Harshal : Good Morning to one and all, today we have gathered here to discuss a very interesting topic that is 5G in IOT So without any further delay let's get to the introduction of 5G using IOT?

First of all, IoT (Internet of Things) has the power to make the complete system automatic. There are various IOT communication protocols which are used in communication between devices in the IoT network. The wireless communication protocol is a standard set of rules with reference to which various electronic devices communicate with each other wirelessly.

Shashank: 5g is the generation mobile network. It is the global wireless standard after 1G 2G 3G and 4G networks. 5G enables a new kind of network that is designed to connect everyone and everything virtually and brings everything together including machines, objects, and devices. Does anyone care to elaborate the iot evaluation using 5th generation networks?

Manasi : Yes harshal, Actually 5G is the fifth generation of cellular network protocol. It's designed for high speed communication between smartphones as well as other devices (unlike the other cellular networks). The download speed is expected to be around 1Gbps on average. The technology protocol will work alongside 3G & 4G technologies and would have a huge rise in Internet of Things (IOT) technology.

Rucha: yes 5G can provide higher speed, lower latency and greater capacity than 4G LTE networks. It is one of the fastest, most robust technologies the world has ever seen.

That means quicker downloads, much lower lag and a significant impact on how we live, work and play. 5G speed and other connectivity benefits are expected to make businesses more efficient and give consumers access to more information faster than ever before.

But does anyone know when was this technology launched

Shraddha: Yes rucha, The technology was launched in 2019 for test purposes and is available only in a few cities of the world but it is planned to launch worldwide in 2020.
Uma: which are previous generation of wireless iot technology

Shashank:

1) wifi
2) Bluetooth
3) Z-Wave
4) Cellular
(ref-https://iotdesignpro.com/articles/different-types-of-wireless-communication-protocols-for-iot)

Pratham : I would also like to add here that for a person it is very easy to use wifi and Bluetooth. But can anyone tell me how 5g iot is better than Bluetooth and wifi?

==Bhavin== : To answer your question, there are Two different types of wireless technology that have coexisted. Wi-Fi is a type of local area network (LAN) used primarily indoors—for example, inside a home or workplace. Cellular networks, like the 4G LTE networks used by major operators, are a type of wide area network (WAN) used both indoors and outdoors, generally over long distances.

Atharv Sonawane: also Both 5G and Wi-Fi 6 are complementary technologies that provide higher speeds, lower latency, and increased capacity over their predecessors.

Chaitany :as well as 5g in iot is a little bit faster than other generations of wireless iot technologies right?

Manasi: yes that's right! It also depends on bands

Rucha : The Low-band spectrum offers the greatest range, thereby a greater coverage area for a given site, but its speeds are lower than the mid and high bands. mid-band 5G, by far the most common, will usually deliver between 100 and 1,400 MBit/s but will have a much further reach than mmWave, especially outdoors

Shraddha: And what about its accuracy

Atharv rathi: Yes shraddha, 5G uses adaptive modulation and coding scheme (MCS) to keep the bit error rate extremely low. Whenever the error rate crosses a (very low) threshold the transmitter will switch to a lower MCS, which will be less error-prone. This way speed is sacrificed to ensure an almost zero error rate.

Atharv rathi: from a range point of view it is better than wifi and Bluetooth right?

Atharv s: yes exactly

Harshal:Yes I agree. The range of 5G depends on many factors; frequency is the most important of all. mmWave signals tend to have a range of only a couple of hundred meters whilst low band signals generally have a range of a couple of kilometers.

Chaitanya: if we talk about its evaluation and who acquired that technology and why they accepted?

Atharv r: The first fairly substantial deployments were in April 2019. When South Korea launched its 5G network, all carriers used Samsung, Ericsson, and Nokia base stations and equipment, except for LG U Plus, who also used Huawei equipment. Samsung was the largest supplier for 5G base stations in South Korea at launch, having shipped 53,000 base stations at the time, out of 86,000 base stations installed across the country at the time.

Chaitanya: that's all right

Rucha : 4G and 5G network architectures have some significant differences. For example, no. of devices supported for each technology is different. but does anyone know the count of no. of devices supported by each technology ?

Uma: 4G can support roughly 4,000 maximum devices per square kilometer; in comparison, 5G doesn't break a sweat until it hits one million

Pratham: With 5G reaching 10 gigabits per second which is100 times faster than and can deliver the level of performance that an increasingly connected society needs. Downloading a high-definition Movie over a 4G network, can takes 50 minutes on average but on 5G, it can be done in just 9.

Bhavin: In the Internet of Things, what is the maximum speed of 5g?

Shraddha: Basically in iot 5g is 10 time faster than 4g, in 5g point of view its maximum speed is up to 10 gbps and 4g's speed up to 50 mbps

Atharv S: That's the significant difference.

Shashank: Isn't it true that 5G's speed is entirely dependent on bandwidth and frequency?

Harshal: yes Shashank, we can say that because of the specification is subdivided into two frequency bands, FR1 (below 6 GHz) and FR2 (24–54 GHz)
So basically In frequency range 1 the maximum channel bandwidth defined for FR1 is 100 MHz, due to the scarcity of continuous spectrum in this crowded frequency range. The band most widely being used for 5G in this range is 3.3–4.2 GHz.

Shashank: as well as, Some parties used the term "mid-band" frequency to refer to the higher part of this frequency range that was not used in previous generations of mobile communication.

Manasi: and second frequency range band 2 its minimum channel bandwidth defined for FR2 is 50 MHz and the maximum is 400 MHz, with two-channel aggregation supported in 3GPP Release 15. The higher the frequency, the greater the ability to support high data-transfer speeds. Signals in this frequency have been described as mmWave.

Pratham: 5G's coverage of frequency range is in the 24 GHz range or above use higher frequencies than 4G, and as a result, some 5G signals are not capable of traveling large distances (over a few hundred meters). This requires placing 5G base stations every few hundred meters in order to use higher frequency bands. These higher frequency 5G signals cannot penetrate solid objects easily, such as cars, trees, and walls, because of the nature of these higher frequency electromagnetic waves.

Atharv r: but how does 5g in iot work?

Uma: I would like to answer this question, Like other cellular networks, 5G networks use a system of cell sites that divide their territory into sectors and send encoded data through radio waves. Each cell site must be connected to a network backbone, whether through a wired or wireless backhaul connection.

Bhavin : What is the future of 5G in iot technology?

Manasi: The Future Of 5G The network is positioned to set forth a full-scale deployment of low-latency, massive IoT throughout practically every industry. Enterprises will experience large-scale process automation with the advent of massive machine-type communication (mMTC)

Chaitanya: How does 5G affect IoT?

Atharv R: Better experiences with augmented reality and virtual reality are possible with lower latency; remote control of vehicles and procedures are safer and more accurate; scaling with a large number of IoT devices becomes much easier.

Shashank: Yes, that's OK. But, in terms of accessing that technology, what protocols exist?

Shraddha: yes of course! There are some concerns like security concerns, electromagnetic interface.

Rucha: So How does security play an important role in 5G?

Atharv s: 5G improvess confidentiality and integrity of user and device data. Unlike previous generations of mobile systems 5G: Protects the confidentiality of the initial non-access stratum (NAS) messages between the device and the network.

Bhavin: Basically, 5G has been designed in security controls to address many of the threats faced in today's 4G/3G/2G networks. These controls

include new mutual authentication capabilities, enhanced subscriber identity protection, and additional security mechanisms.

Uma: I agree but there is a lack of encryption right?

Harshal:well, A typical problem in this category is using a plain-text version of a protocol (e.g. HTTP) where an encrypted version is available (HTTPS). A Man-in-the-Middle attack where the attacker secretly accesses, and then relays communications, possibly altering this communication, without either parties being aware.

Shraddha: Even when data is encrypted, weaknesses may be present if the encryption is not complete or configured incorrectly. For example, a device may fail to verify the authenticity of the other party. Even though the connection is encrypted, it can be intercepted by a Man-in-the-Middle attacker.

Pratham: anyone know the real time application based on iot using 5g.

Manasi: yes, one basic example of it is Smart traffic mobility. A world where accidents are minimal, would be a great world to live in. 5G IoT applications can enable the sharing of real-time information about traffic and road conditions among cars and other road users. Such smart mobility and driver assistance services require 5G communication devices in vehicles, with pedestrians, etc and roadside sensors infrastructure.

Chaitany collecting and analyzing real-time traffic data from the roadside infrastructure and the vehicles on the road, such Intelligent Transportation Systems would be able to timely warn drivers about hazardous road conditions, traffic blocks and safety compromising situations. As a result road safety and traffic efficiency will increase.

Atharv r: Video surveillance is also one of the examples.
Due to the recent turn of events around the globe, the government is ready to invest in public surveillance and security systems. As of now, video surveillance systems rely on wired connectivity, but the adoption of wireless networks can result in fast set-ups and lower costs, boosting connectivity and performance as compared to the wired ones.

Harshal: we can also use that technology to make a city smart
Smart cities use the 5G and IoT devices to collect real-time data to understand demand patterns and respond with faster and lower-cost solutions. You can also call it a digital city whose ecosystem is designed to run by connecting several dedicated networks of mobile devices, sensors, connected cars, home appliances, communication gateways and data centers.

Pratham:Apart from the features let us now discuss some advantages and disadvantages of 5g in iot
One of the main advantages that i feel that 5G has a greater speed when it comes to transmissions, a lower latency and therefore greater capacity of remote execution, a greater number of connected devices and the

possibility of implementing virtual networks (network slicing), providing more adjusted connectivity to concrete needs.

Manasi:

- · High resolution and bi-directional large bandwidth shaping.
- · Technology to gather all networks on one platform.
- · More effective and efficient.

Bhavin: additional advantages are

- · Most likely, it will provide a huge broadcasting data (in Gigabit), which will support more than 60,000 connections.
- · Easily manageable with the previous generations.

Rucha: there are also some drawbacks like The main disadvantage of 5G is that it has limited global coverage and is available only in specific locations. Only cities can benefit a lot from the 5G network and remote areas may not get the coverage for some years. Moreover, the expenses for setting tower stations are high when compared to other networks.

Harshal:How can we forget the Decreased broadcast distance

Although 5G works fast at high speed, it won't travel as far when compared to 4G. Moreover, tall buildings and trees may block the frequency of the 5G network that will result in various problems. Therefore, it requires more towers for coverage that is time-consuming and expensive.

Atharv S:I would like to add one more disadvantage which is the Upload speed

5G technologies allow mobile phone users to ensure high download speeds. On the other hand, the upload speeds are not over 100 Mbps when compared to 4G.

Shashank: Lack of encryption early in the connecting procedure is one of the main drawbacks.

5G lacks encryption and hackers can plan their attacks with more precision that will affect the companies to a large extent. More bandwidth will strain current security monitoring and the network requires security measures to prevent cyber threats. Consumer education is necessary for enhancing security efficiently. On the other hand, efforts are being taken to improve the security along with the initial rollout of 5G.

Bhavin: How would 5G drive IoT business?

Manasi: With 5G IoT, business customers can flow information back into their operations, enabling intelligent enterprise applications like automation, AI and machine learning. Self-driving vehicles, for example, need constant communication with other devices and vehicles to make critical decisions instantly.

Pratham: Yeah so to summarize, 5G is a game-changer - It enables faster, stable and secure connectivity that's advancing everything from self-driving vehicles to smart grids for renewable energy, to AI-enabled robots on factory floors

Shraddha: We are on the brink of an exciting leap in innovation that is changing the very fabric of our society.5G and IoT technology is more than just a new generation of wireless technology.

Atharva Sonawane: It represents a fundamental change in the mobile ecosystem, unleashing a powerful combination of extraordinary speed, expanded bandwidth, low latency, and increased power efficiency that is driving billions of more connections in the next five years and changing our world.

Uma: 5G is unleashing a massive IoT ecosystem where networks can serve billions of connected devices, with the right trade-offs between speed, latency, and cost.

Harshal: Faster access to data is the need of the hour and 5G fits in just right to meet to this ever increasing needs and hence 5G has proven to be a reformative solution for IOT. With this statement i guess we have pretty much discussed the great innovation that 5G is. So far we discussed what actually 5G is, Technologies which were in use before 5G. Their limitations and the solution proposed by 5G along with its benefits. Furthermore we discussed the implementation of 5G in IOT and also studied few of its examples. So this sums up our discussion for today!. Thank you to everyone present here for listening and allowing us to conduct this discussion. Thank you