Chapter 7
Network/Email Protocols ,mobile-wireless technology

Computer Science

Class XII (As per CBSE Board)

Network Protocols

Network protocols are sets of rules and regulations that dictate how to format, transmit and receive data on computer network devices – like servers, routers to endpoints -- can communicate regardless of the differences in their infrastructures, designs or standards.

To successfully send or receive information, network devices must accept and follow protocol conventions .

Network Protocols

TCP/IP (Transmission Control Protocol/Internet Protocol)- also referred to as the Internet Protocol Suite, is the World Wide Web's core communication system which enables every Internet-based device to communicate with every other such devices simultaneously.

An IP address is the unique numerical address of a device in a computer network that uses Internet Protocol for communication. The IP address allow you to pinpoint a particular device from the billions of devices on the Internet. Static IP Addresses-usually never change but they may be changed as a result of network administration.

Dynamic IP Addresses-These IP addresses are temporary and assigned to a computer when they get connected to the Internet each time

Two most used ip versions are ipv4 and ipv6. IPv4 is a 32-Bit IP Address. IPv6 is 128 Bit IP Address. IPv4 is a numeric address, and its binary bits are separated by a dot (.) IPv6 is an alphanumeric address whose binary bits are separated by a colon (:)

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IPv4 ADDRESS CLASS -

Class	Address Range	Supports
Class A	1.0.0.1 to 126.255.255.254	Supports 16 million hosts on each of 127 networks.
Class B	128.1.0.1 to 191.255.255.254	Supports 65,000 hosts on each of 16,000 networks.
Class C	192.0.1.1 to 223.255.254.254	Supports 254 hosts on each of 2 million networks.
Class D	224.0.0.0 to 239.255.255.255	Reserved for multicast groups.
Class E	240.0.0.0 to 254.255.255.254	Reserved for future use, or Research and Development Purposes.

Of the five address classes, three—Class A, B, and C—were designated for unicast single source–to–single destination communication. Addresses in Class D were reserved for IP Multicast applications, which allows one-to-many communication. Class E addresses were reserved for experimental purposes.

Network Protocols

How TCP/IP WORKS -worksTCP/IP is a two-layered program: the higher layer (TCP) disassembles message content into small "data packets" that are then transmitted over the Internet to be re-assembled by the receiving computer's TCP back into the message's original form.
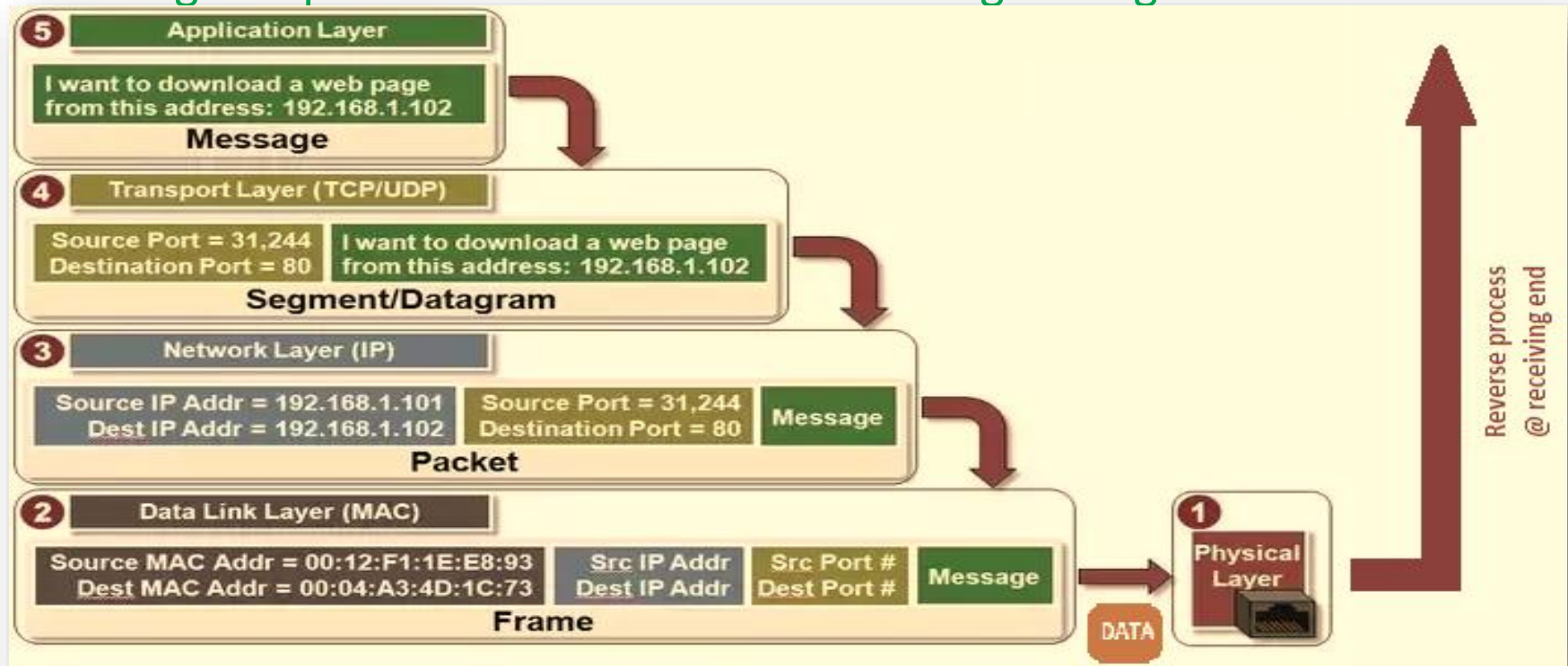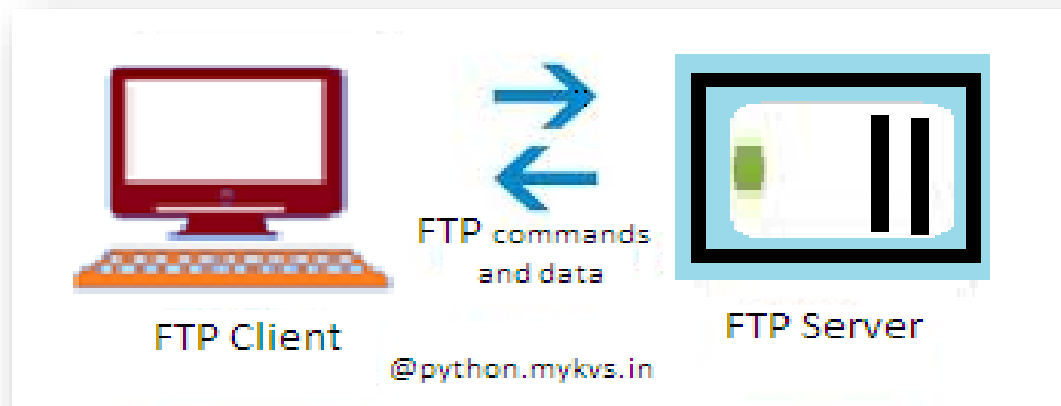
Network Protocols

TCP/IP and Higher-Level Applications - Many higher-level apps that ecommerce businesses need to be familiar with utilize and/or are built on TCP/IP.

- FTP (the Internet's File Transfer Protocol)
- HTTP (the Internet's Hyper-text Transfer Protocol)
- Telnet, which enables logging on computers from remote locations
- SMTP (Simple Mail Transfer Protocol)

Network Protocols

FTP – FTP, or File Transfer Protocol, is one of the standard internet protocols used to transfer data files between a client(FTP client) and a server(FTP server) over a computer network. It was developed in the early 1970s by Abhay Bhushan (alumni IIT Kanpur),while he was a student at MIT. FTP was initially created to allow for the secure transfer of files between servers and host computers over the ARPANET Network Control Program (a precursor to the modern internet).Nowadays it is being used for uploading files on webserver after non anonymous ftp(means username and password available with you).downloading is possible as anonymous ftp(no password is required).FTP is available in two mode – text mode ftp(where user have to give commands in text form) and GUI ftp(graphical interaction is possible).

FTP commands
and data

FTP Client   FTP Server

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Some of the more popular, and reliable, FTP Clients currently operating in the industry are FileZilla,WinSCP,Cyberduck,gFTP
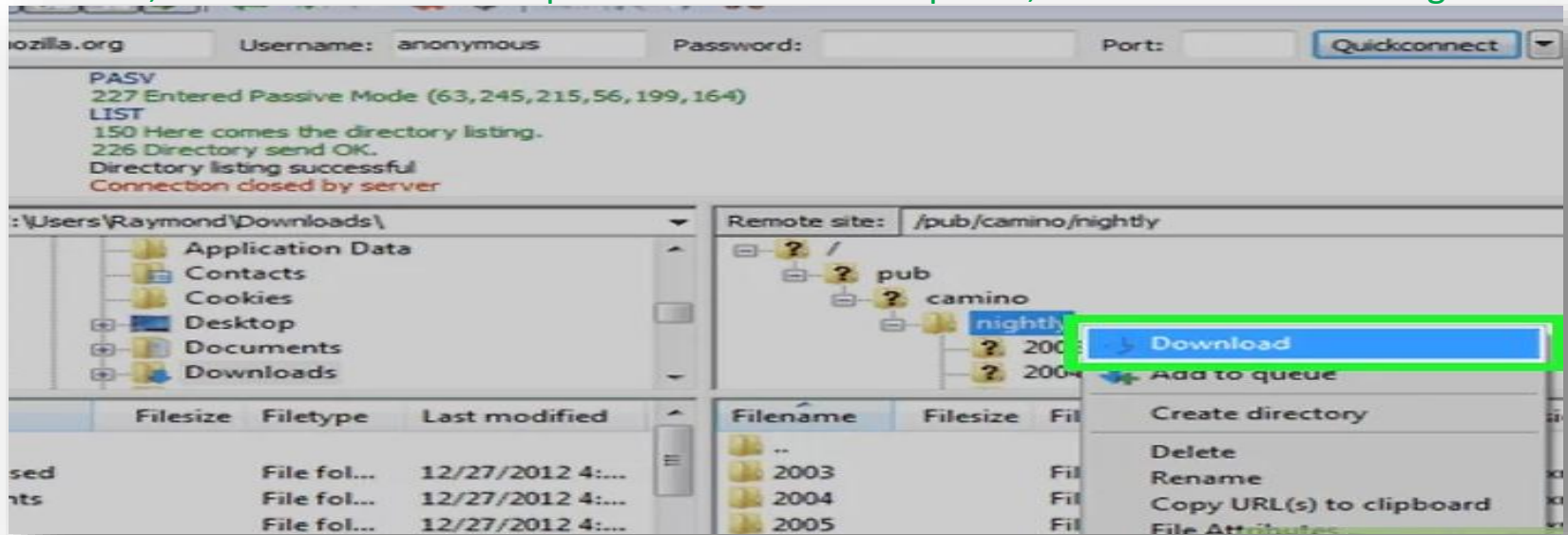
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How to work on FTP – Here we are using Filezilla.

1. Download filezilla then Install filezilla
2. Open site manager from file menu and click on new site button
3. Type credential available of any domain
4. Press ok, It will connect our computer with remote computer ,screen will be something like this

5. Left side pan will display the folder/files of our computer and right side pan will display the file structure of remote computer.through simple drag and drop we can download upload(receive file from remote computer to local computer) or upload(sending file to remote computer from local computer) the files.

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Practice site for FTP

Demo for Web-based Administration:
Location: http://demo.wftpserver.com:5466/
Username: demo-admin
Password: demo-admin

Demo for Web-based Client:
Location: http://demo.wftpserver.com/
Username: demo-user
Password: demo-user

Practice it

Login using your own client with FTP, FTPS, SFTP protocol:
Location: demo.wftpserver.com
Username: demo-user
Password: demo-user
FTP Port: 21
FTPS Port: 990
SFTP Port: 2222

Courtesy - https://www.wftpserver.com/onlinedemo.htm

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Point-to-Point Protocol (PPP) is an open standard protocol that is mostly used to provide connections over point-to-point serial links. The main purpose of PPP is to transport Layer 3 packets over a Data Link layer point-to-point link. PPP can be configured on:

Asynchronous serial connection like Plain old telephone service (POTS) dial-up

Synchronous serial connection like Integrated Services for Digital Network (ISDN) or point-to-point leased lines.

PPP consists of two sub-protocols:Link Control Protocol (LCP): set up and negotiate control options on the Data Link Layer (OSI Layer 2). After finishing setting up the link, it uses NCP.

Network control Protocol (NCP): negotiate optional configuration parameters and facilitate for the Network Layer (OSI Layer 3).

Before a PPP connection is established, the link must go through three phases of session establishment:

1. Link establishment phase: In this phase, each PPP device sends LCP packets to configure and test the data link

2. Authentication phase (optional): If authentication is enabled, either PAP or CHAP will be used. PAP and CHAP are two authentication protocols used in PPP

3. Network layer protocol phase: PPP sends NCP packets to choose and configure Network Layer protocol (OSI Layer 3) to be encapsulated and sent over the PPP data link
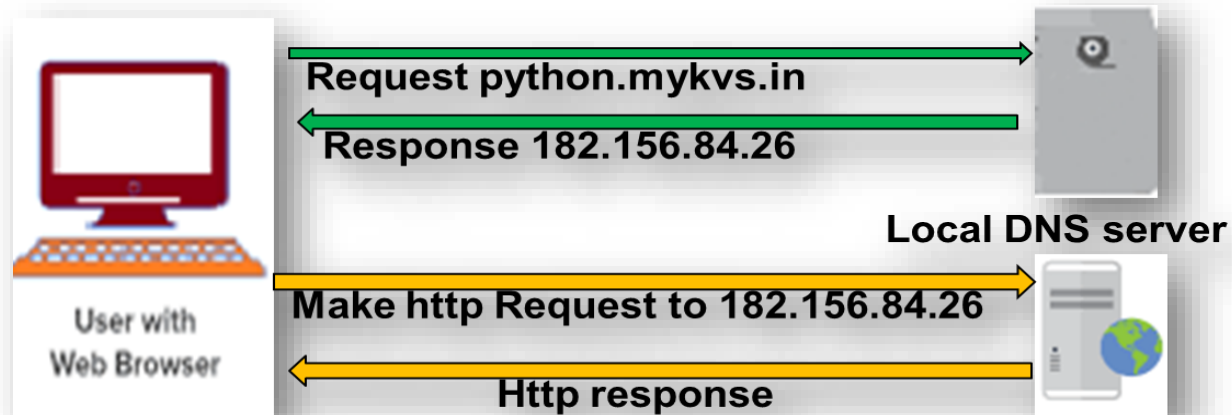
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HTTP - HTTP stands for hypertext transfer protocol and is used to transfer data across the Web. It allow users of the World Wide Web to exchange information found on web pages. When accessing any web page entering http:// in front of the address tells the browser to communicate over HTTP.

How It Works-

It is a connectionless text based protocol. Clients (web browsers) send requests through *request object* of http to web servers for web pages / images etc.Web server respond accordingly through *response object* of http After this cycle(request – response), the connection between client and server across the Internet is disconnected. A new connection must be made for each request(means for each web page).

This diagram shows the working of http protocol. Working with dns server and working with web Server both.

User with Web Browser

Request python.mykvs.in

Response 182.156.84.26

Local DNS server

Make http Request to 182.156.84.26

Http response

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Network Protocols

Remote login – A remote login facility permits a user who is using one computer to login to remote computer or interact with a program on another computer. Command given at remote location is processed by server and result displayed over remote location.

Remote Location
(Remote login through
Client Software)

INTERNET

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Main Office
(Server)

Telnet – Telnet is most popular protocol for accessing remote site/server. Using telnet client software on our computer, we can make a connection to a telnet server (that is, the remote host). Once our telnet client establishes a connection to the remote host, our client becomes a virtual terminal, allowing us to communicate with the remote host from our computer. In most cases, we need to log into the remote host, which requires that we have an account on that system. Occasionally, we can log in as guest or public without having an account.Generally it is used in unix based client server system to interact.

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Wireless/Mobile Communication Protocol-

Wireless communications is a type of data communication that is performed and delivered wirelessly between mobile devices.

The network architecture used is unique in that it separates the mobile network(s) from fixed networks and provides connectivity between the two via the protocols specially used for wireless/mobile communication which are not as wireless/mobile communication protocol.E.g. of such protocols are GSM,GPRS and WLL.

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Network Protocols

GSM- Global System for Mobile Communications, is a standard developed by the European Telecommunications Standards Institute (ETSI) for 2G cellular networks for mobile phones.

It initially started as a circuit switching network, but later packet switching was implemented after integration General Packet Radio Service (GPRS) technology as well. The widely-used GSM frequency bands are 900 MHz and 1800 MHz.

GSM mobile use sim cards -Subscriber Identity Module card is a tiny, portable memory chip that stores information about you as a cell phone user. On it, there's a seventeen-digit code that designates its country code of origin, the system carrier and a unique user ID.

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How GSM works-

A Mobile Station: It is the <u>mobile phone</u> which consists of the transceiver, the display and the processor and is controlled by a <u>SIM card </u>operating over the network.

Base Station Subsystem: It connects mobile station and network subsystem.

It consists of the <u>Base Transceiver Station </u>which contains the radio transceivers and handles the protocols for communication with mobiles. It also consists of the <u>Base Station Controller</u> which controls the Base Transceiver station and acts as a interface between the mobile station and mobile switching centre.

Network Subsystem: It provides the basic network connection to the mobile stations. The basic part of the Network Subsystem is the Mobile Service Switching Centre which provides access to different networks like ISDN, PSTN etc. It also consists of the <u>Home Location Register</u> and the <u>Visitor Location Register </u>which provides the call routing and roaming capabilities of GSM. It also contains the <u>Equipment Identity Register </u>which maintains an account of all the mobile equipments wherein each mobile is identified by its own IMEI number. IMEI stands for International Mobile Equipment Identity.
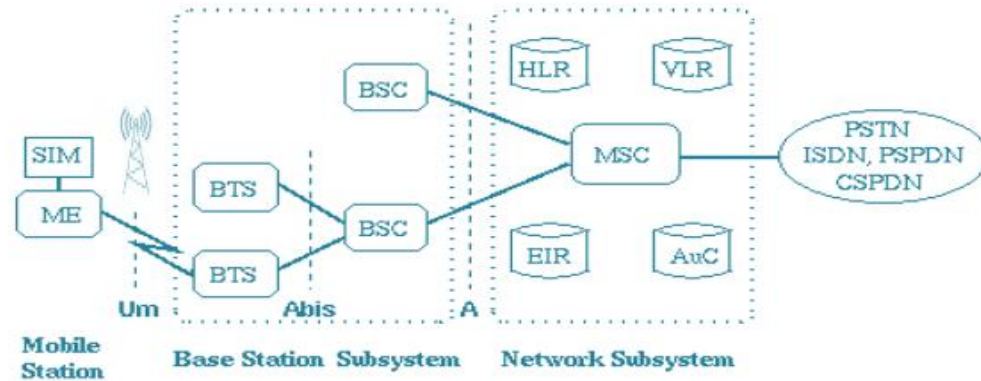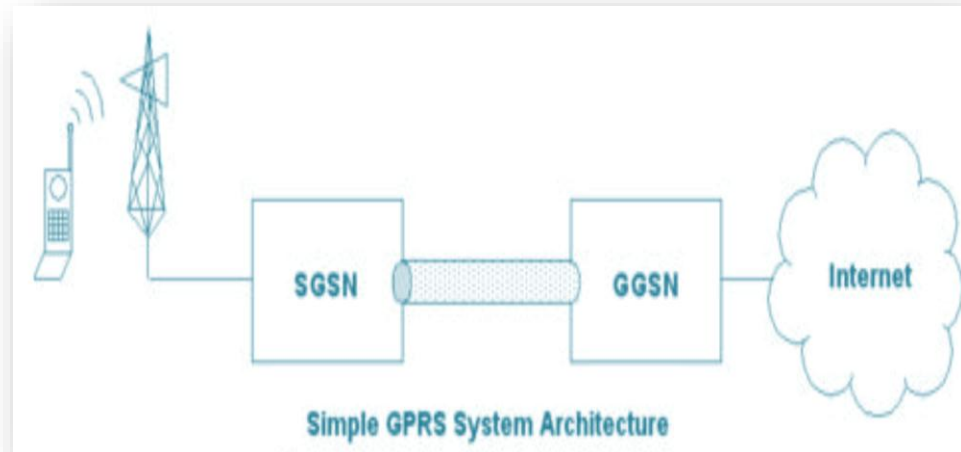
GPRS-General Packet Radio Service,In GSM cell phone systems, there will always be idle radio capacity. Which is not being used and it stays unused until other cell phone users decide to make phone calls. GPRS uses this idle radio capacity to establish a data network to be used for data transmission(115 kbps).

Simple GPRS System Architecture

Gateway GPRS Support Node (GGSN) & Serving GPRS Support Node (SGSN) are two major components of gprs network .

The GGSN converts incoming data traffic from mobile users (via the SGSN) and forwards it to the relevant network, and vice versa. The Serving GPRS Support Node (SGSN) to keep mobile users connected to the Internet and IP-based applications.

WLL: Wireless Local Loop

Initially, the telephones were connected via copper cables but with wll protocol telephones with wll support can be used while roaming.

When somebody calls from WLL to another person, the Base Trans-Receiver accepts the signal and sends it to Base-Station Controller.

Controller decodes them according to given code and sends it to Base Station Manager which sends it to Telephone Exchange. This gets back to a specific customer on the same route via different Trans-Receiver.

However, this was quite inefficient when it has to cover a bigger ground, probably that's why it became obsolete.
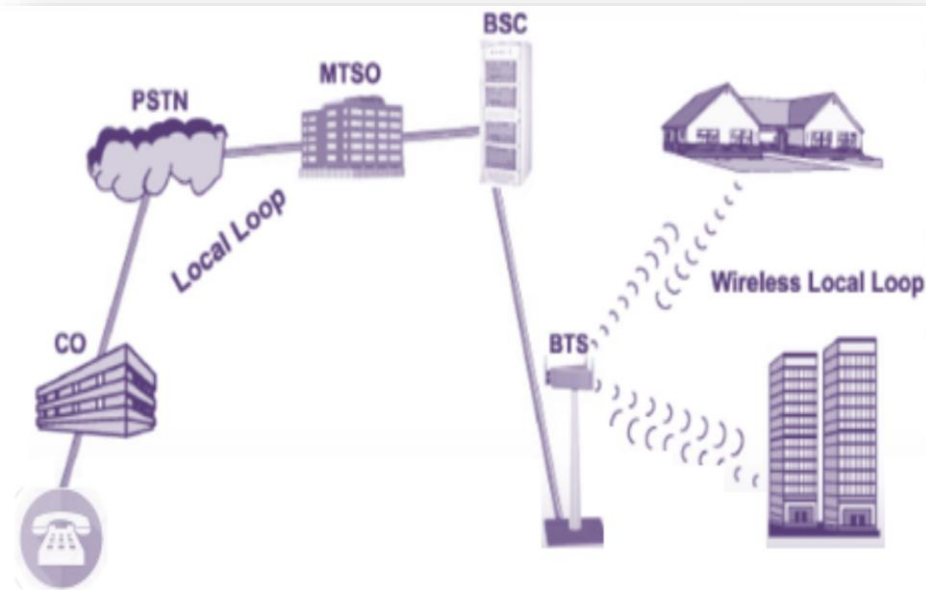
Mobile communication technologies

Technology & Feature	FIRST GENRATION (1G)	SECOND GENRATION (2G)	THIRD GENRATION (3G)	FOURTH GENRATION (4G)	FIFTH GENRATION (5G)
Start/Deployment	1980 – 1990	1990-2000	2000-2010	Now	Probably Soon(2020)
Data Rate	2kb/s	64kb/s	2 Mb/s	1Gb/s	< 1Gb/s
Technology	Analog Cellular Technology	Digital Cellular Technology	Broad bandwidth CDMA IP Technology	WiMax LTE, Wi-Fi	4G+WWWW
Service	Analog voice service No data service	Digital voice, SMS,MMS, Higher capacity packetized data	Integrated high quality audio, video and data	Dynamic Information access Wearable devices	Dynamic Information access Wearable devices with AI Capabilities
Multiplexing	FDMA	TDMA,CDMA	CDMA	CDMA	CDMA
Standards	MTS,AMTS,IMTS	GSM,GPRS,EDE	IMT-2000 HDSPA, HSUPA	Single unified Standard WiMax, LTE	Single unified Standard
Switching	Circuit	Circuit, Packet	Packet	All Packet	All Packet
Core Network	PSTN	PSTN	Packet N/W	Internet	Internet

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Mobile communication technologies

Mobile processors, also known as chipset, is a component that controls everything going on in your smartphone and ensures it functions correctly.

processors based on specs – Cores and clock speed

A processor performance mostly depends on two specifications; the number of cores and the clock speeds .A core is an element of the processor that implements and executes tasks. Smartphones today, come with multiple cores. Each core is designed to handle and execute tasks. More the number of cores, more and heavier apps it can e.g. dual-core (two), quad-core (four) and octa-core (eight), hexa-core (six).etc.

Popular Entry-Level SoCs
- Snapdragon 665-The most popular affordable chipset that replaced Snapdragon 400 series.
- MediaTek Helio P70 has emerged as a popular alternative to Snapdragon chipsets.

Popular Mid-Range SoCs
- Snapdragon 765/ 765G   is the first Qualcomm chipset with an integrated 5G modem.
- MediaTek G90/ G90T-only popular MediaTek chipset in 2019.

Popular High-End SoCs
- Snapdragon 865 -The latest Qualcomm flagship that will be a part all 2020 flagships.
- Kirin 990 5G/ 990-This is the current Huawei flagship chipset in Mate 30 and P40- phones.

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Email Protocols

Email –Electronic mail is a facility that allows users to transmit messages across the internet in fast and secure manner.
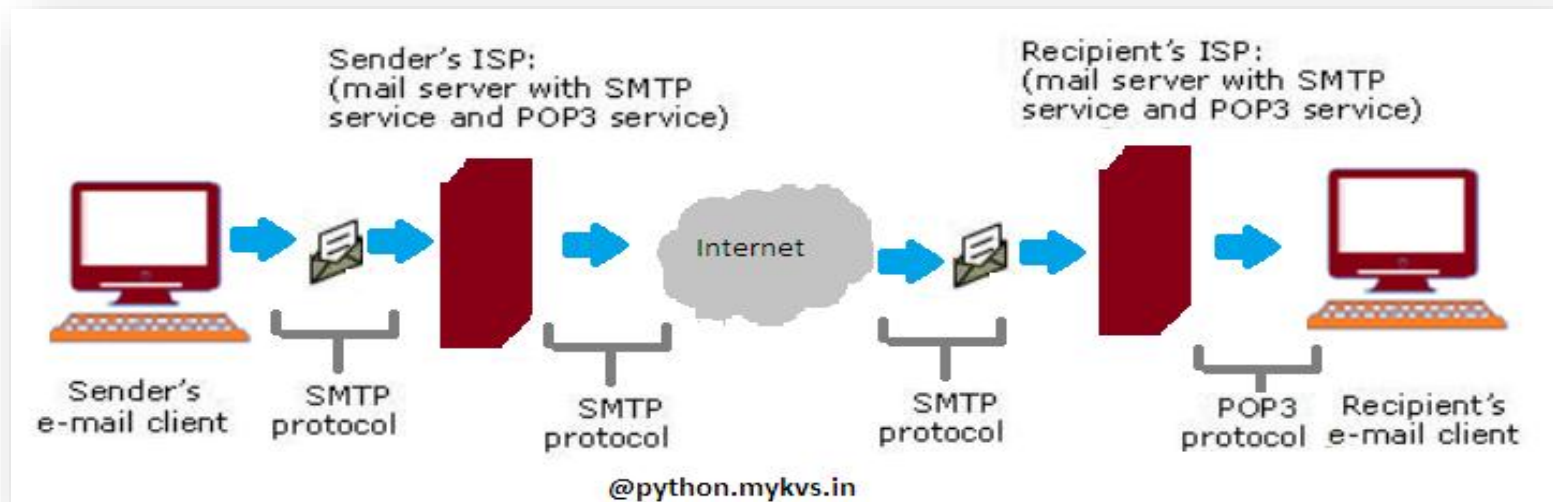

Email created using email client program->on press of send button ,it is delivered to sender's mail server through SMTP(Simple mail transfer protocol)->which further transmit the same through internet to recipient's mail server->whenever recipient's email client program's inbox is opened,that email is delivered to inbox through POP3 (post office protocols 3rd version)->which user will read in email client program.

Email Protocols

SMTP – Most of the internet systems use SMTP as a method to transfer mail from one user to another. SMTP is a push protocol and is used to send the mail to email server. it is usually used with one of two other protocols, POP3 or IMAP, that let the user save messages in a server mailbox and download them periodically from the server.An alternative to SMTP that is widely used in Europe is X.400. Many mail servers now support Extended Simple Mail Transfer Protocol (ESMTP), which allows multimedia files to be deliver as e-mail.
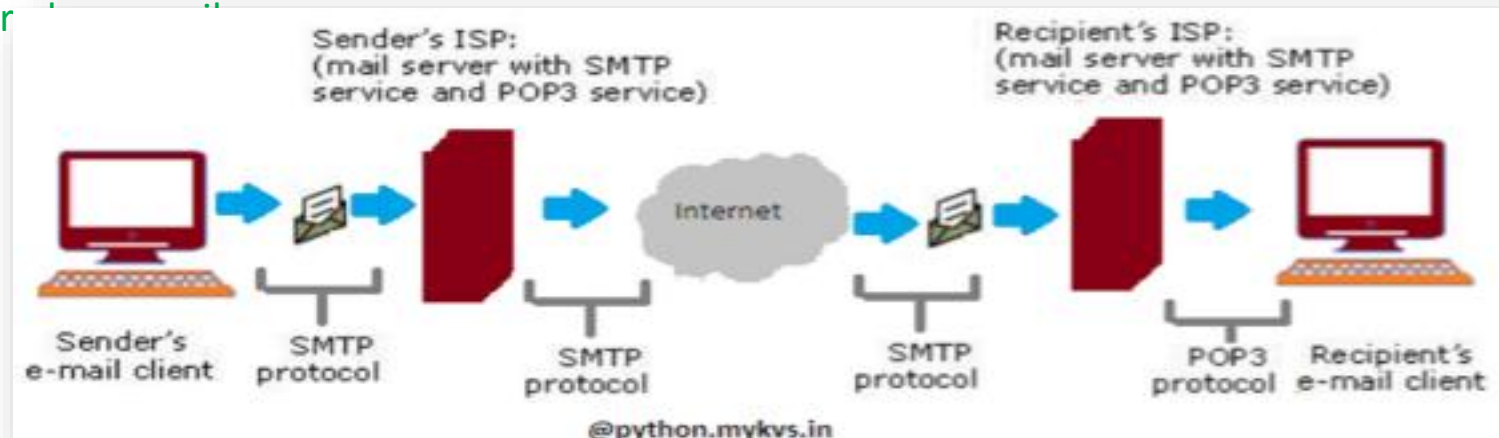
The SMTP model is of two type :
*   End-to- end method
*   Store-and- forward method
The end to end model is used to communicate between different organizations whereas the store and forward method is used within an organization.

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POP3 – Post Office Protocol version 3 (POP3) is a standard mail protocol used to receive emails from a remote server to a local email client. POP3 allows us to download email messages on our local computer and read them even when we are offline. Note, that when we use POP3 to connect to our email account, messages are downloaded locally and removed from the email server. This means that if we access our account from multiple locations, that may not be the best option for us. On the other hand, if we use POP3, our messages are stored on our local computer, which reduces the space of email account uses on your web server.

Protocols for chat & video conferencing

VOIP – Voice over Internet Protocol (VoIP), is a technology that allows us to make voice calls using a broadband Internet connection instead of a regular (or analog) phone line.

VoIP services convert our voice into a digital signal that travels over the Internet. If we are calling a regular phone number, the signal is converted to a regular telephone signal before it reaches the destination. VoIP can allow us to make a call directly from a computer, a special VoIP phone. In addition, wireless "hot spots" in locations such as airports, parks, and cafes allow us to connect to the Internet and may enable us to use VoIP service wirelessly.

Advantages:
- Less Cost
- Accessibility
- Flexibility
- Voice Quality
- Extra/Less Expensive Features

Disadvantages:
- Reliable Internet Connection Required
- Power Outages/Emergencies
- Latency

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Protocols for chat & video conferencing

Services provided by VOIP – Phone to phone,pc to phone ,phone to pc,voice to email,ip phone,toll free number,call center applications,vpn,unified messaging etc.

Protocols used for VOIP are

- Session Initiation Protocol (SIP)- connection management protocol developed by the IETF
- H.323 - one of the first VoIP call signaling and control protocols that found widespread implementation.
- Real-time Transport Protocol (RTP)- transport protocol for real-time audio and video data
- Real-time Transport Control Protocol (RTCP)- sister protocol for RTP providing stream statistics and status information
- Secure Real-time Transport Protocol (SRTP) - encrypted version of RTP
- Session Description Protocol (SDP) - file format used principally by SIP to describe VoIP connections

Wireless technology

BASIS OF COMPRISON	WI-FI	WiMAX
Description	Wi-Fi is an acronym for Wireless Fidelity. It is a wireless networking technology that uses radio waves to provide wireless high-speed internet and network connections.	WiMAX is an acronym for Worldwide Interoperability for Microwave Access. It also goes by the IEEE name 802.16. It is a technology standard for long-range wireless networking for both mobile and fixed connection.
Protocol	Uses CSMA/CA protocol	Uses connection based MAC protocol.
Licensed and Unlicensed Spectrum	Exclusively unlicensed	Can run on both licensed and unlicensed spectrum.
Data Transmission Rates	data at speeds up to 54 mbps.	data at speeds upto 40mbps.
Channel Bandwidth	fixed channel bandwidth of 20 MHz.	flexible channel bandwidth - 1.25 MHz to 20 MHz.
IEEE Standards	Defined under IEEE 802.11x standards where x is various Wi-Fi versions.	Standardized under 802.16y family of wireless networking where y refers to various WiMAX versions.
Coverage	coverage of up to 100 meters for outdoor applications and 30 meters for indoor coverage.	Non-line of sight connectivity covers a radius of above 25 kilometers (Km). For line of sight connectivity coverage area of above 600- square

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