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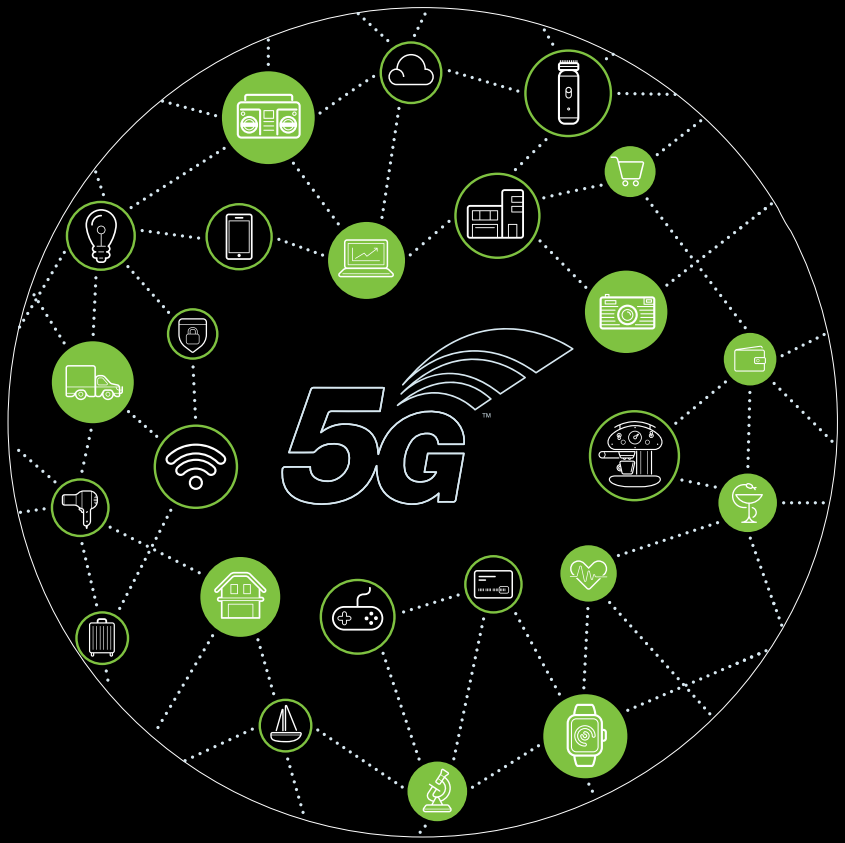


The Leap to 5G

2017

Network methodologies that deliver higher speeds and greater capacity

Carrier aggregation: This enables higher bandwidth by aggregating multiple carriers (or channels). The more the spectrum available, the faster the speed. LTE-A supports up to five carriers while LTE-A pro supports up to 32. LTE-A also enables the use of unlicensed spectrum, including frequencies in the 5GHz range normally used for Wi-Fi. Combining spectrum within licensed and unlicensed spectrum enables faster connections.

MIMO (multiple-input multiple-output): This method enables greater spectral efficiency (more from same amount of frequency) and greater capacity by deploying more than one antenna on the same device. More antennas also offer greater speeds when connecting with a MIMO-equipped access point. LTE-A Pro offers between 8-16 antennas. Evolution of Massive MIMO capability is planned for 5G and likely to be tested in 2017 with 128 antennas.

QAM (quadrature amplitude modulation): This approach also enables improved spectral efficiency. The higher the QAM, more the bits per transmission. This helps achieve higher peak data rates. For example, 256 QAM sends 8 bits per transmission, which is 33 percent more efficient than 64 QAM (6 bits). The latest version of LTE-A introduced 256 QAM.

Relay nodes: These network components (introduced in LTE-A) are low-powered base stations which provide greater coverage and capacity at cell edges and in hot-spots.

Beamforming: This technique, introduced with the first release of LTE, directs a signal from a cellular base station more precisely towards each device. Beamforming is delivered via software application, while LTE uses two-dimensional beamforming; LTE-A pro incorporates 3D-beam forming, enabling higher speeds.

Other features which make cellular a key enabler for innovations

Lower latency: LTE-A Pro offers lower latency. LTE-A Pro has 600 microseconds latency compared to 8 milliseconds for standard LTE. Lower latency enables more responsive applications, making fast-moving machine control more viable; critical to any application for vehicles that use cellular networks as part of autonomous or partially autonomous control.

Dedicated support for IoT: An improvement introduced in LTE-A Pro is support for IoT devices. LTE-A Pro incorporates a Low-Power Wide Area Network (LPWAN) specification that enables low bandwidth (up to 250 Kbit/s) connections to a large number of connected devices, many of which may be battery powered. This feature enables low power transmission such that devices are able to last several years before batteries require replacement.

LPWAN is also designed to operate at lower frequencies such as 180KHz (where current low end cellular network frequencies are in 600MHz range) which would enable greater coverage allowing signals to reach basement floors and deep inside buildings, permitting connections to utility meters, boilers and other machines located below ground level.

While 5G is a significant and complex upgrade to 4G, it is not a single step upgrade but rather a culmination of incremental sustained upgrades to 4G.

Building the 5G network
Carriers planning for 5G should consider integrating the network elements of LTE-A and LTE-A Pro. The carriers would be able to get a better insights on economics, performance and technical challenges of using these new techniques.

Another learning would be in terms of network densification and new approaches to deployment that offers substantially lower cost per site.

Marketing the 5G network
Higher costs of deploying 5G networks (estimated at US$63.1 billion for EU alone) also pose a question on business case realization for carriers. Marketing of 5G services would be another challenge carriers would need to address. Efforts will be required to map evolving network capabilities with useful applications and utilities including those that are derived from entertainment services. Cross-functional teams comprising engineering, customer experience, marketing etc. at carriers should be aligned and work in tandem with wide range of industry players and vendors whose offerings would be enhanced by 5G.

Enterprises should also start experimenting with new products and services based on higher speeds, greater capacity and a lower cost per gigabyte. Companies should also consider how faster, lower cost downloads, allied to larger capacity smartphones can change user habits. For example, 4G's greater speeds relative to 3G unlocked latent demand for streaming music into cars and for watching video on public transport.

A major new capability unlocked will be in the enterprise IoT space, and much experimentation will be required in this space to identify the optimal applications.

Improving the fixed broadband economics
With speeds attainable on LTE-A Pro and 5G networks, carriers would have a viable option to fixed broadband at significantly cheaper cost. Using 5G would be significantly cheaper than deploying fiber. In some markets LTE speeds are comparable with fixed line networks accessed via Wi-Fi.

At some point, LTE-A Pro and 5G could provide sufficient coverage, speed and capacity for some households such that fixed broadband in addition to mobile becomes superfluous. Home with multiple low to medium connectivity requirements may be able to 'get by' with just the wireless connection alternative.

Implications for legacy networks
Carriers might also want to consider switching off some of their legacy networks for example, 2G and reallocate spectrum for more efficient use. In 2017, a few operators are expected to turn off part or all of their 2G networks, but the vast majority have not stated any plans.

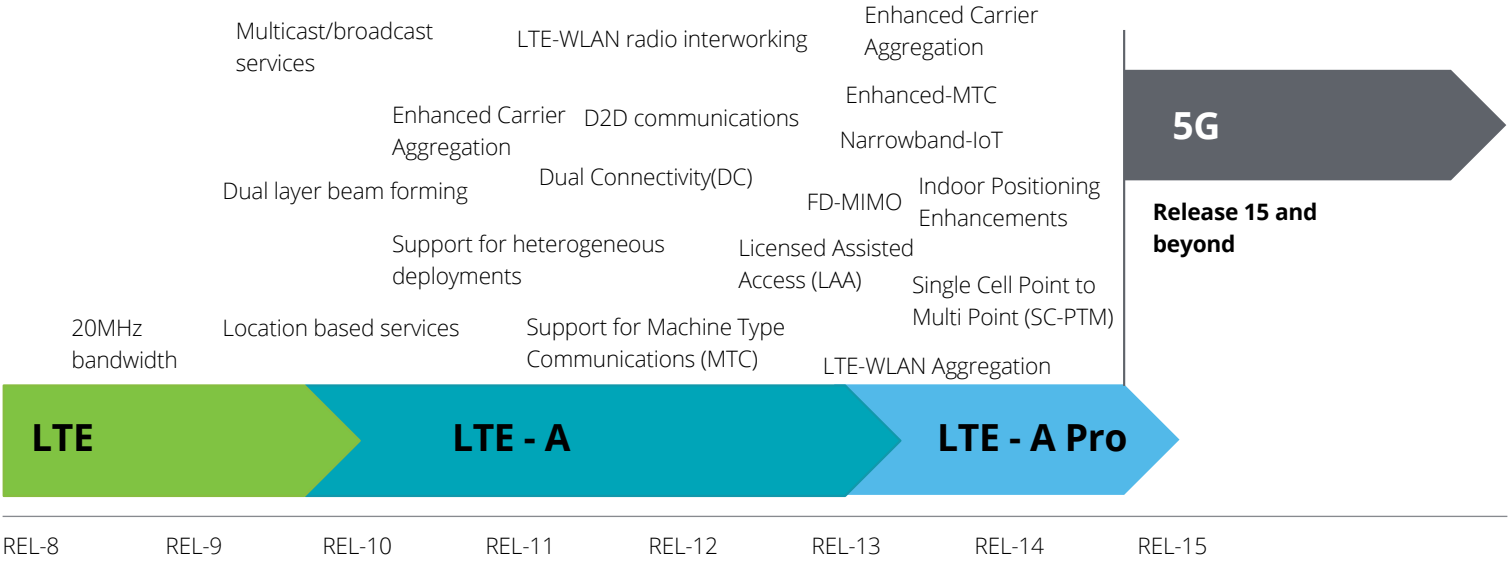
LTE evolution and path to 5G

LTE technology revolution, bringing in incremental improvements and building upon the LTE standards is laying the path for 5G.

The evolution has seen two iterations of LTE networks namely LTE-Advanced (LTE-A) and LTE-Advanced Pro (LTE-A Pro). LTE releases 10 to 12 are also known as LTE-A and the term LTE-A Pro is being used by 3GPP for releases 13 onwards.

The incremental improvements in LTE are focused on meeting as many requirements for 5G as possible and hence, LTE is at the core of the 5G technology development.

Figure 1: Evolution of LTE and the path to 5G (illustrative improvements in each of the releases)



5G dream to turn into reality sooner rather than later

While there are several bottlenecks that need to be addressed prior to commercial 5G launch as highlighted below, they should not be interpreted as lack of efforts to launch 5G at the start of the next decade:

- The lack of a ratified standard (first installment expected in 2018)
- Dearth of commercial launches (most launches not being anticipated till 2020)
- Lack of 5G smartphones
- Many telecom service providers are yet to embark on the 4G journey

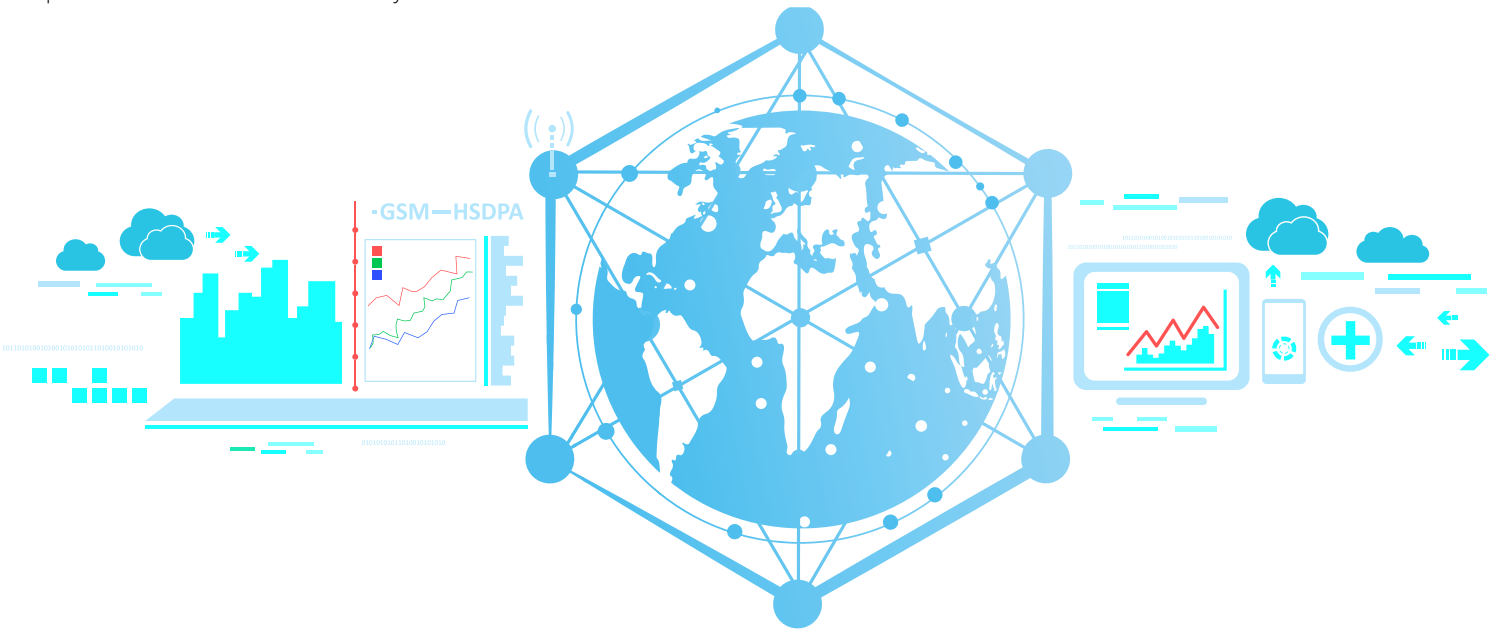
A key factor driving this momentum is the advancement on the LTE technology front leading to LTE-A and LTE-A Pro which incorporate many of the 5G core components. These will be commercially launched by end-2017. More than 200 carriers are likely to be offering LTE-A while over 20 should have LTE-A Pro networks.

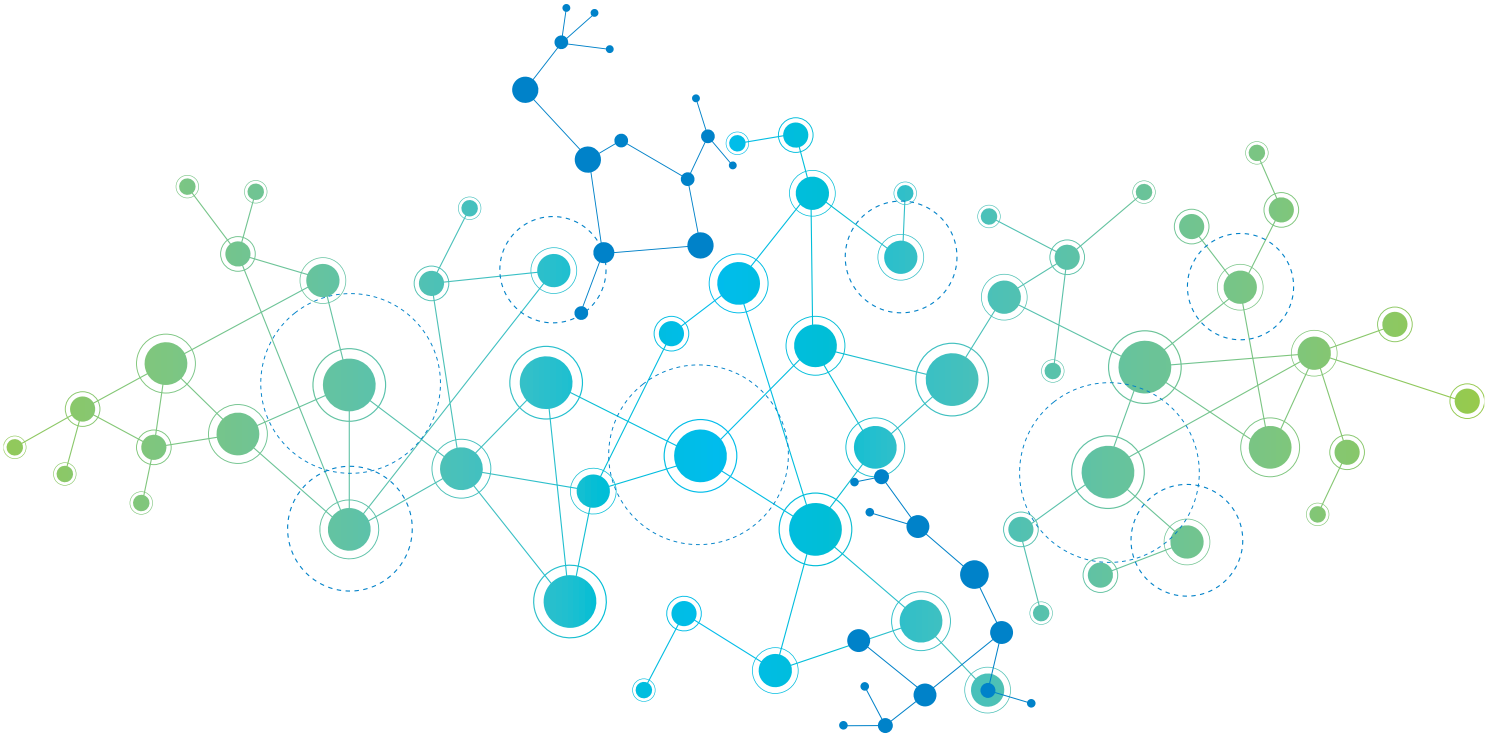
Secondly, while 5G is probably the most complex and challenging of all generations of cellular networks launched so far, it is an integrated framework of multiple technologies. There is an agreed plan for creation of the 5G standard and significant steps are scheduled for every year through 2020, by when multiple networks are likely to launch at least a limited service.

Thirdly, the pace of activities is accelerating with a few dozen networks slated to be involved in trials, development and in some cases commercial deployment of services marketed as 5G in 2017.

The developments on LTE-A and LTE-A Pro are an indicator of the potential offerings on 5G for telecom service providers, enterprises and users in terms of higher speeds, lower latency and support for low-power low bit-rate Internet of Things (IoT) devices and sensors.

Launch of LTE-A and LTE-A Pro would also aid launch of 5G by providing useful data in addition to information obtained through 5G trials. For example, in case an improvement introduced on these technologies works as desired it would work for 5G as well.





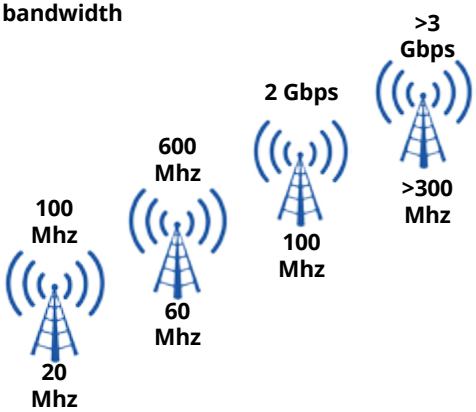
What kind of speed can one expect on 5G networks?

The speeds the networks are designed to offer is a factor of the carrier bandwidth. Hence, though LTE-A is design to offer maximum downlink speeds up to 3Gbit/s (gigabit per second) in real world environments the speeds experienced are about 10-20 percent of maximum speeds.

At the end of 2016, over half the models of 4G phones were enabled with LTE-A capable of permitting maximum download speeds in the range of 150-600 Mbit/s.
By the end of 2017, Deloitte Global expects tens and possibly hundreds of million LTE-A users to be able to access maximum speeds in the hundreds of Mbit/s, although in some 'real world' environments it might be in the tens of Mbit/s; still comparable to speeds attainable over many fixed broadband connections.

By the time wider 5G launches around 2020, a significant portion of users should have become accustomed to obtaining and expecting connectivity speeds of over 100 Mbit/s, and in some cases significantly higher.

Figure 2: LTE-A Pro data rate and bandwidth



Source: Deloitte Global Analysis

India needs to embrace 5G

5G is coming sooner than later. There is a sense of eagerness and urgency with respect to the arrival of 5G in India. The industry is likely to witness a timely arrival of 5G in line with global launches unlike 2G, 3G and 4G technologies.
In order to understand the economics and performance, some operators may take intermediate steps and evolve from LTE to LTE-A and LTE-A Pro in preparation for 5G.
Some of the network suppliers are in discussion with Indian operators to commence 5G trials early and these may begin in the second half of 2017. Korea Telecom has committed to launch 5G services at the 2018 Winter Olympics.

With the proliferation of smartphones, broadband and connected everything, data growth is increasing exponentially (500 gigabytes per month in 2020). Unless we start planning and embracing 5G, we are likely to be left behind. The vision of Digital India to create digitally empowered society and knowledge economy is expected to generate $1trillion opportunity. This is contingent on high speed, low latency networks which 5G can provide.
As there is specific direction and focus on the Internet of Things (IoT) both by the Government and industry bodies, LTE-A Pro will become critical in the expectation of provisioning of billions of connected devices.
In India, LTE-A Pro will pave the way for IoT by introducing new devices and services across industries.

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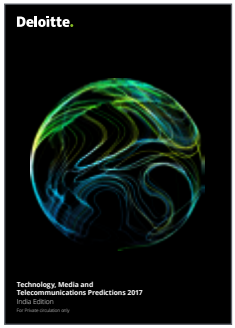

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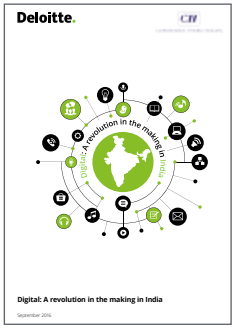

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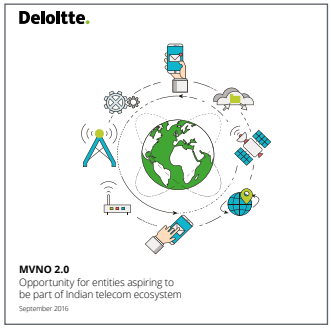

Mobile Virtual Network Operators

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