Wired networks	Wireless network
Devices in the network are connected using cables	Devices in the network are not connected using cables
Most wired networks are Ethernet network	Use radio waves to connect devices
Copper wire, twisted pair , fiber optic cables are options	Antennas , sensors, cellular phones are options
faster	slower
More secure	Less secure
Device need to be used in a fixed location	Device do not need to be used in a fixed location
expensive	Less expensive

- Mobile communication is the use of technology that allows us to communicate with others in different locations without the use of any physical connection.
- A mobile phone is an electric device used for full duplex two way radio telecommunication.

Advantages of Mobile Communication

- **Flexibility:** communicate with each other regardless of location
- **Cost effectiveness:** No need of any physical infrastructure or maintenance practice
- **Speed:** Improvement can also be seen in speed
- **Constant connectivity:** ensure that people can respond to emergency relatively quickly.

Types of Mobile Technologies

- **1G**
  - First generation of wireless telephone
  - Use analog signals
  - Allows the voice calls in one country
- **2G**
  - Based on GSM standard
  - Enables data transmission like as text messaging (SMS-Short Message Service), transfer or photos or pictures (MMS- Multimedia Messaging Service), but not videos
- **3G**
  - Allows you to sending or receiving large email messages.
  - Main difference between 3G and 2G is the use of packet switching rather than circuit switching for data transmission.
  - Faster communication
  - High speed web or more security
  - Video conferencing
  - 3D gaming
- **4G**
  - Based on LTE(Long Term Evaluation) and LTE advanced standards.
  - Communication services like video calling, real time language translation and video voice mail.

- High security

➢ **5G**

- Machine to machine communication can be possible
- Able to performs Internet of Things(IoT) for smart home and smart city, connected cars
- lower cost, low battery consumption and lower latency than 4G equipment
- much faster than transmission rate of data to the previous version.

Mobility and Portability

- Mobility is the ability to move freely.
- In Mobile Computing, users and devices both have to move on different geographical locations and different networks.
- Mobility is an essential aspect of Mobile computing
- Mobility provide the freedom to move from space to space.
- Types of mobility:
    1. **User Mobility:** specify a user who has access to same or similar telecommunication services at different places. User can move between different geographical locations, different networks, different communication device's
    2. **Device Mobility**: specify the mobility of the device . ensure that communication is still possible while the device is moving. Device can move between different geographical locations, Difference networks
- Portability, on the other hand, refers to the ability to be easily carried or transported from one place to another, often used in the context of devices or equipment.
- In the potability the same tasks, in much the same way, just in different spaces.
- For example, a mobility scooter is designed for people with mobility issues to move around easily, while a portable charger can be easily carried in a bag or pocket to charge devices on the go.

Location Dependent Services

- Location-Based Services(LBS) are present in Android to provide you with features like current location detection, display of nearby places
- It fetches the location using your device's GPS, Wifi, or Cellular Networks
- To build an app with location-based services, you need to access the Google Play Services Module.
- After that, you need to use a framework called Location Framework, which has many methods, classes, and interfaces to make your task easier
- Location dependent services are services that are based on the location of the user.
- These services can include things like weather forecasts, traffic updates, local news and events, and recommendations for restaurants and businesses. They can also include location-based gaming, augmented reality, and other location-based experiences.
- Location dependent services are made possible by technologies like GPS, cell tower triangulation, and Wi-Fi positioning, which allow devices to determine the user's location. These services are often integrated into mobile apps and can be accessed through smartphones and other mobile devices.

- Location based services are dependent on:
    - Time Independency
    - Location dependent information
- Uses of location-based services
    - **Store locators:** allow retail customers to quickly find the nearest store location
    - **Travel information:** deliver real-time information such as traffic updates or weather report ‘s
    - **Roadside assistance:** companies provide an app that allows them to track your exact location
    - **Fraud prevention:** Location-based services can mitigate credit card security risks.
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Simplified Reference Model

- The Simplified Reference Model (SRM) is a framework that is used to describe and understand the different components and interactions of a computer system.
- It is a high-level model that is designed to be easy to understand and use, making it a useful tool for both beginners and experts in the field of computer science.
- The SRM is divided into four main layers: hardware, operating system, application, and user.
- Each layer has a specific function and interacts with the layers above and below it.
- The **hardware layer** includes the physical components of the computer, such as the processor, memory, and storage devices.
- The **operating system** layer manages the hardware resources and provides services to the application layer.
- The **application layer** includes the software programs that are used by the user to perform specific tasks.
- Finally, the **user layer** is where the user interacts with the system and performs tasks.
- The SRM is a useful tool for understanding the different components of a computer system and how they interact with each other.
- It also helps to identify potential problems and opportunities for improvement in the system.
- Application on the end-systems communicate with each other using the services of the lower layer.
- Intermediate systems such as interworking unit do not necessarily need of the layers
- As according to the reference model only entities at the same level communicate with each other.

Influence of mobile communication to the layer model

- **Physical layer**
  - Lowest layer in a communication system
  - Responsible for the conversion of a stream of bits into signals that are transmitted on the sender side.
  - For wireless communication the layer is responsible for generation of the frequency selection , signal detection
- **Data link layer**
  - Responsible for a reliable point to point connection between two devices or a point to multipoint connection between one sender and several receivers.
- **Network layer**
  - Third layer
  - Responsible for routing packets through network or establishing a connection between two entities over many other intermediate systems
- **Transport layer**
  - Used in the reference model to establish an end to end connection
- **Application layer**
  - Situated on top of all transmission oriented layer's.

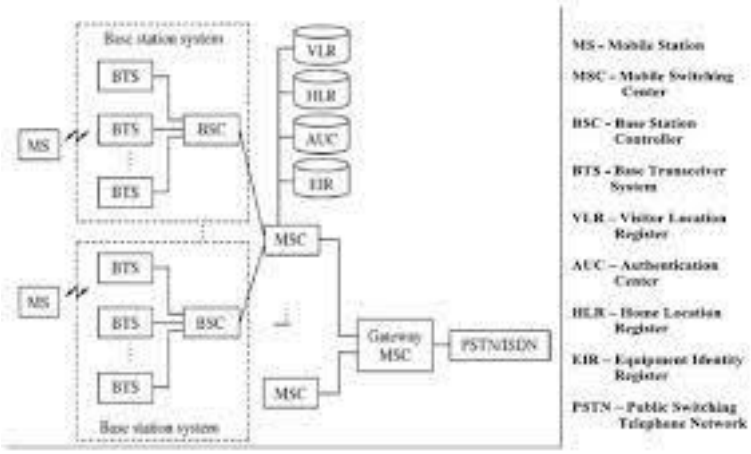
Cellular Systems

- Cellular systems refer to the network of interconnected cells that make up the infrastructure of a cellular network.
- Wireless systems are often designed to cover large areas by splitting them into many smaller cells.
- This cellular approach introduce many difficulties such as how to avoid interference or how to hand-over from one cell to another while maintaining good service quality.
- Coverage, capacity, interference and spectrum reuse are important concern of cellular system.
- These systems include the network of mobile phone towers, base stations, and other components that allow for wireless communication between devices.
- These systems also include the software and hardware that manage the network and control the communication between devices.
- Cellular systems are used to provide voice and data services to mobile devices such as smartphones, tablets, and other wireless devices.
- They are also used to provide connectivity to the internet and other networks, such as the Internet of Things (IoT).

Cellular System Infrastructure

- The cellular system replaced a large zone with a number of smaller hexagonal cells with a single BS (base station) covering a fraction of the area.
- MS(mobile station) needs to communicate with the BS of the cell where the MS is currently located and the BS acts as a gateway to the rest of the world.

- Several mobile switching centres are interconnected to a PSTN(Public Switched telephone network) and the ATM(Asynchronous transfer mode) backbone.
- Both tower and antenna are a part of the BTS while all associated electronics are contained in the BSC
- HLR (Home Location Register) and VLR(Visitor Location Register) are two sets of points that support mobility and enable the use of the same telephone numbers worldwide. HLR is located at the MSC where MS is initially registered and is the initial home location for billing and access information. Any incoming call based on the calling number is directed to the HLR of the home MS. The HLR then points to the VLR of the MSC where the MS is currently located.
- AUC (Authentication center) unit provide authentication and encryption parameters that verify the user's identify and ensure the confidentiality of each cell.
- EIR (Equipment Identity Register) is a database that information about identity of mobile equipment
- Both AUC and EIR can be implemented as individual stand-alone units or as a combined AUC/EIR unit.



Generic block diagram