1a Describe at least five hardware components that enable access to the web and enable website production.

Hardware Components

Web Server Hardware

Web server hardware comprises a dedicated computer that is used to serve web pages to users. The web server stores web server software and a website's component files (e.g. HTML documents, images, CSS stylesheets, and JavaScript files). It is connected to the Internet and supports physical data interchange with other devices connected to the web. The client (user) uses a browser to access the server and request web pages from the web site hosted on that server. The server then responds by sending the client the web pages which are then displayed in the client's browser. This architecture is an example of the client/server model.

Proxy Server

A proxy server is a computer that acts as an intermediary gateway between the user's computer and the Internet. It allows client computers to make indirect network connections to other network services.by separating end users from the websites they browse. Proxy servers act as a firewall and web filter, they provide shared network connections and cache data to speed up common requests. A good proxy server provides high levels of security and privacy.

Mail Server

A mail server (email server) is a server that handles and delivers email over a network, usually over the Internet. A mail server can receive emails from client computers and deliver them to other mail servers.

DSL Modem

This converts digital signals into analogue signals that are suitable for sending over a telephone line. It is usually built into the Internet/broadband router and not normally purchased as a separate component.

Routers

A router connects networks together. Routers operate at the networking level of the TC protocol stack. On Home networks the router is responsible for connecting the home network to the Internet and provides several important networking services like DHCP and DNS. Most home routers provide both Wi-Fi and Ethernet connections. Home routers also provide NAT (Network Address translation) services. They are also commonly known as hubs but this doesn't actually describe their networking role.

Network Switch

A switch Connects two or more computers together and is used today in preference to a hub or a bridge. Like a bridge a switch learns about the MAC addresses connected to each port and will only send data to the port that has the MAC address specified in the data. A switch is effectively computer and a bridge with more ports. Using switches usually speeds up a network but it depends on the network configuration.

Network Bridge

A bridge connects two network segments together and is a selective repeater. It examines the MAC address of the traffic it sees and learns which network segments contain the various MAC addresses. It uses this information to decide whether or not to repeat the traffic on a network segment. A Bridge works at level 2 (data link Level) and will transmit broadcasts. Bridges are being replaced by switches.

Network Hub

A hub connects two or more computers together. Hubs are effectively multi-port repeaters and operate at the physical layer (level one). They do not examine the network traffic. They are being replaced today by switches. The smallest hub usually has 4 ports.

Wi-Fi Range Extender/Repeater

When placed within the range of an existing wireless network, it takes the signal from the network and rebroadcasts it, thus increasing the range of the network. Modern range extenders plug directly into a mains socket and require no other connections.

Firewall

A firewall functions like a router except that it blocks traffic from the external network according to user configured rules. A firewall protects your home/small business network computers and devices from intruders on the Internet. It effectively acts like a one-way digital gate blocking access to your network from devices on the Internet, but at the same time allowing devices on your network to connect to devices on the Internet.

Wireless Access Point

A wireless access point connects wireless devices to an Ethernet network, and to each other. It effectively does the same job as a hub/switch but for wireless devices.

Mi-Fi-BroadBand Wi-FI Hub

A Mi-Fi Hub is a relatively new device, and it can be used for connecting multiple devices to the Internet over the mobile network (3g and 4G). Your devices connect to the hub using Wi-Fi and the Hub connects to the mobile network using 3G/4G. Mi-Fi hubs are low cost and many will work for several hours without being connected to the mains. You will need a SIM card and a mobile data plan.

UTP Cable

Unshielded **T**wisted **P**air (UTP) cable is a 100-ohm copper cable that consists of 2 to 1800 unshielded twisted pairs surrounded by an outer jacket and is used in Ethernet based LANs, data centre networks and telephone wiring. UTP cable has no metallic shield. This makes the cable small in diameter but unprotected against EMI (Electromagnetic Interference), however, the twist in pairs of cable helps to improve the cables immunity to electrical noise. The two main types of UTP cabling in common use have four twisted pairs of wires. And they are CAT5e (supporting 1 Gbps for 100 meters) and CAT6 (supporting 1 Gbps for up to 100 meters and 10 Gbps for up to 50 meters). The most common connector used with UTP cable is RJ-45. Fiber optic cable is an alternative to UPT cable.

Fiber Optic Cable

A fiber optic cable is a network cable that contains strands of glass fibers inside an insulated casing. They're designed for long distance, very high-performance data networking, and telecommunications. Compared to wired cables, fiber optic cables provide higher bandwidth and can transmit data over longer distances. Fiber optic cables support much of the world's internet, cable television, and telephone systems.

NIC

A **N**etwork **I**nterface **C**ontroller (NIC, also known as a Network Interface Card, network adapter, LAN adapter or physical network interface, and by similar terms) is a computer hardware component that connects a computer to a computer network.

Computer/Laptop

An electronic device for storing and processing data usually used to search the internet with the assistance of a browser.

Smart Phone

A smart phone is a mobile phone that offers computer-like features that can include e-mail, an Internet browser, a personal organiser, a touch screen or a keyboard.

Tablet

A tablet is a smaller version of a laptop. It is a handheld personal computer that incorporates a touch screen.

1b. Describe at least three software components that enable access to the web and enable website production.

Software Components

Web Server Software

Web server software is comprised of several parts that control how web users access the web sites hosted on the web server computer. At a minimum, web server software contains a HTTP (HyperText Transfer Protocol) server. HTTP is the protocol used by a client browser to view webpages. HTTP uses URLs (Uniform Resource Locator - web addresses) to access the websites stored on the server, and deliver their content to the client's browser. Leading Web servers include Apache, Microsoft Internet Information Server (IIS), NGNIX, Novell NetWare server, Google Web Server and IBM Domino servers. Web server software is run on a hardware computer also referred to as a web server.

Website Development Software

Web development software enables you to develop (design, create, edit, update) a website for the Internet (World Wide Web) or an intranet (a private network). This may include anything from a simple single static page of plain text to complex web-based internet applications (web apps), electronic businesses, and social network services. Common web development software applications include; WordPress, Adobe Dreamweaver and Google Web Designer.

Operating System

An operating system (OS) is system software that manages computer hardware and software resources and provides common services for computer programs. The best-known operating systems are those found on personal computers; Microsoft Windows, MacOS and Linux (a UNIX-like OS). A modern OS contains built-in software designed to simplify the networking of a computer and access to the Internet.

Computer Firewalls

Modern operating systems will have built-in software firewalls. This software firewall is less secure than the one built into a switch/router/hub but it is normal to leave it enabled on a user’s computer.

Browser

A browser is a piece of software that allows you access and view information on the Internet. The most popular browsers are currently Chrome, Microsoft's Internet Explorer, Mozilla, Firefox and Edge.

Email Client

Email client is a desktop application that enables configuring one or more email addresses to receive, read, compose and send emails from that email address(s) through the desktop interface.

2. Explain the role of the TCP/IP protocol including IPv6

Explain the role of the following protocols:

- TCP/IP including IPv6
- HTTP
- SMTP

TCP/IP including IPv6

Transmission **C**ontrol **P**rotocol/**I**nternet **P**rotocol (TCP/IP) defines a set of rules for message formats and procedures that allow machines and application programs to exchange information. These rules must be followed by each machine involved in the communication in order for the receiving host to be able to understand the message. TCP/IP carefully defines how information moves from sender to receiver.

The sending procedure is:

1. Application programs send messages or streams of data using either the User Datagram Protocol (UDP) or the Transmission Control Protocol (TCP)
2. The data is then divided it into smaller pieces called packets
3. The packets are then enclosed in an Internet Protocol (IP) datagram and header and trailer information is added
4. The datagrams are then transmitted as frames over a specific network hardware, such as Ethernet or Token-Ring networks

Frames received by a host go through the protocol in reverse. The receiving procedure is:

1. The frames of data are received
2. The IP header is removed and footer are removed
3. The data packets are reassembled
4. The application receives the data

TCP/IP includes an Internet addressing scheme that allows users and applications to identify a specific network or host with which to communicate.

An Internet address works like a postal address, allowing data to be routed to the chosen destination. TCP/IP provides standards for assigning addresses to networks, subnetworks, hosts, and sockets, and for using special addresses for broadcasts and local loopback.

Internet addresses are made up of a network address and a host (or local) address. This two-part address allows a sender to specify the network as well as a specific host on the network. A unique, official network address is assigned to each network when it connects to other Internet networks. However, if a local network is not going to connect to other Internet networks, it can be assigned any network address that is convenient for local use.

IPv4 and IPv6

An **I**nternet **P**rotocol (IP) address is an identifier for a computer or device on a TCP/IP network. Networks using the TCP/IP protocol route messages based on the IP address of the destination.

The format of an IPv4 IP address is a 32-bit numeric address written as four numbers separated by periods. Each number can be in the range of zero to 255. For example, 1.160.10.240 could be an IP address.

Within an isolated network (not connected to the Internet), you can assign IP addresses at random as long as each one is unique. However, connecting a private network to the Internet requires using registered IP addresses (called Internet addresses) to avoid duplicates.

An IP address can be static or dynamic. A static IP address will never change and it is a permanent Internet address. A dynamic IP address is a temporary address that is assigned each time a computer or device accesses the Internet.

The number of addresses that IPv4 can manage is running out, so a new system, IPv6 (or IPng) is the next generation of IP and has been designed to be an evolutionary step from IPv4. In IPv6 the IP address size is increased from 32 bits to 128 bits. This extension anticipates considerable future growth of the Internet and provides relief for what was perceived as an impending shortage of network addresses. IPv6 also supports auto-configuration to help correct most of the shortcomings in version 4, and it has integrated security and mobility features.

To view your IP address, you can use the **`ipconfig`** command from the command prompt.

HTTP

Hyper**T**ext **T**ransfer **P**rotocol (HTTP) is the underlying protocol used by the World Wide Web and defines how messages are formatted and transmitted, and what actions Web servers and browsers should take in response to various commands. Hypertext documents include hyperlinks to other resources that the user can easily access and HTTP was developed specifically to facilitate hypertext and the World Wide Web.

For example, when you enter a URL in your browser, this actually sends an HTTP command to the Web server directing it to fetch and transmit the requested Web page. The other main standard that controls how the World Wide Web works is HTML, which covers how Web pages are formatted and displayed.

HTTP is called a stateless protocol because each command is executed independently, without any knowledge of the commands that came before it. This is the main reason that it is difficult to implement Web sites that react intelligently to user input. This shortcoming of HTTP is being addressed in a number of new technologies, including ActiveX, Java, JavaScript and cookies.

There is a secure version of HTTP; Hyper Text Transfer Protocol Secure (HTTPS). Communications between the browser and website are encrypted by Transport Layer Security (TLS), or its predecessor, Secure Sockets Layer (SSL).

SMTP

Simple Mail Transfer Protocol (SMTP) is an Internet standard used for sending and receiving email between servers. Email messages can then be retrieved with an email client that uses either POP or IMAP (SMTP is used to send email and POP or IMAP is used for receiving email).

POP

Post Office Protocol (POP) is an application-layer Internet standard protocol used by email clients to retrieve email from a mail server. It works by contacting your email service and downloading all of your new messages from it. Once they are downloaded onto your computer, they are deleted from the email service. This means that after the email is downloaded, it can only be accessed using the same computer. If you try to access your email from a different device, the messages that have been previously downloaded won't be available to you. Sent mail is stored locally on your PC or Mac, not on the email server.

IMAP

The Internet Message Access Protocol (IMAP) is an email protocol used for accessing email on a remote web server from a local client. IMAP allows you to access your email wherever you are, from any device. When you read an email message using IMAP, you aren't actually downloading or storing it on your computer; instead, you're reading it from the email service. As a result, you can check your email from different devices, anywhere in the world. IMAP only downloads a message when you click on it, and attachments aren't automatically downloaded. This way you're able to check your messages a lot more quickly than POP.

Glossary of Terms

LAN

A **L**ocal **A**rea **N**etwork (LAN) is a computer network that interconnects computers within a limited area such as a residence, school, laboratory, university campus or office building.

MAC Address

A **M**edia **A**ccess **C**ontrol address (MAC address) of a device is a unique identifier assigned to a network interface controller (NIC) for communications at the data link layer of a network segment. MAC addresses are used as a network address for most IEEE 802 network technologies, including Ethernet, Wi-Fi and Bluetooth.

MiFi

MiFi stands for **M**obile Wi-**Fi** and describes a wireless router that acts as mobile Wi-Fi hotspot. A MiFi device can be connected to a cellular network and provide internet access for up to ten devices.

RJ45

RJ45 (**R**egistered **J**ack 45) is a type of connector commonly used for Ethernet networking. Ethernet cables have an RJ45 connector on each end and are sometimes called RJ45 cables.

SIM Card

A **S**ubscriber **I**dentity **M**odule or **S**ubscriber **I**dentification **M**odule (SIM), widely known as a SIM card, is an integrated circuit that is intended to securely store the international mobile subscriber identity (IMSI) number and its related key, which are used to identify and authenticate subscribers on mobile telephony devices (such as mobile phones and computers). It is also possible to store contact information on many SIM cards. SIM cards are always used on GSM phones; for CDMA phones, they are only needed for newer LTE-capable handsets. SIM cards can also be used in satellite phones, smart watches, computers, or cameras.

WAN

A **W**ide **A**rea **N**etwork (WAN) is a telecommunications network or computer network that extends over a large geographical area/distance/place. Wide area networks are often established with leased telecommunication circuits.

Wi-Fi

Wi-Fi is a technology used for radio wireless local area networking of devices based on the IEEE 802.11 standards allowing computers, smartphones, or other devices to connect to the Internet or communicate with one another wirelessly within a particular area. The term Wi-Fi (**Wi**reless **Fi**delity) was invented as a pun on the word hi-fi (**Hi**gh **fi**delity), a term for high-quality audio technology.