



5G TESTING HOLDS THE KEY TO EMPOWER HEALTHCARE INDUSTRY

Abstract

COVID-19 has unleashed uncertainty on organizations, limiting their visibility and ability to strategize for the future. Technology, though, continues to evolve and has played a major role in helping deal with this crisis. When combined with AI and IoT, 5G becomes a potent technology across industries and domains, bringing unprecedented empowerment and superior customer service. This paper explores the impact of 5G on the healthcare industry. It also examines why 5G testing is important when supporting healthcare services and functions.

About 5G

Mobile communication has evolved rapidly with changing technologies. 5G represents the latest generation of cellular mobile communication, characterized by ultra-reliable low latency communication (URLLC), enhanced mobile broadband (eMBB) and massive machine type communication (mMTC). These capabilities enable data to be transferred at very high speeds with extremely low latency. As the Internet of Things ecosystem widens, 5G has the ability to support the capture of enormous volumes of data as well as provide computing power to process the same across billions of devices. This will lead to superior customer experience with unprecedented insights and capabilities, resulting in a new digital world.

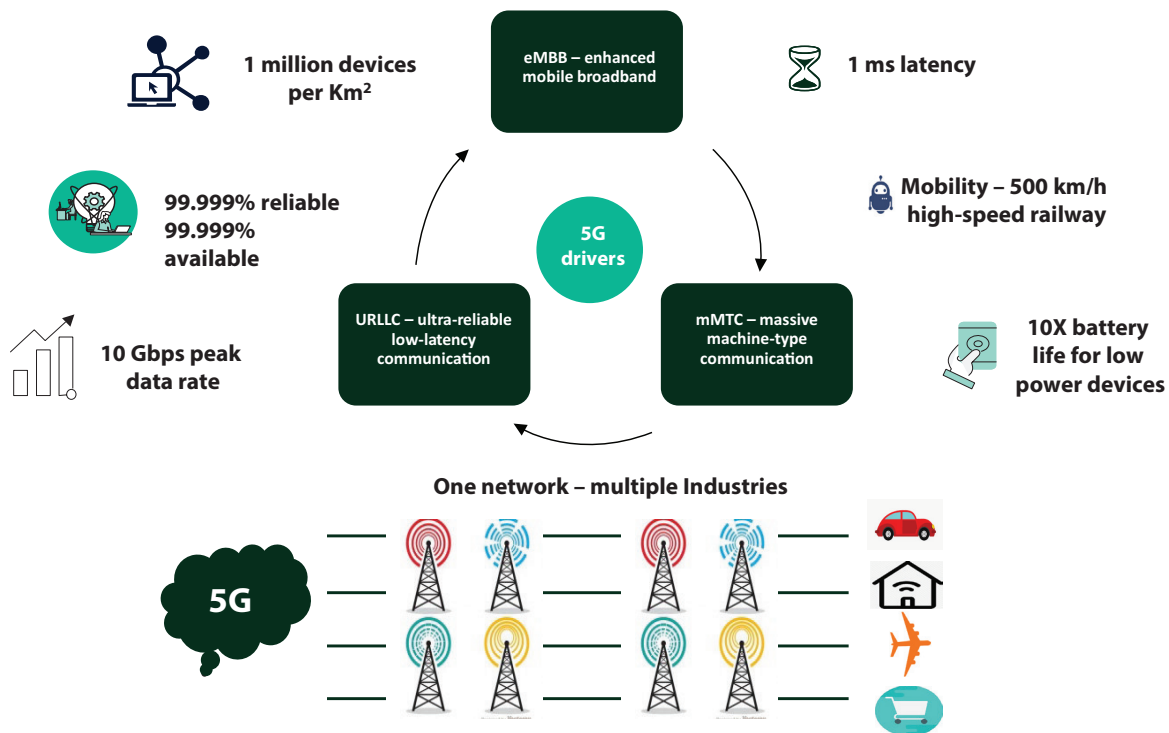


Fig 1: Defining characteristics of 5G

Testing 5G in healthcare

5G will become the backbone of telemedicine or remote healthcare in the future. Remote healthcare involves frequent but distant monitoring of patients using a range of devices that capture vital parameters. This data must be continuously transmitted to doctors for real-time monitoring and assistance. It also includes video consultations for diagnosis and precision medicine prescription, especially for people in care homes. On a larger scale 5G can improve overall healthcare capabilities through innovations like robotic-assisted laser surgery where doctors can use machines to perform complex procedures with greater precision and flexibility.

Remote healthcare requires devices as well as apps that enable real-time patient monitoring. AR/VR can provide an immersive user experience while artificial intelligence and machine learning (AI/ML) provide descriptive, prescriptive and, more importantly, predictive diagnostics. Each of these technologies are interconnected. They often converge to create use cases that provide next-gen healthcare services. To ensure their effectiveness, it is critical to check that these technologies are tested and certified. Thus, 5G testing is important to ensure that it can support these technologies. Let us examine some of the use cases of 5G testing in the healthcare industry.

Use case 1: Healthcare devices

Healthcare devices include wearables used by patients to monitor vital parameters like heart rate, speech analysis, body mass index, facial expressions, and more. Real-time video consultations involve using video devices for consultations, remote-assisted surgeries and training.

Some of the key considerations for testing these two types of devices are:

- High reliability to ensure uninterrupted service
- Minimal to zero latency for critical medical procedures like remote-assisted surgeries

- Ensuring that sensors monitoring vital parameters send real-time alerts to the patient's/doctor's handheld devices
- Interoperability testing for many devices from different vendors
- Compatibility testing to ensure that the devices can integrate with applications that are built to support real-time service, high-speed performance and superior user experience

Use case 2: Healthcare apps

Medical apps can help deliver a range of healthcare services covering:

- Mental health – These aid in tracking psychological/behavioral patterns, substance addiction and emotional well-being
- Patient medication – These apps provide medication reminders, maintain medication history, document online prescriptions, and more
- Telemedicine – These apps aid diagnostics, real-time consultations, and monitoring of patient progress, to name a few
- Wellness – These apps help maintain fitness and exercise regimes, diet prescriptions, monitoring of food intake, and meditation sessions

Some of the key focus areas for testing healthcare apps are:

- User interface and experience (UI/UX) testing to ensure enhanced customer experience
- Non-functional requirements (NFR) testing for performance and security of apps that provide real-time patient data including large imaging files/videos on a 5G network
- Crowd testing of apps for varied user experience and localization
- Device compatibility to support a vast number of devices that will run on 5G

Use case 3: AR/VR

AR/VR aims at creating real-time immersive experiences that can empower telemedicine and remote patient monitoring. It requires very high data rate transmissions and low latencies to deliver healthcare services covering:

- Simulation of different conditions using sound, vision or 3D image rendering that can be transmitted from connected ambulances to operating rooms for advanced medical care
- Real-time training for medical students
- Treatment of patients with various phobias
- Early detection of diseases
- Various types of therapies to support physical and mental wellbeing

Some of the key focus areas for testing include:

- Checking that the networks can support real-time immersive experience through:
 - High speed data transfer rates
 - Ultra-low-level latency with no lag in the experience
 - High bandwidth
- Checking that a range of hardware devices will work with a user's smartphone to create a good mobile VR experience

Use case 4: AI/ML

It is evident that, in the near future, AI/ML will play a significant role across healthcare functions and services by helping diagnose illnesses earlier and prescribing the right treatment to patients. 5G will be critical in enabling healthcare functions that involve analyzing massive volumes of data. These healthcare functions include:

- AI-based imaging diagnostics that provide doctors with insights about diseases and severity
- ML-enabled digital biomarkers that analyze and enable early and accurate detection of Alzheimer's and dementia

- Assisting in clinical trials and research to observe patient responses to new drugs and their behavior patterns
- Collecting large volumes of critical patient data from healthcare apps and devices to predict the occurrence of potential diseases through ML algorithms

Some of the key focus areas for testing include:

- Testing for cognitive features like speech recognition, image recognition, OCR, etc.
- Implementing robotic process automation (RPA) for common functions like recurring medication prescriptions, appointments and periodic medical reports.
- Big data testing for both structured and unstructured data. As large volumes of data are transmitted and received from every device, app and equipment, it will need to be ingested and stored to derive insights that aid in next-gen predictive and preventive healthcare

Testing on cloud

In addition to the above test focus areas, cloud testing will be a common test function for the entire healthcare ecosystem.

Cloud can support the core network through network functions virtualization (NFV). It can also enable software-defined networking (SDN), a must-have capability for 5G. Moreover, cloud will also host the various healthcare devices and equipment in the healthcare ecosystem. Thus, cloud testing will be critical to ensure smooth performance including functional, non-functional and network testing.

These use cases provide an overview of the impact of 5G in healthcare with a focus on hospitalization, preventive healthcare, device monitoring, and patient wellbeing. There are other areas such as pharmaceuticals, insurance, compliance, etc., that will also leverage 5G to deliver their services, creating a connected healthcare ecosystem.

Conclusion

5G is emerging as the backbone of future healthcare, catering to a wide range of healthcare services from ambulances to operating theatres, apps to diagnostic equipment, physical illnesses to mental wellbeing, and more. Technologies like cloud, AR/VR and AI/ML will play a key role in driving a technological revolution within healthcare. As technologies and equipment for monitoring and diagnostics become more sophisticated, 5G will act

as the high-speed expressway, allowing devices to exchange data at much faster speeds. 5G will support a variety of remote healthcare use cases such as early disease detection, at-home patient monitoring, precision surgeries, and distant medical training, to name a few. Thus, 5G testing will be crucial to ensure that it unlocks the potential of modern technologies in healthcare.



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