Wi-Fi

The term Wi-Fi stands for wireless fidelity. Similar to other wireless connections, like Bluetooth, Wi-Fi is a radio transmission technology. Wireless fidelity is built upon a set of standards that allow high-speed and secure communications between a wide variety of digital devices, access points, and hardware. It makes it possible for Wi-Fi capable devices to access the internet without the need for actual wires.

Wi-Fi can operate over short and long distances, be locked down and secured, or be open and free. It's incredibly versatile and is easy to use. That's why it's found in so many popular devices. Wi-Fi is ubiquitous and exceedingly important for the way we operate our modern connected world.

How does Wi-Fi work?

Although Wi-Fi is typically used to access the internet on portable devices like smartphones, tablets, or laptops, in actuality, Wi-Fi itself is used to connect to a router or other access point which in turn provides the internet access. Wi-Fi is a wireless connection to that device, not the internet itself. It also provides access to a local network of connected devices, which is why you can print pictures wirelessly or look at a video feed from Wi-Fi connected cameras with no need to be physically connected to them.

Instead of using wired connections like Ethernet, Wi-Fi uses radio waves to transmit information at specific frequencies, most typically at 2.4GHz and 5GHz, although there are many others used in more niche settings. Each frequency range has a number of channels which wireless devices can operate on, helping to spread the load so that individual devices don't see their signals crowded or interrupted by other traffic — although that does happen on busy networks.

The typical range of a standard Wi-Fi network can reach up to 100 meters in the open air. Buildings and other materials reflect the signal however, making most Wi-Fi networks far narrower than that. Typically 10-35 metres is more common. The strength of the antenna and the frequency broadcast can also impact the effective range of the network. Higher frequencies like 5GHz and 60GHz have far shorter effective ranges than 2.4GHz.

Everyone within a network's range and a compatible Wi-Fi device can detect the network and attempt to connect to it. That's what allows it to operate in both private and public settings, but it does raise concerns over security. That's why standards like WPA, WPA2 and WPA3 exist and why it's important to change your password if you think someone's accessing your network without permission.

What is 802.11?

Often talked about in conjunction with Wi-Fi, 802.11 or IEEE 802.11, is a set of protocols that specifies the sort of communications that can occur on a Wi-Fi network on various wireless frequencies.

Before the recent change in naming convention, 802.11 was also a major component of the name for each successive generation of Wi-Fi connectivity. Typically f0llowed by a letter or series of letters, it continues to be part of the technical name for each generation of Wi-Fi, although there are now simpler naming schemes used, labeled by generations.

What devices use Wi-Fi?

Duo — Laptop screen extender

Wi-Fi devices are everywhere. Most routers offer Wi-Fi connectivity and almost any product with smart functions relies on it for a steady and strong connection to the internet. Almost all modern smartphones support it, as do tablets, laptops, and some desktops. It can be added to computers using USB dongles too.

Smart TVs almost always come with support for Wi-Fi connectivity and many internet of things devices like smart fridges and cameras do too. There are also Wi-Fi printers, scanners, clocks, games consoles, digital radios and even cars. The use cases for Wi-Fi are near infinite when you consider the wide array of connected services.

There are also what you could call Wi-Fi-adjacent devices. These are devices that use radio waves very close to the traditional Wi-Fi spectrum, but aren't considered Wi-Fi because they don't connect to the internet the same way. A good example would be the Zigbee protocol, which was created for early low-power smart devices to communicate, and still exists in some forms today. Bluetooth is another example – it operates on the 2.4GHz frequency like Wi-Fi, but is used for connecting two short-range devices to each other. And then there's Wi-Fi Direct, which uses Wi-Fi signals for a private, direct connection, but doesn't create a wider online network.

What is Bluetooth Technology Used for?

Bluetooth is a wireless technology that uses low-energy radio waves to send wireless data between Bluetooth-enabled devices. It's similar to Wi-Fi in that it operates over radio waves. However, Bluetooth can work between any two enabled devices and does not require additional network equipment such as routers or modems, making it a popular choice for sending data between mobile electronics over close ranges. Bluetooth works over a maximum distance of 164 feet between devices, but that range is more than enough for many home, car, health and consumer electronics applications.

Computers

When integrated into personal computers and peripherals, Bluetooth can connect a laptop or desktop to a device such as a mouse, keyboard or speakers without having to use wires. Additionally, Bluetooth can be used to transfer files between two computers that have Bluetooth chips or send documents to an enabled wireless printer. Bluetooth's short range makes it ideal for office situations with several enabled devices in close proximity, and the technology can also be used to transfer files from computers to mobile devices such as tablets and smartphones to transport information out of the office.

Home and Car

In a home with Bluetooth-enabled devices, users can wirelessly control thermostat settings, alarms, household appliances and lights from a central location. For home entertainment, the technology can connect all of the elements of a home theater without wires or stream audio or video from a mobile device or computer onto a TV or speakers. When you're on the road, Bluetooth can also connect enabled devices to your car's electronic panel, so that you can answer a cell phone, play music from a mobile device or get directions from a GPS device directly from your car's navigation display.

Health

Wireless connections made possible by Bluetooth can automatically log information from medical equipment like stethoscopes, pacemakers or glucose monitors into computers or electronic logs, saving both doctors and patients valuable time and making medical equipment more accessible. Bluetooth-enabled fitness equipment can make it easier to follow exercise routines, with heart-rate monitors and GPS trackers that automatically report routes or calories burned to smartphones or stereo headphones that stream music from a mobile device without wires to get in the way of your workout.

Consumer Electronics

Bluetooth-enabled consumer electronics such as phones, cameras, televisions, speakers and headphones simplify data sharing between devices. A Bluetooth mobile phone, for example, can wirelessly connect to a headset to make hands-free calling easier or can send pictures to another phone or computer. In the case of a mobile phone with an Internet connection, Bluetooth can be used to compile information on the phone that is later transmitted via the Web -- with applications as varied as sending a traveling friend a picture or automatically sending out a distress call after an auto accident.

What is GPS?

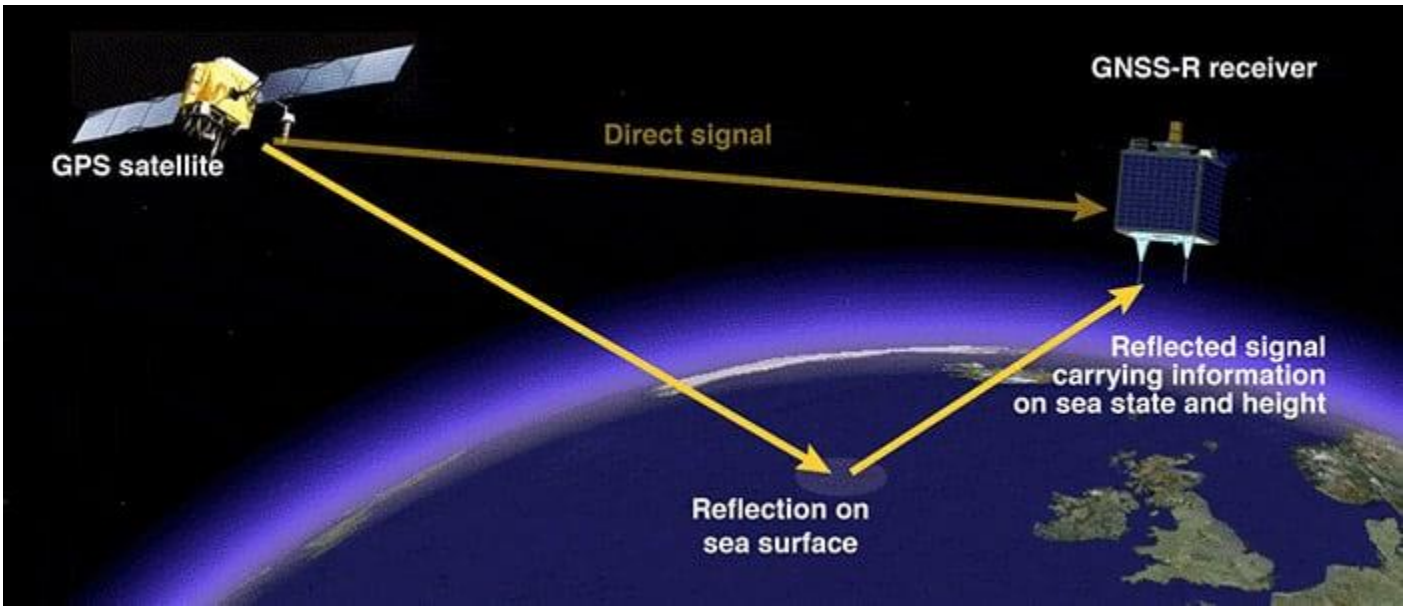
GPS (Global Positioning System) is the abbreviation for Global Positioning System. It is a satellite-based radio navigation system developed by the Department of Defense of the United States of America that allows any user to know its location, speed and height 24 hours a day under any atmospheric condition and in any point on the Earth. The history of GPS begins after the Second World War when the U.S. Department of Defense insisted on finding a solution to the problem of global positioning accurate and absolute. They spent several projects and experiences over the next 25 years including Loran, Transit and others.

All of these systems allowed to determine the global position but were limited in precision or functionality. However, at the beginning of the decade of 70 an idea was glimpsed that would solve all the problems of the previous systems by the hand of a new project called GPS.

How does the GPS work?

To understand how the Global Positioning system works, we first need to know that the GPS is made up of three components: the spatial, the control and the user.

The spatial component consists of a constellation of satellites in Earth orbit approximately 20200 km, distributed in 6 orbital planes. These planes are separated from each other by approximately 60 in length and have inclinations close to 55 in relation to the terrestrial equatorial plane. It was conceived so that there are at least 4 satellites visible above the horizon at any point on the surface and at any height.
The control component consists of 5 tracking stations distributed along the Globe and a main control station (MCS-Master control station). This component tracks the satellites, updates their orbital positions and calibrates and synchronizes their clocks. Another important function is to determine the orbits of each satellite and to foresee its trajectory during the following 24 hours. This information is sent to each satellite and then transmitted by this one, informing the local receiver where it is possible to find the satellite.



The user component includes all those using a GPS receiver to receive and convert the GPS signal to position, speed and time. It also includes all the necessary elements in this process, such as antennas and processing software.

The basic fundamentals of GPS are based on the determination of the distance between the receiver and satellites. Knowing the distance that separates us from 3 points we can determine our position relative to those same 3 points through the intersection of 3 circumferences whose radii are the distances measured between the receiver and the satellites.

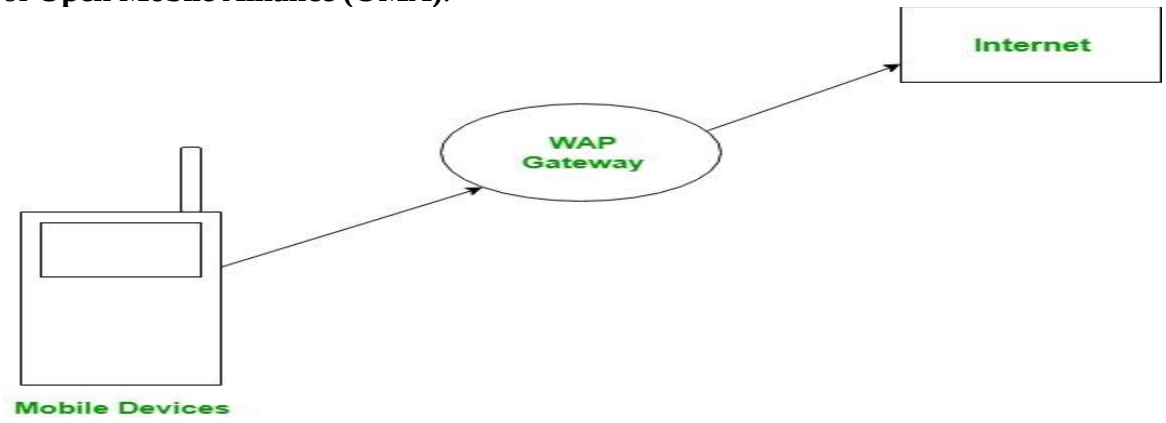
Each satellite transmits a signal that is received by the receiver, on the other hand, measures the time that the signals take to reach it. Multiplying the time measured by the speed of the signal (the speed of light) we can obtain the distance receiver-satellite (distance = speed x time).

But satellite positioning is not that simple. Getting the precise measurement of distance is not an easy task. The distance can be determined by means of the codes modulated in the wave sent by the satellite (Codes C/A and P), or by the analysis of the carrier wave. These codes are complicated. The receiver was prepared in such a way that it only deciphers those codes and no more, so he is immune to interference generated by natural or intentional sources. This is one of the reasons for the complexity of the codes.

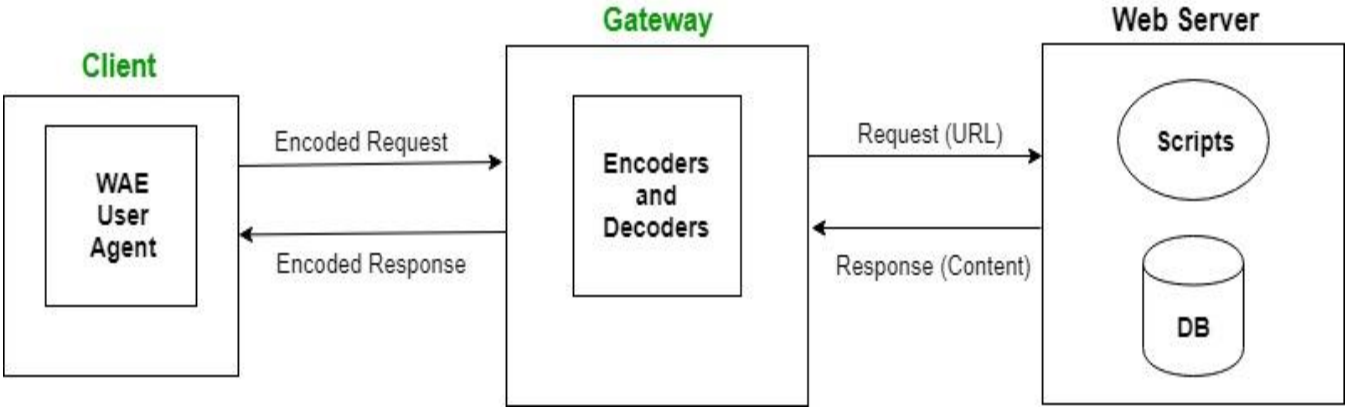
How do I use a GPS?
GPS technology is already on many portable devices that we use in our daily life. There are many models of cell phones, watches, handhelds, laptops and car trackers. The most popular use is in vehicles used as a map navigation system and ideal for guiding distracted drivers. GPS is also widely used in the civil and commercial aviation industry, and is equally sought after in maritime shipping. Everyone benefits from this technology. It should be noted that some countries, such as Syria, North Korea and Egypt, prohibit the use of GPS.

Wireless Application Protocol

WAP stands for **Wireless Application Protocol**. It is a protocol designed for micro-browsers and it enables the access of internet in the mobile devices. It uses the mark-up language WML (Wireless Markup Language and not HTML), WML is defined as XML 1.0 application. It enables creating web applications for mobile devices. In 1998, *WAP Forum* was founded by Ericson, Motorola, Nokia and Unwired Planet whose aim was to standardize the various wireless technologies via protocols.
WAP protocol was resulted by the joint efforts of the various members of WAP Forum. In 2002, WAP forum was merged with various other forums of the industry resulting in the formation of **Open Mobile Alliance (OMA)**.

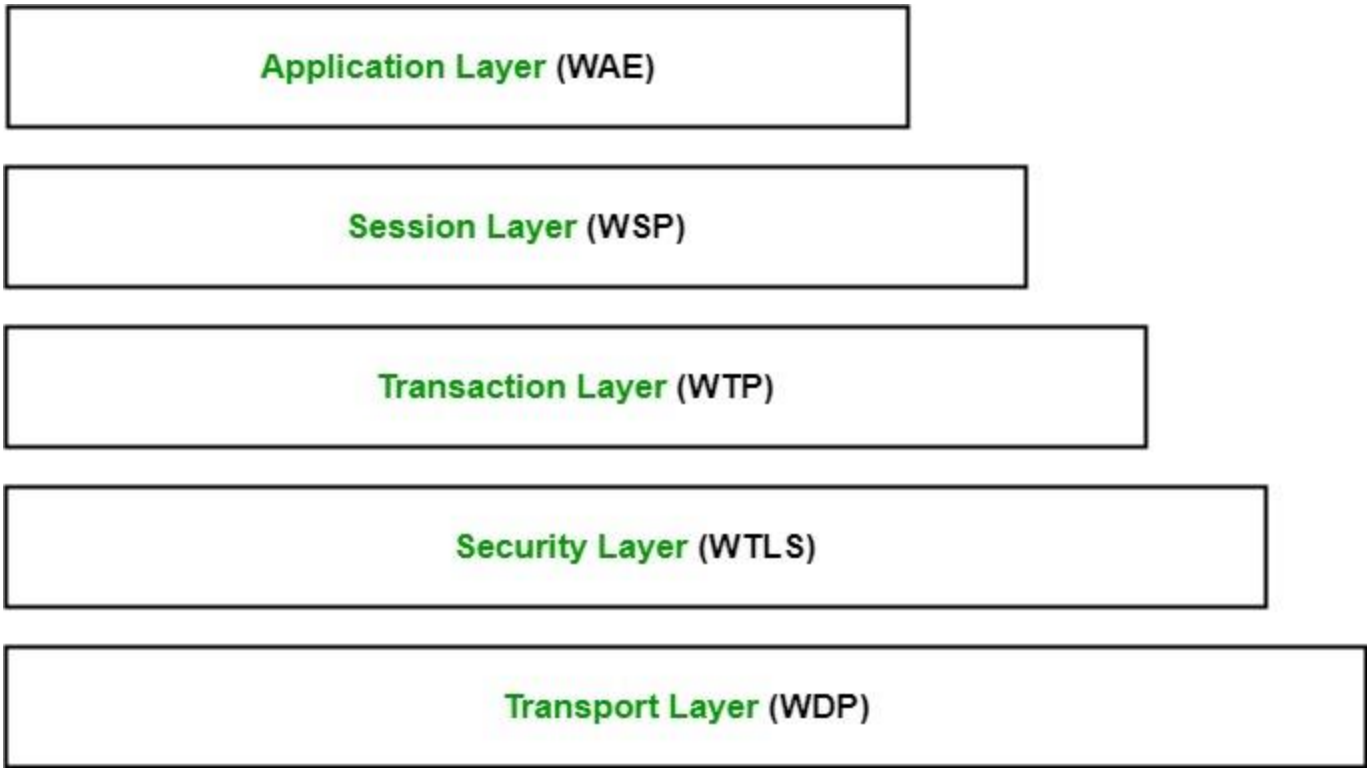


WAP Model:
The user opens the mini-browser in a mobile device. He selects a website that he wants to view. The mobile device sends the URL encoded request via network to a WAP gateway using WAP protocol.



The WAP gateway translates this WAP request into a conventional HTTP URL request and sends it over the internet. The request reaches to a specified Web server and it processes the request just as it would have processed any other request and sends the response back to the mobile device through WAP gateway in WML file which can be seen in the micro-browser.

WAP Protocol stack:



1. **Application Layer:**
   This layer contains the *Wireless Application Environment (WAE)*. It contains mobile device specifications and content development programming languages like WML.

2. **Session Layer:**
   This layer contains *Wireless Session Protocol (WSP)*. It provides fast connection suspension and reconnection.
3. **Transaction Layer:**
   This layer contains *Wireless Transaction Protocol (WTP)*. It runs on top of UDP (User Datagram Protocol) and is a part of TCP/IP and offers transaction support.
4. **Security Layer:**
   This layer contains *Wireless Transaction Layer Security (WTLS)*. It offers data integrity, privacy and authentication.
5. **Transport Layer:**
   This layer contains *Wireless Datagram Protocol*. It presents consistent data format to higher layers of WAP protocol stack.

Ecommerce (**e-commerce**) or **e**lectronic **commerce**, a subset of ebusiness, is the purchasing, selling, and exchanging of goods and services over computer networks (such as the Internet) through which transactions or terms of sale are performed electronically. Contrary to popular belief, ecommerce is not just on the Web. In fact, ecommerce was alive and well in business to business transactions before the Web back in the 70s via EDI (Electronic Data Interchange) through VANs (Value-Added Networks). Ecommerce can be broken into four main categories: B2B, B2C, C2B, and C2C.

BUSINESS-TO-BUSINESS (B2B)
B2B e-commerce refers to all electronic transactions of goods and sales that are conducted between two companies. This type of e-commerce typically explains the relationship between the producers of a product and the wholesalers who advertise the product for purchase to consumers. Sometimes this allows wholesalers to stay ahead of their competition.

BUSINESS-TO-CONSUMER (B2C)
Perhaps the most common form of e-commerce, B2C e-commerce deals with electronic business relationships between businesses and consumers. Many people enjoy this avenue of e-commerce because it allows them to shop around for the best prices, read customer reviews and often find different products that they wouldn't otherwise be exposed to in the retail world. This e-commerce category also enables businesses to develop a more personalized relationship with their customers.

CONSUMER-TO-CONSUMER (C2C)
This level of e-commerce encompasses all electronic transactions that take place between consumers. Generally, these transactions are provided by online platforms (such as PayPal), but often are conducted through the use of social media networks (Facebook marketplace) and websites (Craigslist).

CONSUMER-TO-BUSINESS (C2B)
Not the most traditional form of e-commerce, C2B e-commerce is when a consumer makes their services or products available for companies to purchase. An example of this would be a graphic designer customizing a company logo or a photographer taking photos for an e-commerce website.

BUSINESS-TO-ADMINISTRATION (B2A)
This e-commerce category refers to all transactions between companies and public administration. This is an area that involves many services, particularly in areas such as social security, employment and legal documents.

CONSUMER-TO-ADMINISTRATION (C2A)
Another popular e-commerce category, C2A e-commerce encompasses all electronic transactions between individuals and public administration. Examples of this include taxes (filing tax returns) and health (scheduling an appointment using an online service.

m-commerce (mobile commerce)

M-commerce (mobile commerce) is the buying and selling of goods and services through wireless handheld devices such as smartphones and tablets. As a form of e-commerce, m-commerce enables users to access online shopping platforms without needing to use a desktop computer. Examples of m-commerce include in-app purchasing, mobile banking, virtual marketplace apps like the Amazon mobile app or a digital wallet such as Apple Pay, Android Pay and Samsung Pay.

Over time, content delivery over wireless devices has become faster, more secure and scalable. As of 2017 the use of m-commerce accounted for 34.5% of e-commerce sales. The industries affected most by m-commerce include:

- Financial services, which includes mobile banking (when customers use their handheld devices to access their accounts and pay their bills) as well as brokerage services, in which stock quotes can be displayed and trading conducted from the same handheld device.
- Telecommunications, in which service changes, bill payment and account reviews can all be performed from the same handheld device.
- Service and retail, as consumers are given the ability to place and pay for orders on-the-fly.
- Information services, which include the delivery of financial news, sports figures and traffic updates to a single mobile device.

Types of m-commerce

M-commerce can be categorized by function as either mobile shopping, mobile banking or mobile payments. Mobile shopping allows for a customer to purchase a product from a mobile device, using an application such as Amazon, or over a web app. A subcategory of mobile shopping is app commerce, which is a transaction that takes place over a native app. Mobile banking includes any handheld technology that enables customers to conduct fanatical transactions. This is typically done through a secure, dedicated app provided by the banking institution. Mobile payments enable users to buy products in-person using a mobile device. Digital wallets, such as Apple Pay, allow a customer to buy a product without needing to swipe a card or pay with physical cash.

How mobile commerce works

With most m-commerce enabled platforms, the mobile device is connected to a wireless network that can be used to conduct online product purchases. For those in charge of developing an m-commerce application, important KPIs to monitor include the total mobile traffic, total amount of traffic on the application, average order value and the value of orders over time. Similarly, tracking the mobile add to cart rate will help developers see if users are becoming customers. M-commerce developers may also be interested in logging average page loading times, mobile cart conversion rates and SMS subscriptions.

In terms of mobile payment products specifically, they operate through a form of peer-to-peer (P2P) sharing. Once a mobile device is paired with a bank card's information, the phone can be waved over a payment terminal to pay for a product. This contactless payment using a mobile device is possible due to the use of Near Field Communication (NFC).

Advantages and disadvantages of mobile commerce

The advantages of m-commerce include:

- Added customer retention by being more easily accessible.

- More convenience for customers in comparing prices, reading reviews and making purchases without the need of a desktop computer.
- Wider variety of products and services.
- Automates a businesses' point of customer contact and sales.

Disadvantages of m-commerce include:

- A poorly executed mobile experience can deter customers from making purchases.
- Mobile payment options are not available in every geographic location and may not support every type of digital wallet.
- Businesses must know and comply with tax laws and regulations of all countries they ship to (some businesses will avoid this by only allowing purchases and shipping from their country of origin).

Mobile computing

- **A technology that is capable of providing an environment which enables users to transmit data from one device to other device without the use of any physical link/cables is known as Mobile Computing.**
- **It means, data transmission is done wireless-ly with the help of wireless devices such as mobiles, laptops etc.**
- **Whenever any device is connected to a network without being connected physically over a link or cable, data transmission such as messages, voice recording, videos etc. can be done be done by using the concept of mobile computing.**
- **Mobile Computing technology helps users to access and transmit data from any remote locations without being present there physically.**
- **Thus, having such a big coverage diameter, it is one of the fastest and most reliable sectors of computing technology field.**

Mobile Computing is a technology that allows transmission of data, voice and video via a computer or any other wireless enabled device without having to be connected to a fixed physical link. The main concept involves –

- Mobile communication
- Mobile hardware
- Mobile software

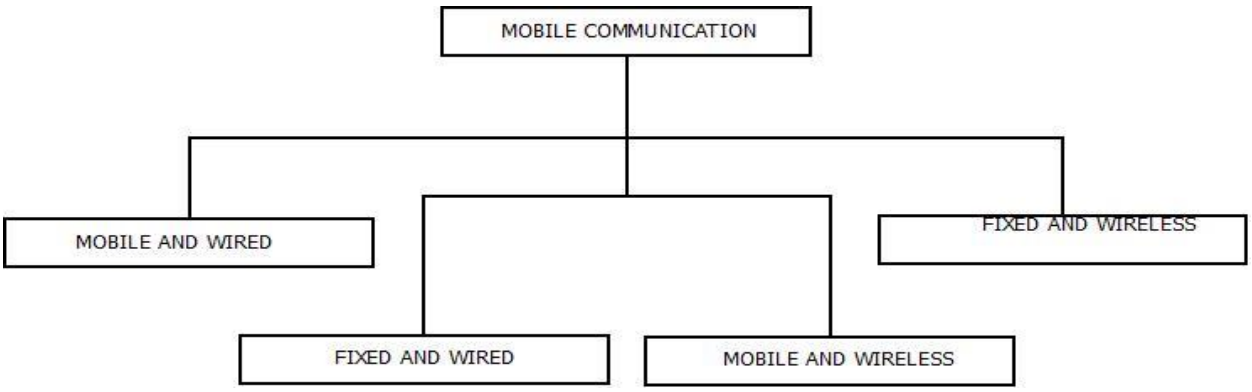
Mobile communication

The mobile communication in this case, refers to the infrastructure put in place to ensure that seamless and reliable communication goes on. These would include devices such as protocols, services, bandwidth, and portals necessary to facilitate and support the stated services. The data format is also defined at this stage. This ensures that there is no collision with other existing systems which offer the same service.

Since the media is unguided/unbounded, the overlaying infrastructure is basically radio wave-oriented. That is, the signals are carried over the air to intended devices that are capable of receiving and sending similar kinds of signals.

Mobile Communication : Introduction

- **Mobile Communication is the framework that is responsible behind the working of mobile computing technology.**
- **It ensures the consistency and reliability of communication process through this framework.**
- **Mobile communication framework includes communication devise such as mobiles, laptops, as rules of conduct, fitness etc. They are responsible for delivering of smooth communication process.**
- **Mobile communication can be of one of the following form as mentioned below.**



Mobile Communication

1. **Mobile and Wired : In this configuration, Some of the devices are wired and some are mobile in nature. For Example : Laptops.**
2. **Fixed and Wired : In this configuration, The devices are fixed at a position and are connected through a physical link for communication. For Example : Office/Desktop Computer.**
3. **Mobile and Wireless : In this configuration, devices can communicate(data transmission) with each other irrespective of their position and can connect to any network without the use of any wired device. For Example : WiFi Dongle.**

Mobile Hardware

Mobile hardware includes mobile devices or device components that receive or access the service of mobility. They would range from portable laptops, smartphones, tablet Pc's, Personal Digital Assistants.

Applications : Mobile Computing

- **Some of the major field in which mobile computing can be applied are:**
  - **Web or Internet access.**
  - **Global Position System(GPS).**
  - **Emergency services.**
  - **Entertainment services**
  - **Educational services.**

What Is Cloud Computing?

Cloud computing is the delivery of different services through the Internet. These resources include tools and applications like data storage, servers, databases, networking, and software.

Rather than keeping files on a proprietary hard drive or local storage device, cloud-based storage makes it possible to save them to a remote database. As long as an electronic device has access to the web, it has access to the data and the software programs to run it.

Cloud computing is a popular option for people and businesses for a number of reasons including cost savings, increased productivity, speed and efficiency, performance, and security.

Understanding Cloud Computing
Cloud computing is named as such because the information being accessed is found remotely in the cloud or a virtual space. Companies that provide cloud services enable users to store files and applications on remote servers and then access all the data via the Internet. This means the user is not required to be in a specific place to gain access to it, allowing the user to work remotely.

Cloud computing takes all the heavy lifting involved in crunching and processing data away from the device you carry around or sit and work at. It also moves all of that work to huge computer clusters far away in cyberspace. The Internet becomes the cloud, and voilà—your data, work, and applications are available from any device with which you can connect to the Internet, anywhere in the world.

Cloud computing can be both public and private. Public cloud services provide their services over the Internet for a fee. Private cloud services, on the other hand, only provide services to a certain number of people. These services are a system of networks that supply hosted services. There is also a hybrid option, which combines elements of both the public and private services.

KEY TAKEAWAYS

- Cloud computing is the delivery of different services through the Internet, including data storage, servers, databases, networking, and software.
- Cloud-based storage makes it possible to save files to a remote database and retrieve them on demand.
- Services can be both public and private—public services are provided online for a fee while private services are hosted on a network to specific clients.

Types of Cloud Services
Regardless of the kind of service, cloud computing services provide users with a series of functions including:

- Email
- Storage, backup, and data retrieval
- Creating and testing apps
- Analyzing data
- Audio and video streaming
- Delivering software on demand

Cloud computing is still a fairly new service but is being used by a number of different organizations from big corporations to small businesses, nonprofits to government agencies, and even individual consumers.

Deployment Models
There are various types of clouds, each of which is different from the other. Public clouds provide their services on servers and storage on the Internet. These are operated by third-party companies, who handle and control all the hardware, software, and the general infrastructure. Clients access services through accounts that can be accessed by just about anyone.

Private clouds are reserved for specific clientele, usually one business or organization. The firm's data service center may host the cloud computing service. Many private cloud computing services are provided on a private network.

Hybrid clouds are, as the name implies, a combination of both public and private services. This type of model allows the user more flexibility and helps optimize the user's infrastructure and security.

Newer forms of cloud computing services include the community cloud, the big data cloud, and the multicloud.
Types of Cloud Computing
Cloud computing is not a single piece of technology like a microchip or a cellphone. Rather, it's a system primarily comprised of three services: software-as-a-service (SaaS), infrastructure-as-a-service (IaaS), and platform-as-a-service (PaaS).

1. **Software-as-a-service (SaaS)** involves the licensure of a software application to customers. Licenses are typically provided through a pay-as-you-go model or on-demand. This type of system can be found in Microsoft Office's 365.
2. **Infrastructure-as-a-service (IaaS)** involves a method for delivering everything from operating systems to servers and storage through IP-based connectivity as part of an on-demand service. Clients can avoid the need to purchase software or servers, and instead procure these resources in an outsourced, on-demand service. Popular examples of the IaaS system include IBM Cloud and Microsoft Azure.
3. **Platform-as-a-service (PaaS)** is considered the most complex of the three layers of cloud-based computing. PaaS shares some similarities with SaaS, the primary difference being that instead of delivering software online, it is actually a platform for creating software that is delivered via the Internet. This model includes platforms like Force.com and Heroku.

Advantages of Cloud Computing
Cloud-based software offers companies from all sectors a number of benefits, including the ability to use software from any device either via a native app or a browser. As a result, users can carry their files and settings over to other devices in a completely seamless manner.

Cloud computing is far more than just accessing files on multiple devices. Thanks to cloud computing services, users can check their email on any computer and even store files using services such as Dropbox and Google Drive. Cloud computing services also make it possible for users to back up their music, files, and photos, ensuring those files are immediately available in the event of a hard drive crash.

It also offers big businesses huge cost-saving potential. Before the cloud became a viable alternative, companies were required to purchase, construct, and maintain costly information management technology and infrastructure. Companies can swap costly server centers and IT departments for fast Internet connections, where employees interact with the cloud online to complete their tasks.

The cloud structure allows individuals to save storage space on their desktops or laptops. It also lets users upgrade software more quickly because software companies can offer their products via the web rather than through more traditional, tangible methods involving discs or flash drives. For example, Adobe customers can access applications in its Creative Suite through an Internet-based subscription. This allows users to download new versions and fixes to their programs easily.

Disadvantages of the Cloud
With all of the speed, efficiencies, and innovations that come with cloud computing, there are, naturally, risks.

Security has always been a big concern with the cloud especially when it comes to sensitive medical records and financial information. While regulations force cloud computing services to shore up their security and compliance measures, it remains an ongoing issue. Encryption protects vital information, but if that encryption key is lost, the data disappears.

Servers maintained by cloud computing companies may fall victim to natural disasters, internal bugs, and power outages, too. The geographical reach of cloud computing cuts both ways: A blackout in California could paralyze users in New York, and a firm in Texas could lose its data if something causes its Maine-based provider to crash.

As with any technology, there is a learning curve for both employees and managers. But with many individuals accessing and manipulating information through a single portal, inadvertent mistakes can transfer across an entire system.

virtual reality

Virtual reality is an artificial environment that is created with software and presented to the user in such a way that the user suspends belief and accepts it as a real environment. On a computer, virtual reality is primarily experienced through two of the five senses: sight and sound.

The simplest form of virtual reality is a 3-D image that can be explored interactively at a personal computer, usually by manipulating keys or the mouse so that the content of the image moves in some direction or zooms in or out. More sophisticated efforts involve such approaches as wrap-around display screens, actual rooms augmented with wearable computers, and haptics devices that let you feel the display images.

Virtual reality can be divided into:

- The simulation of a real environment for training and education.
- The development of an imagined environment for a game or interactive story.

The Virtual Reality Modelling Language (VRML) allows the creator to specify images and the rules for their display and interaction using textual language statements.

What is a Neural Network?

An Artificial Neural Network (ANN) is an information processing paradigm that is inspired by the way biological nervous systems, such as the brain, process information. The key element of this paradigm is the novel structure of the information processing system. It is composed of a large number of highly interconnected processing elements (neurones) working in unison to solve specific problems. ANNs, like people, learn by example. An ANN is configured for a specific application, such as pattern recognition or data classification, through a learning process. Learning in biological systems involves adjustments to the synaptic connections that exist between the neurones. This is true of ANNs as well.

Why use neural networks?

Neural networks, with their remarkable ability to derive meaning from complicated or imprecise data, can be used to extract patterns and detect trends that are too complex to be noticed by either humans or other computer techniques. A trained neural network can be thought of as an "expert" in the category of information it has been given to analyse. This expert can then be used to provide projections given new situations of interest and answer "what if" questions.
Other advantages include:

1. Adaptive learning: An ability to learn how to do tasks based on the data given for training or initial experience.
2. Self-Organisation: An ANN can create its own organisation or representation of the information it receives during learning time.
3. Real Time Operation: ANN computations may be carried out in parallel, and special hardware devices are being designed and manufactured which take advantage of this capability.
4. Fault Tolerance via Redundant Information Coding: Partial destruction of a network leads to the corresponding degradation of performance. However, some network capabilities may be retained even with major network damage.

Grid computing

Grid computing (also called "distributed computing") is a collection of computers working together to perform various tasks. It distributes the workload across multiple systems, allowing computers to contribute their individual resources to a common goal.
A computing grid is similar to a cluster, but each system (or node) on a grid has its own resource manager. In a cluster, the resources are centrally managed, typically by a single system. Additionally, clusters are usually located in a single physical space (such as a LAN), whereas grid computing often incorporates systems in several different locations (such as a WAN).
In order for systems in a computing grid to work together, they must be physically connected (over a network or the Internet) and run software that allows them to communicate. The software used in grid computing is called middleware since it translates the information passed from one system to another into a recognizable format. This allows the data computed by one node within the grid to be stored or processed by another system on the grid.
Grid computing has many different scientific applications. For example, it is used to model the changes in molecular structures, analyze brain behavior, and compute complex physics models. It is also used to perform weather and economic simulations. Some companies also use grid computing to process internal data and provide services over the Internet. Cloud computing, for instance, is considered to be a subset of grid computing.

VLAN

Stands for "Virtual Local Area Network," or "Virtual LAN." A VLAN is a custom network created from one or more existing LANs. It enables groups of devices from multiple networks (both wired and wireless) to be combined into a single logical network. The result is a virtual LAN that can be administered like a physical local area network.
In order to create a virtual LAN, the network equipment, such as routers and switches must support VLAN configuration. The hardware is typically configured using a software admin tool that allows the network administrator to customize the virtual network. The admin software can be used to assign individual ports or groups of ports on a switch to a specific VLAN. For example, ports 1-12 on switch #1 and ports 13-24 on switch #2 could be assigned to the same VLAN.

Say a company has three divisions within a single building — finance, marketing, and development. Even if these groups are spread across several locations, VLANs can be configured for each one. For instance, each member of the finance team could be assigned to the "finance" network, which would not be accessible by the marketing or development teams. This type of configuration limits unnecessary access to confidential information and provides added security within a local area network.

VLAN Protocols

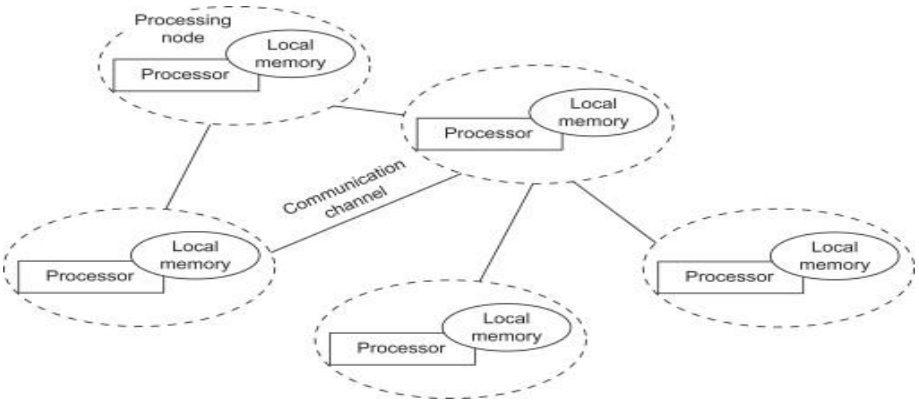
Since traffic from multiple VLANs may travel over the same physical network, the data must be mapped to a specific network. This is done using a VLAN protocol, such as IEEE 802.1Q, Cisco's ISL, or 3Com's VLT. Most modern VLANs use the IEEE 802.1Q protocol, which inserts an additional header or "tag" into each Ethernet frame. This tag identifies the VLAN to which the sending device belongs, preventing data from being routed to systems outside the virtual network.

Data is sent between switches using a physical link called a "trunk" that connects the switches together. Trunking must be enabled in order for one switch to pass VLAN information to another.

4,904 VLANs can be created within an Ethernet network using the 802.1Q protocol, but in most network configurations only a few VLANs are needed. Wireless devices can be included in a VLAN, but they must be routed through a wireless router that is connected to the LAN.

Distributed Computing

Distributed computing is a much broader technology that has been around for more than three decades now. Simply stated, distributed computing is computing over distributed autonomous computers that communicate only over a network (Figure 9.16). Distributed computing systems are usually treated differently from parallel computing systems or shared-memory systems, where multiple computers share a common memory pool that is used for communication between the processors. Distributed memory systems use multiple computers to solve a common problem, with computation distributed among the connected computers (nodes) and using message-passing to communicate between the nodes. For example, grid computing, studied in the previous section, is a form of distributed computing where the nodes may belong to different administrative domains. Another example is the network-based storage virtualization solution described in an earlier section in this chapter, which used distributed computing between data and metadata servers.



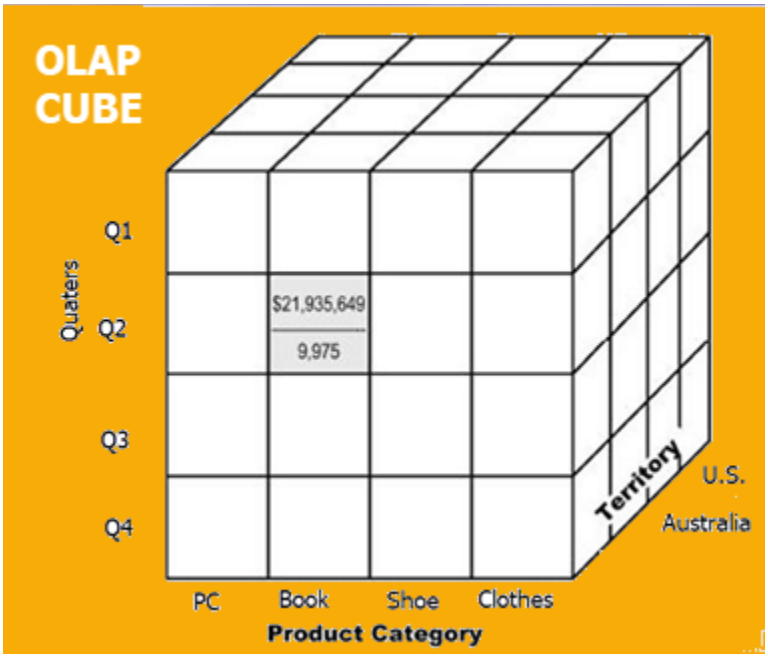
What is Online Analytical Processing?

OLAP is a category of software that allows users to analyze information from multiple database systems at the same time. It is a technology that enables analysts to extract and view business data from different points of view. OLAP stands for Online Analytical Processing.

Analysts frequently need to group, aggregate and join data. These operations in relational databases are resource intensive. With OLAP data can be pre-calculated and pre-aggregated, making analysis faster.

OLAP databases are divided into one or more cubes. The cubes are designed in such a way that creating and viewing reports become easy.

OLAP cube:



At the core of the OLAP, concept is an OLAP Cube. The OLAP cube is a data structure optimized for very quick data analysis.

The OLAP Cube consists of numeric facts called measures which are categorized by dimensions. OLAP Cube is also called the **hypercube**.

Usually, data operations and analysis are performed using the simple spreadsheet, where data values are arranged in row and column format. This is ideal for two-dimensional data. However, OLAP contains multidimensional data, with data usually obtained from a different and unrelated source. Using a spreadsheet is not an optimal option. The cube can store and analyze multidimensional data in a logical and orderly manner.

How does it work?

A Data warehouse would extract information from multiple data sources and formats like text files, excel sheet, multimedia files, etc.

The extracted data is cleaned and transformed. Data is loaded into an OLAP server (or OLAP cube) where information is pre-calculated in advance for further analysis.