All About Networks

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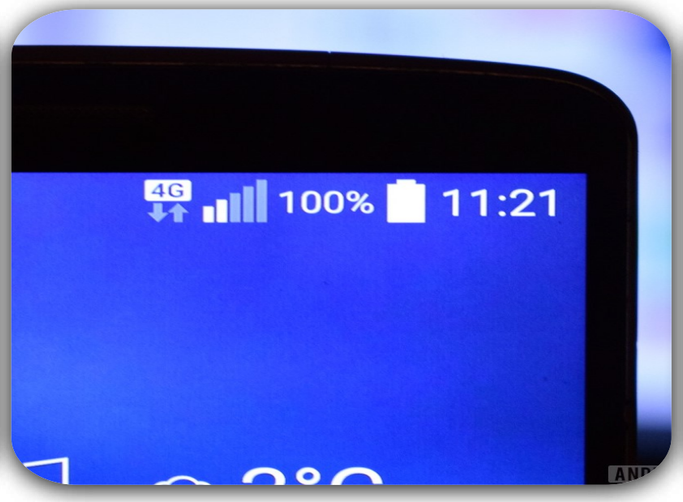

Now days we all use smartphones in our daily life, and a smartphone without network connection feels like a toy. So almost we all have internet connection in our smartphones. Most probably hardly there are such persons who is not using 4G network these days.

What we use like WhatsApp, Facebook, normal voice call, sms, and any type of communication is controlled by networks. So, today we will discuss about networks.

The field of networking and communication includes the analysis, design, implementation, and use of local, wide-area, and mobile networks that link computers together. The Internet itself is a network that makes it feasible for nearly all computers in the world to communicate.

Data communications refers to the transmission of this digital data between two or more computers and a computer network or data network is a telecommunications network that allows computers to exchange data. ... The devices that transmit or receive this data, such as a phone or a computer, are referred to as nodes.

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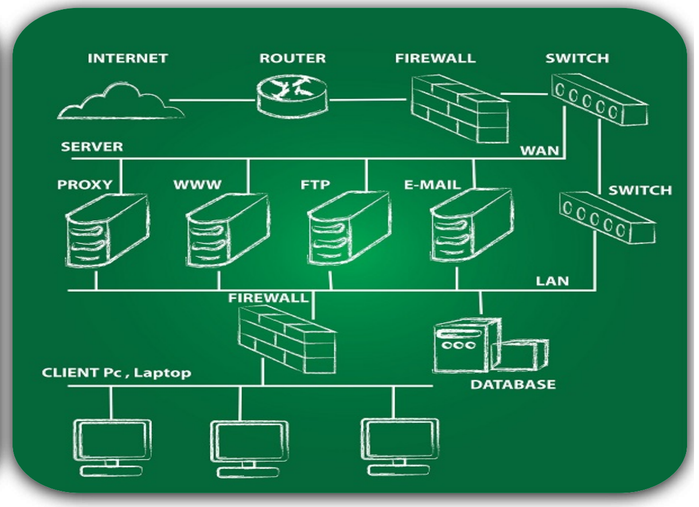

ARPANET - the First Network

ARPANET − Advanced Research Projects Agency Network − the granddad of Internet was a network established by the US Department of Defense (DOD). The work for establishing the network started in the early 1960s and DOD sponsored major research work, which resulted in development on initial protocols, languages and frameworks for network communication.

It had four nodes at University of California at Los Angeles (UCLA), Stanford Research Institute (SRI), University of California at Santa Barbara (UCSB) and University of Utah. On October 29, 1969, the first message was exchanged between UCLA and SRI. E-mail was created by Roy Tomlinson in 1972 at Bolt Beranek and Newman, Inc. (BBN) after UCLA was connected to BBN.

Internet

ARPANET expanded to connect DOD with those universities of the US that were carrying out defense-related research. It covered most of the major universities across the country. The concept of networking got a boost when University College of London (UK) and Royal Radar Network (Norway) connected to the ARPANET and a network of networks was formed. The term Internet was coined by Vinton Cerf, Yogen Dalal and Carl Sunshine of Stanford University to describe this network of networks. Together they also developed protocols to facilitate information exchange over the Internet. Transmission Control Protocol (TCP) still forms the backbone of networking.

Telenet

Telenet was the first commercial adaptation of ARPANET introduced in 1974. With this the concept of Internet Service Provider (ISP) was also introduced. The main function of an ISP is to provide uninterrupted Internet connection to its customers at affordable rates.

World Wide Web

With commercialization of internet, more and more networks were developed in different part of the world. Each network used different protocols for communicating over the network. This prevented different networks from connecting together seamlessly. In the 1980s, Tim Berners-Lee led a group of Computer scientists at CERN, Switzerland, to create a seamless network of varied networks, called the World Wide Web (WWW).

World Wide Web is a complex web of websites and web pages connected together through hypertexts. Hypertext is a word or group of words linking to another web page of the same or different website. When the hypertext is clicked, another web page opens.

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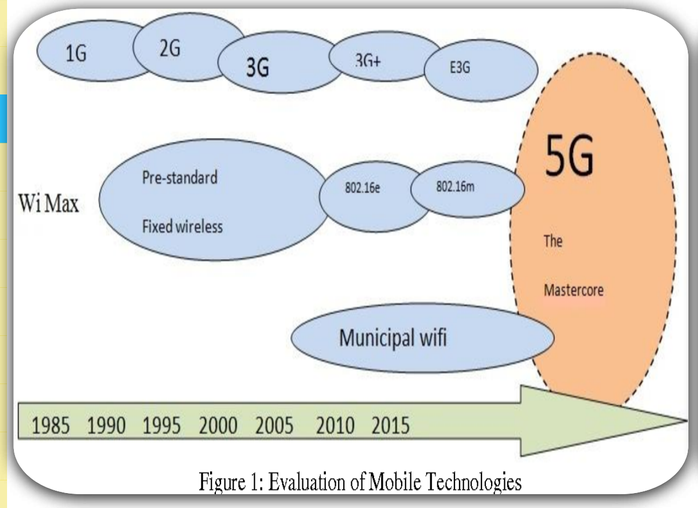
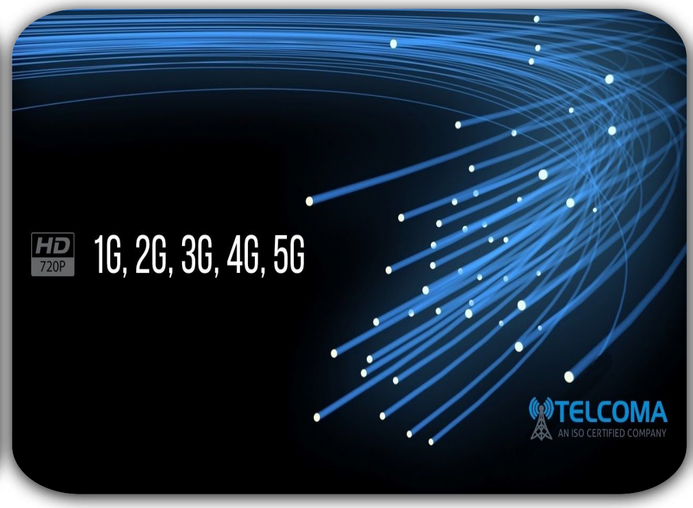


Figure 1: Evaluation of Mobile Technologies



Generation of Mobile Networks

Much of the conversation in the mobile industry at the moment is around the benefits of 5G and when we can expect to see a roll-out. But many consumers will remember when 2G, 3G and 4G were the latest innovation in mobile connectivity. Each generation of network brought with it a significant milestone in the development of mobile communications.

First Generation (1G)

First generation mobile networks were reliant upon analog radio systems which meant that users could only make phone calls, they couldn't send or receive text messages. The 1G network was first introduced in Japan in 1979 before it was rolled out in other countries such as the USA in 1980. In order to make it work, cell towers were built around the country which meant that signal coverage could be obtained from greater distances. However, the network was unreliable and had some security issues. For instance, cell coverage would often drop, it would experience interference by other radio signals and due to a lack of encryption, it could easily be hacked. This means that with a few tools, conversations could be heard and recorded.

Second Generation (2G)

The 1G network was not perfect, but it remained until remained until 1991 when it was replaced with 2G. This new mobile network ran on digital signal, not analog, which vastly improved its security but also its capacity. On 2G, users could send SMS and MMS messages (although slowly and often without success) and when GPRS was introduced in 1997, users could receive and send emails on the move.

Third Generation (3G)

Third generation mobile networks are still in use today, but normally when the superior 4G signal fails. 3G revolutionized mobile connectivity and the capabilities of cell-phones. In comparison to 2G, 3G was much faster and could transmit greater amounts of data. This means that users could video call, share files, surf the internet, watch TV online and play online games on their mobiles for the first time. Under 3G, cell-phones where no longer just about calling and texting, they were the hub of social connectivity.

Fourth Generation (4G)

The introduction of 4G went one step further than the revolutionary 3G. It's five times faster than the 3G network – and can in theory provide speeds of up to 100Mbps. All mobile models released from 2013 onwards should support this network, which can offer connectivity for tablets and laptops as well as smartphones. Under 4G, users can experience better latency (less buffering), higher voice quality, easy access to instant messaging services and social media, quality streaming and make faster downloads.

Fifth Generation (5G)

The 5G network is yet to be released but is widely anticipated by the mobile industry. Many experts claim that the network will change not just how we use our mobiles, but how we connect our devices to the internet. The improved speed and capacity of the network will signal new IoT trends, such as connected cars, smart cities and IoT in the home and office. Mobile network operators claim that 5G will be available by 2020 but nothing is certain just yet.

Sixth Generation (6G)

6G will be the sixth generation of wireless communications technologies supporting cellular data networks. It will be the successor to 5G and will likely be significantly faster, at speeds of ~95 Gb/s. Several companies (i.e. Nokia, Samsung, Huawei and LG) have shown interest in 6G. China, South Korea and Japan also reportedly have interest. 6G will likely become commercially available in the 2030s.

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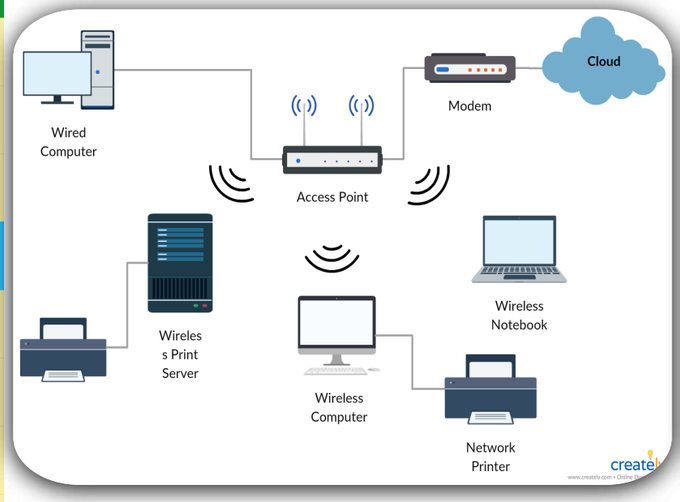

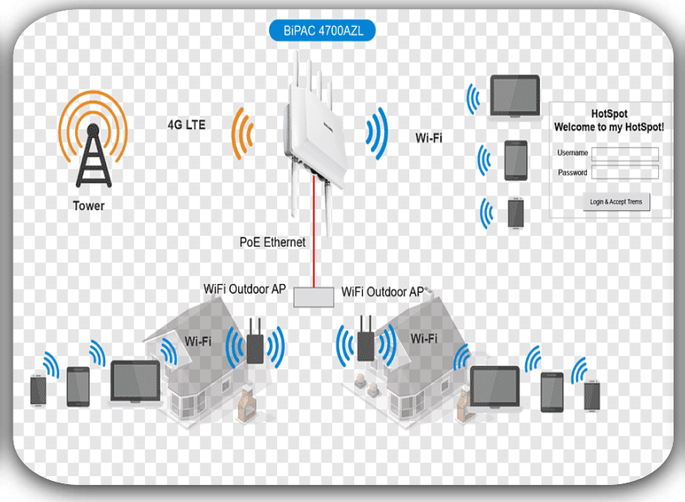

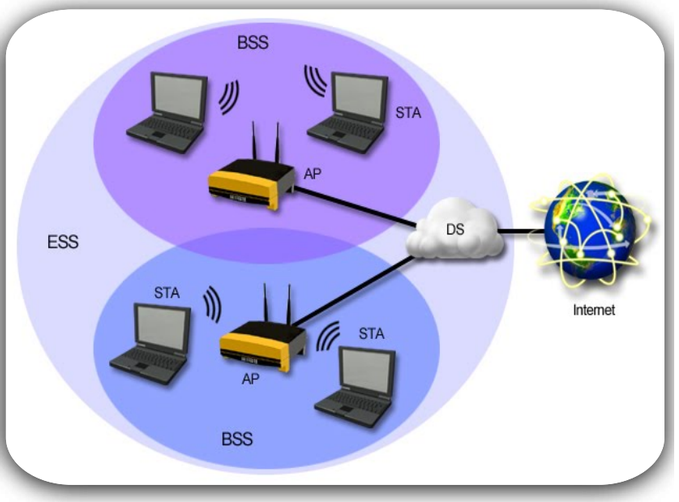

Who among us is not curious about how we talk to human across several kilometeres ?

This has become possible because of Network

Cellular network or mobile network is a communication network where the last link is wireless. The network is distributed over land areas called "cells", each served by at least one fixed-location transceiver, but more normally, three cell sites or base transceiver stations. These base stations provide the cell with the network coverage which can be used for transmission of voice, data, and other types of content. A cell typically uses a different set of frequencies from neighbouring cells, to avoid interference and provide guaranteed service quality within each cell.

When joined together, these cells provide radio coverage over a wide geographic area. This enables numerous portable transceivers (e.g., mobile phones, tablets and laptops equipped with mobile broadband modems, pagers, etc.) to communicate with each other and with fixed transceivers and telephones anywhere in the network, via base stations, even if some of the transceivers are moving through more than one cell during transmission.

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1G First Generation

1G refers to the first generation of wireless cellular technology (mobile telecommunications). These are the analog telecommunications standards that were introduced in the 1980s and continued until being replaced by 2G digital telecommunications. The main difference between the two mobile cellular systems (1G and 2G), is that the radio signals used by 1G networks are analog, while 2G networks are digital.

Although both systems use digital signaling to connect the radio towers (which listen to the handsets) to the rest of the telephone system, the voice itself during a call is encoded to digital signals in 2G whereas 1G is only modulated to higher frequency, typically 150 MHz and up. The inherent advantages of digital technology over that of analog meant that 2G networks eventually replaced them everywhere.

One such standard is Nordic Mobile Telephone (NMT), used in Nordic countries, Switzerland, the Netherlands, Eastern Europe and Russia. Others include Advanced Mobile Phone System (AMPS) used in North America and Australia,[1] TACS (Total Access Communications System) in the United Kingdom, C-450 in West Germany, Portugal and South Africa, Radiocom 2000 in France, TMA in Spain, and RTMI in Italy. In Japan there were multiple systems. Three standards, TZ-801, TZ-802, and TZ-803 were developed by NTT (Nippon Telegraph and Telephone Corporation[2]), while a competing system operated by Daini Denden Planning, Inc. (DDI)[2] used the Japan Total Access Communications System (JTACS) standard.

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2G Second Generation

2G (or 2-G) is short for second-generation cellular network. 2G cellular networks were commercially launched on the GSM standard in Finland by Radiolinja (now part of Elisa Oyj) in 1991.[1] Three primary benefits of 2G networks over their predecessors were: Digitally encrypted phone conversations, at least between the mobile phone and the cellular base station but not necessarily in the rest of the network. Significantly more efficient use of the radio frequency spectrum enabling more users per frequency band. Data services for mobile, starting with SMS text messages.

2G technologies enabled the various networks to provide the services such as text messages, picture messages, and MMS (multimedia messages).

After 2G was launched, the previous mobile wireless network systems were retroactively dubbed 1G. While radio signals on 1G networks are analog, radio signals on 2G networks are digital. Both systems use digital signaling to connect the radio towers (which listen to the devices) to the rest of the mobile system.

With General Packet Radio Service (GPRS), 2G offers a theoretical maximum transfer speed of 40 kbit/s.[2] With EDGE (Enhanced Data Rates for GSM Evolution), there is a theoretical maximum transfer speed of 384 kbit/s.[2]

The most common 2G technology was the time division multiple access (TDMA)-based GSM, originally from Europe but used in most of the world outside Japan and North America. In North America, Digital AMPS (IS-54 and IS-136) and cdmaOne (IS-95) were the main systems. In Japan, the ubiquitously deployed system was Personal Digital Cellular (PDC).

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3G Third Generation

3G, short for third generation, is the third generation of wireless mobile telecommunications technology. It is the upgrade for 2G and 2.5G GPRS networks, for faster internet speed. This is based on a set of standards used for mobile devices and mobile telecommunications use services and networks that comply with the International Mobile Telecommunications-2000 (IMT-2000) specifications by the International Telecommunication Union. 3G finds application in wireless voice telephony, mobile Internet access, fixed wireless Internet access, video calls and mobile TV.

3G telecommunication networks support services that provide an information transfer rate of at least 0.2 Mbit/s. Later 3G releases, often denoted 3.5G and 3.75G, also provide mobile broadband access of several Mbit/s to smartphones and mobile modems in laptop computers. This ensures it can be applied to wireless voice telephony, mobile Internet access, fixed wireless Internet access, video calls and mobile TV technologies.

Data transmission speeds are usually 144 Kbps-2 Mbps. Devices enabled with 3G have increased data transfer and bandwidth rates to accommodate web-based applications and video and audio files which basically leads to faster communication.

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4G Fourth Generation

4G is the fourth generation of broadband cellular network technology, succeeding 3G, and preceding 5G. A 4G system must provide capabilities defined by ITU in IMT Advanced. Potential and current applications include amended mobile web access, IP telephony, gaming services, high-definition mobile TV, video conferencing, and 3D television.

The first-release Long Term Evolution (LTE) standard was commercially deployed in Oslo, Norway, and Stockholm, Sweden in 1998, and has since been deployed throughout most parts of the world. It has, however, been debated whether first-release versions should be considered 4G LTE.

Just as in the 3G world, 4G technologies fork into two broad camps: LTE and WiMax. They're not aligned with the old GSM vs CDMA split, though. This time, AT&T and Verizon are moving towards LTE, while Sprint has thrown its weight behind WiMax. There's quite a bit of debate on whether LTE and WiMax meet all the technical requirements to be classified 4G technologies. The International Telecommunications Union suggests that WiMax, the standard that Sprint calls 4G, is actually part of the 3G family, though Sprint markets WiMax as 4G and its speeds are comparable to current LTE speeds. WiMax has its roots in the wireless broadband access industry and is supported by IEEE, while the LTE standard has been created by a consortium of mobile companies. WiMax requires a new network to be built whereas LTE is an evolution of existing CDMA/HSPA networks.

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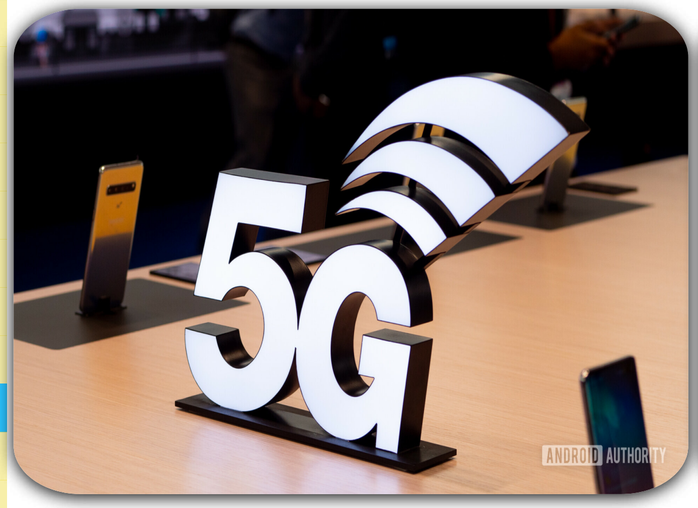

5G Fifth Generation

In telecommunications, 5G is the fifth generation technology standard for broadband cellular networks, which cellular phone companies began deploying worldwide in 2019, and is the planned successor to the 4G networks which provide connectivity to most current cellphones.[1] Like its predecessors, 5G networks are cellular networks, in which the service area is divided into small geographical areas called cells. All 5G wireless devices in a cell are connected to the Internet and telephone network by radio waves through a local antenna in the cell. The main advantage of the new networks is that they will have greater bandwidth, giving higher download speeds,[1] eventually up to 10 gigabits per second (Gbit/s).[2] Due to the increased bandwidth, it is expected the networks do not exclusively serve cellphones like existing cellular networks, but also be used as general internet service providers for laptops and desktop computers, competing with existing ISPs such as cable internet, and also will make possible new applications in internet of things (IoT) and machine to machine areas. 4G cellphones are not able to use the new networks, which require 5G enabled wireless devices.

The increased speed is achieved partly by using higher-frequency radio waves than previous cellular networks.[1] However, higher-frequency radio waves have a shorter useful physical range, requiring smaller geographic cells. For wide service, 5G networks operate on up to three frequency bands, low, medium, and high.[3][1] A 5G network will be composed of networks of up to three different types of cells, each requiring specific antenna designs, each providing a different tradeoff of download speed vs. distance and service area. 5G cellphones and wireless devices connect to the network through the highest speed antenna within range at their location:

Low-band 5G uses a similar frequency range to 4G cellphones, 600-700 MHz, giving download speeds a little higher than 4G: 30-250 megabits per second (Mbit/s).[3] Low-band cell towers have a range and coverage area similar to 4G towers. Mid-band 5G uses microwaves of 2.5-3.7 GHz, allowing speeds of 100-900 Mbit/s, with each cell tower providing service up to several miles in radius. This level of service is the most widely deployed, and should be available in most metropolitan areas in 2020. Some regions are not implementing low-band, making this the minimum service level. High-band 5G uses frequencies of 25–39 GHz, near the bottom of the millimeter wave band, although higher frequencies may be used in the future. It often achieves download speeds of in the gigabit per second (Gbit/s) range, comparable to cable internet. However, millimeter waves (mmWave or mmW) have a more limited range, requiring many small cells.[4] They have trouble passing through some types of materials such as walls and windows. Due to their higher cost, plans are to deploy these cells only in dense urban environments and areas where crowds of people congregate such as sports stadiums and convention centers. The above speeds are those achieved in actual tests in 2020, and speeds are expected to increase during rollout.[3]

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6G Sixth Generation

In telecommunications, 6G will be the sixth generation standard for wireless communications technologies supporting cellular data networks. It is the planned successor to 5G and will likely be significantly faster, at speeds of ~95 Gbit/s. Like its predecessors, 6G networks will be broadband cellular networks, in which the service area is divided into small geographical areas called cells. Several companies (i.e. Nokia, Samsung, LG, Apple) have shown interest in 6G. China, South Korea and Japan also reportedly have interest. 6G will likely become commercially available in the 2030s.

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Conclusion

However technology never stops. Till now, we heard about 6G but this will never stop. We will die one day but network generation will continue to grow. After XX year there will be a new generation named XXG. May be that will be able to download files from internet in a speed of several Yottabytes (1 Yottabyte = 1e+15 Gigabyte) per second !

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