will bring new opportunities and buoy the growth of its digital economy.
- According to a forecast by the industry group, "Global System for Mobile Communications Association", China is expected to become the world's largest 5G market with 460 Million users by 2025.
- Having said this, first and foremost is the question of how much will the operators have to pay for

Perspective on India:

- **The Telecom sector in India has made it clear that it cannot afford 5G spectrum at the current reserve price.**
- Global Telecom Industry body, GSMA, expects India to have 920 million unique mobile subscribers by 2025, which will include 88 million 5G connections.
- According to GSMA, the emergence of 5G ecosystem in India will depend on telecom operators' ability to invest in network which requires support on policy and regulatory fronts.
- 5th Generation 5G mobile internet could be launched as early as late 2019, or early 2020 in some countries. It promises download speeds 10 to 20 times faster than what we have now. But, how is it different from 4G? And what difference would it really make to our lives?
- It is important to maximise India's opportunities for value creation from the global 5G revolution. India has limited intellectual property in 5G technologies and is largely going to be a buyer of this technology. However, the size of the Indian market and our strengths in services and software create some opportunities for symmetric dependencies and value creation.
- For example, global deployments of 5G are expected to continue over the next decade and will require skilled labour to design, install, and monitor these networks.
- The government should encourage capacity building in Indian companies for "5G deployment services" such that Indian talent can be used across the world.
- For vendors winning large 5G contracts in India, preferential agreements with Indian software companies could be considered. Additionally, setting up "use-case validation and development centres" should be incentivised to develop new applications of 5G that are most relevant to India's social development such as health, education, agriculture, transportation and water. These solutions can also be exported.
- Data Security is a paramount concern in the World today and India cannot remain secure in terms of data, unless it manufactures its own chips.
- Next, India's first Indigenous Semiconductor Chips was made by a Bengaluru based semiconductor company "SIGNALCHIP" for 4G/LTE and 5G NR MODEMs.
- At present, only 8 companies and a few countries can design and build semiconductor chips.
- When US and China are battling it out for the core ICT technology, India cannot lag behind.
- India's progress in communications technology in recent years has been rapid. Increased affordability, propensity to spend, and lower internet tariff rates have all helped the communications sector boom in India. This has put India on the verge of rolling out 5G technology based services.
- 5G networks are the next generation of mobile internet connectivity, offering faster speeds and more reliable connections on smartphones and other devices than ever before.
- One would be able to download a High Definition (HD) film in a few seconds.
- Video buffering during a streaming session would virtually disappear as data transmission would happen at lightning speeds on a 5G network. This would happen because 5G networks would deliver data with less than a millisecond of delay. Currently, 4G networks have a delay of around 70 milliseconds. All this would happen when 5G networks are built alongside the existing 4G LTE networks.
- The standalone 5G networks, operating at very high speed frequencies, could easily achieve Gigabit plus browsing speeds.
- Experts believe that with advances in communications technology, the world is fast moving towards a connected society.
- With all our devices being smart and connected to the internet, we would be able to look at Smart Homes that are energy efficient, save time on housekeeping and shopping, and enjoy safer and more efficient public and private transportation. Besides, it also enables new approaches in education, healthcare, transportation, energy, and entertainment.
- 5G networks could run on 3400 Mhz, 3500 Mhz, and 3600 Mhz. spectrum bands respectively.
- It is important to note that airwaves in the 3500 Mhz band are considered ideal for the first wave of

5G.

- Going forward, millimetre-wave spectrum may play a significant role in 5G networks.
- They are called millimetre-waves as they vary in length from 1 to 10 millimetres, unlike radio waves that serve the present smartphones.
- Millimetre waves are broadcast on frequencies between 30 and 300 GHz. They have largely been used by those running satellite networks and radar systems.

Differences between 4G and 5G Networks:

- - 5G uses different kinds of antennas, operates on different radio spectrum frequencies, connects many more devices to the internet, minimizes delays, and delivers ultrafast speeds.
 - 5G is the newest mobile network that's replacing the current 4G technology by providing a number of improvements in speed, coverage, and reliability.
 - One fundamental difference is 5G's **use of unique radio frequencies** to achieve what 4G networks cannot.
- The radio spectrum is broken up into bands, each with unique features as you move up into higher frequencies. 4G networks use frequencies below 6 GHz, but **5G uses extremely high frequencies in the 30 GHz to 300 GHz range.**

How do these high frequencies help?

- - These high frequencies are helpful for a variety of reasons. As a matter of fact, one of the most important being that they **support a huge capacity for fast data.**
 - Next, not only are they less cluttered with existing cellular data, and so can be used in the future for increasing bandwidth demands, they're also highly directional and can be used right next to other wireless signals without causing interference.
 - This is very different than 4G towers which fire data in all directions, and potentially wastes both energy and power to beam radio waves at locations that aren't even requesting access to the internet.
- 5G also uses shorter wavelengths, which means that **antennas can be much smaller than existing antennas while still providing precise directional control.**
- Next, since one base station can utilize even more directional antennas, it means that 5G can support over 1,000 more devices per meter than what's supported by 4G.
- As a consequence of all this, 5G networks, when they become widely available, will be able to beam ultrafast data to a lot more users, with high precision and little latency.
- Another difference between 5G and 4G is that **5G networks can more easily understand the type of data being requested**, and are able to switch into a lower power mode when not in use or when supplying low rates to specific devices, but then switch to a higher powered mode for things like HD

video streaming.

- 5G is 10 times faster than 4G. This means that during the time it took to download just one piece of data with 4G (like a movie), the same could have been downloaded 10 times over a 5G network.

Some Negatives of 5G:

- Most of the super-high frequencies of 5G networks work only if there's a clear, direct line-of-sight between the antenna and the device receiving the signal. What's more is that **some of these high frequencies are easily absorbed by humidity, rain, and other objects, meaning that they don't travel as far.**
- It's for these reasons that we can expect lots of strategically placed antennas to support 5G, either really small ones in every room or building that needs it or large ones positioned throughout a city; maybe even both.
- There will also probably be many repeating stations to push the radio waves as far as possible to provide long range 5G support.
- Also, the spectrum that we use today for 4G technology is for the lower bands. This cannot carry large amounts of data. We are talking about hundreds of thousands of Giga bits of data in a second. For this, it is natural that we need higher frequencies.

Tracing the journey of Communications Technology:

(I) 1G: Voice Only

- Cell phones began with 1G technology in the 1980s. 1G is the first generation of wireless cellular technology. 1G supports voice only calls.
- 1G is analog technology, and the phones using it had poor battery life and voice quality, little security, and were prone to dropped calls.
- The maximum speed of 1G technology is 2.4 Kbps.

(II) 2G: SMS and MMS

- Cell phones received their first major upgrade when their technology went from 1G to 2G. This leap took place in Finland in 1991 on GSM networks and effectively took cell phones from analog to digital communications.
- The 2G telephone technology introduced call and text encryption, along with data services such as SMS, picture messages, and MMS.
- Although 2G replaced 1G and is superseded by later technology versions, it's still used around the world.
- The maximum speed of 2G with General Packet Radio Service (GPRS) is 50 Kbps.

(III) 2.5G and 2.75G: Data

- Before making the major leap from 2G to 3G wireless networks, the lesser-known 2.5G and 2.75G were interim standards that bridged the gap to make data transmission, i.e. slow data transmission, possible.
- 2.5G introduced a new packet-switching technique that was more efficient than 2G technology. This led to 2.75G, which provided a theoretical threefold speed increase.
- AT&T was the first GSM network to support 2.75G with EDGE in the U.S.

- 2.5G and 2.75G were not defined formally as wireless standards. They served mostly as marketing tools to promote new cell phone features to the public.

(IV) 3G: More Data, Video Calling, and Mobile Internet

- The introduction of 3G networks in 1998 ushered in faster data-transmission speeds; one could use their cell phones in more data-demanding ways such as for video calling and mobile internet access.
- The term "mobile broadband" was first applied to 3G cellular technology.
- Like 2G, 3G evolved into the much faster 3.5G and 3.75G as more features were introduced to bring about 4G.
- The maximum speed of 3G is estimated to be around 2 Mbps for non-moving devices and 384 Kbps in moving vehicles.

(V) 4G: The Current Standard

- The fourth generation of networking, which was released in 2008, is 4G. It supports mobile web access like 3G does and also gaming services, HD mobile TV, video conferencing, 3D TV, and other features that demand high speeds.
- The max speed of a 4G network when the device is moving is 100 Mbps. The speed is 1 Gbps for low-mobility communication such as when the caller is stationary or walking.
- Most current cell phone models support both 4G and 3G technologies.

(VI) 5G: The Future

- 5G is a not-yet-implemented wireless technology that's intended to improve on 4G.
- 5G promises significantly faster data rates, higher connection density, much lower latency, and energy savings, among other improvements.

