Introduction to Web Programming

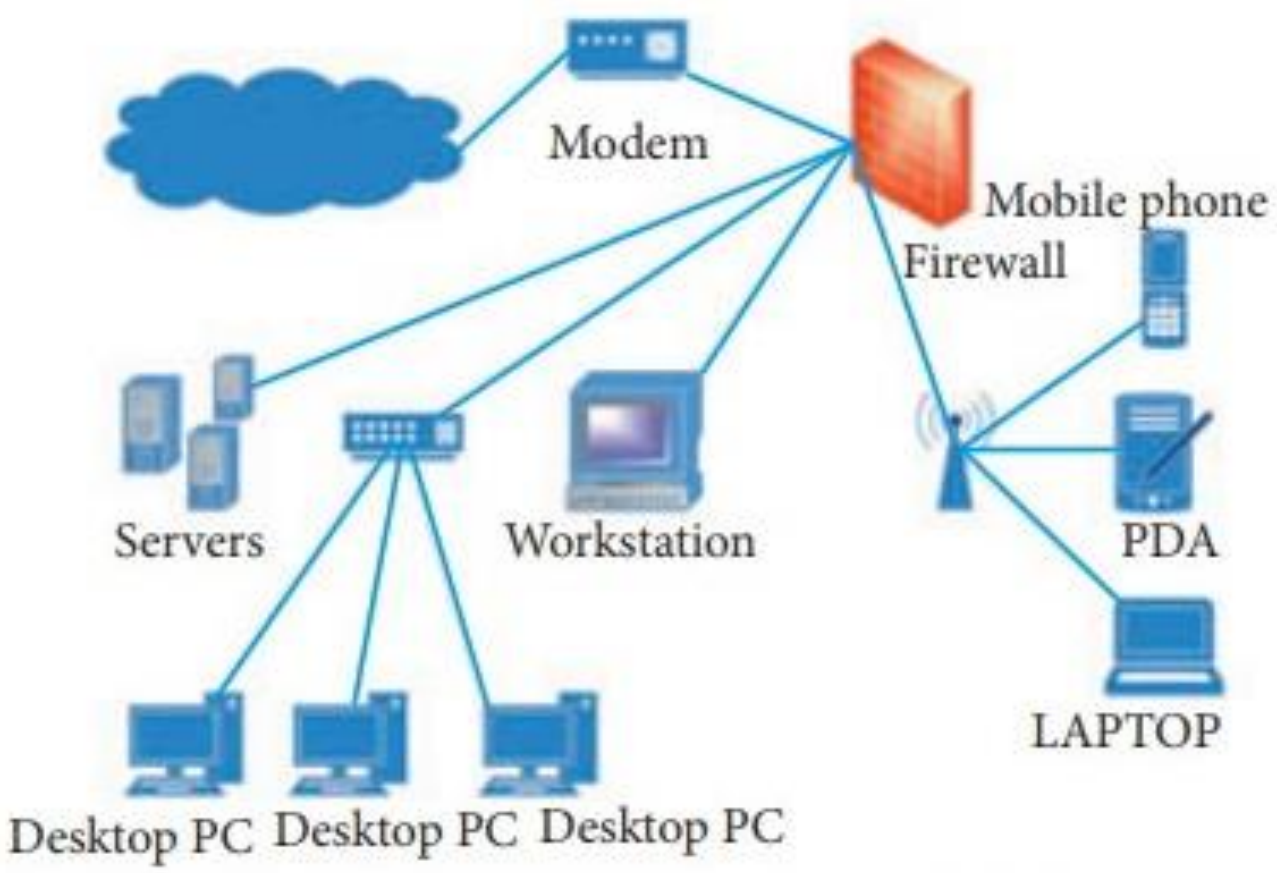
Shilpa Mahangade

Introduction to Internet

Shilpa Mahangade

Going online

- What does it mean?



What is network?

- A **network** is a group of 1 or extra computer systems (Multiple gadgets, additionally called hosts), which are related through a couple of channels
  - Purpose of sending and receiving records or media in a shared environment
- Can consist of gadgets/mediums - Network devices
  - routers, switches, hubs, and bridges, amongst others

Terms

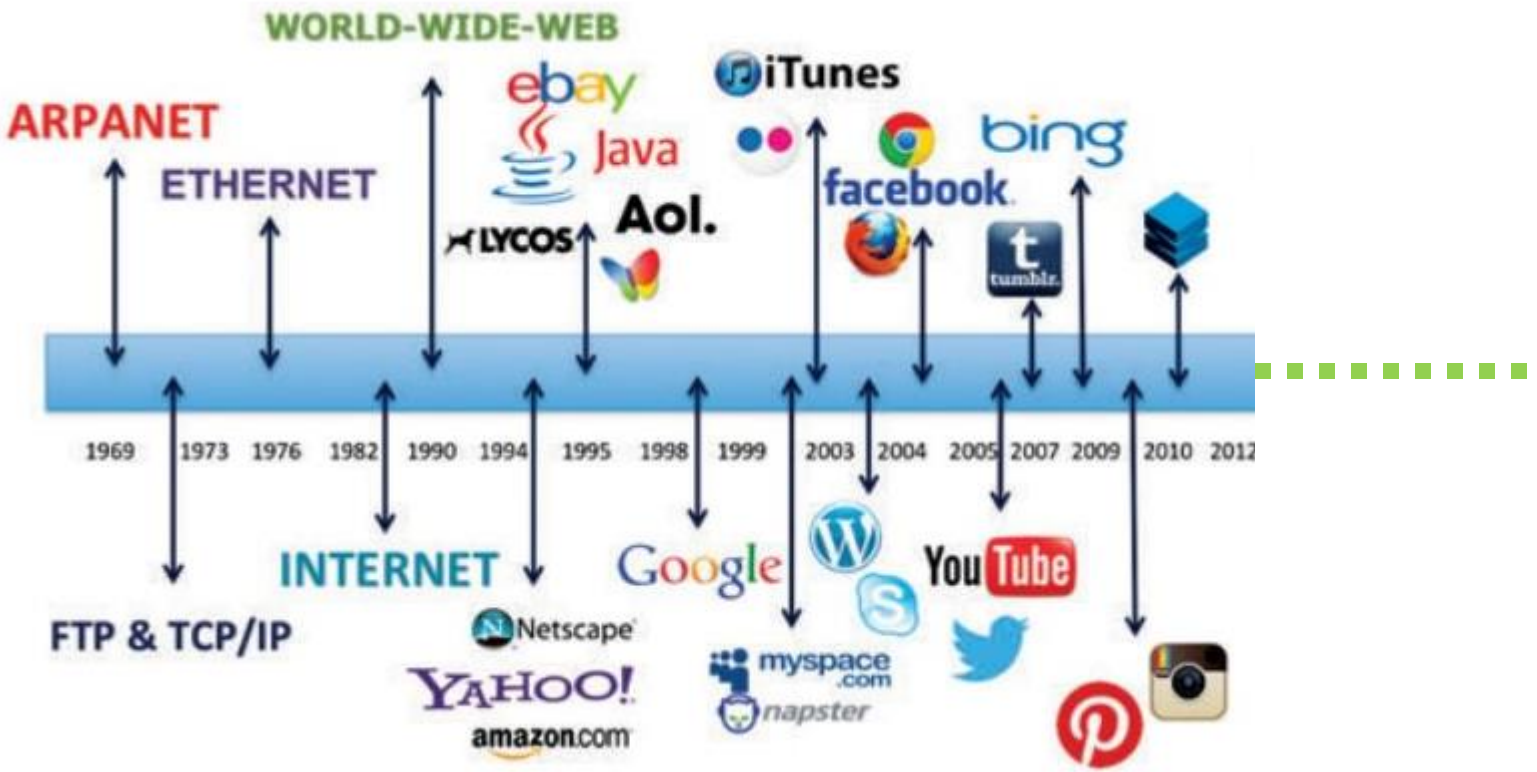
- Router
  - connects two or more networks or sub-networks
  - forwards data between different networks (LAN-WAN)
- Switches
  - forwards data between groups of devices in the same network
  - traffic police of a simple LAN
- Modem
  - connects those networks to the Internet
- Hubs
  - a physical layer networking device which is used to connect multiple devices in a network
  - Connecting computers on LAN

- ABC - has a router, but no modem, he will be able to create a LAN and send data between the devices on that network. However, he will not be able to connect that network to the Internet.
- PQR - has a modem, but no router. She will be able to connect a single device to the Internet (for example, her work laptop), but cannot distribute that Internet connection to multiple devices (say, her laptop and her smartphone).
- XYZ - has a router and a modem. Using both devices, she can form a LAN with her desktop computer, tablet, and smartphone and connect them all to the Internet at the same time.

What is internet?

- “Global system of interconnected computer networks that use **the Internet protocol suite** to link devices worldwide.”
- It is a network of networks that consists of private, public, academic, business, and government networks of local to global scope, **linked by a broad array of electronic, wireless, and optical networking technologies**.
- Carries a vast range of information resources and services, such as the inter-linked hypertext documents and applications of the World Wide Web (WWW), electronic mail, telephony and file sharing.

Evolution



Shilpa Mahangade

Image taken from internet

Evolution

- Cold war
  - In 1960s – way for govt to transfer information
  - Formation of ARPANET (Advanced Research Projects Agency Network)
- “Official Birthday” of Internet - January 1, 1983
  - Standard way to communicate – new communication protocol TCP/IP

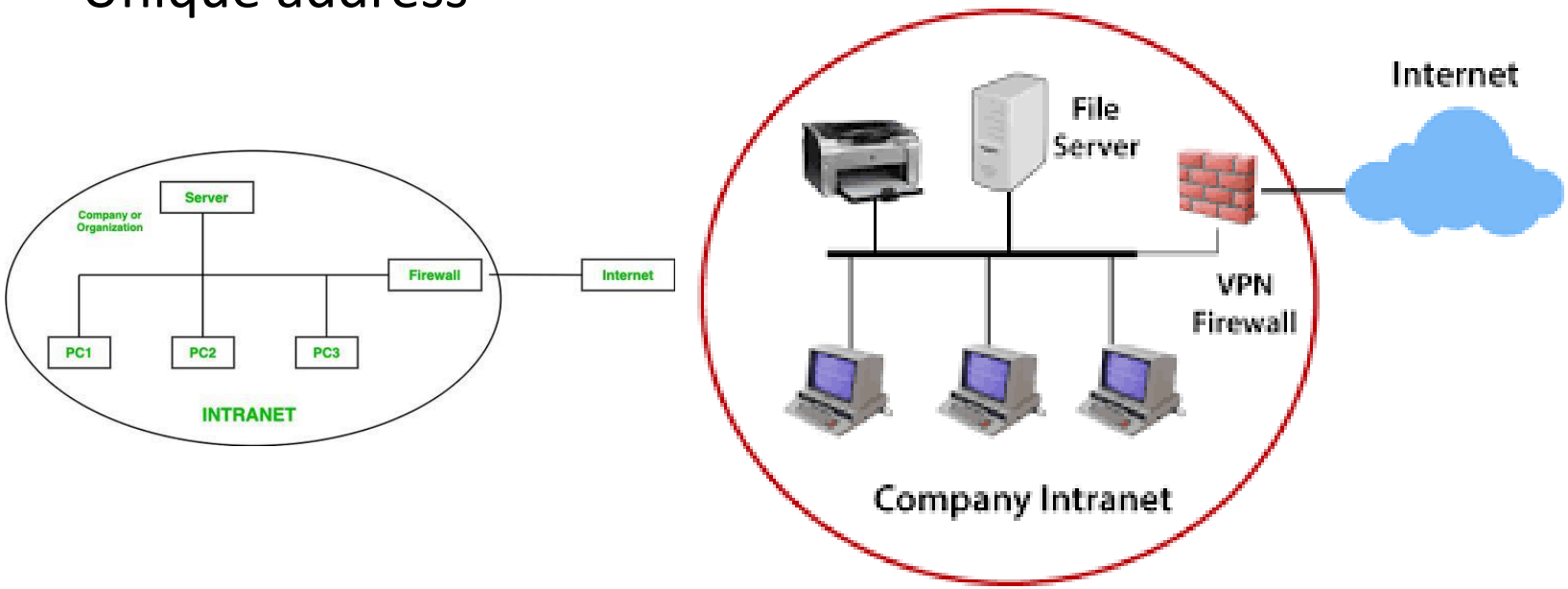
Uses

- Information
  - WWW
  - Search engine – google, bing, yahoo search
  - Technology, health, science, social science
- Communication
  - Social networking sites - Facebook, Twitter, etc.
- Entertainment
- Services
  - Email, chat rooms, internet banking, meetings
  - E-commerce
  - Ticket booking
  - E - learning
  - E – governance
  - E - marketing
  - Internet telephony
  - Maps
  - And many more . . .

- https://www.youtube.com/watch?v=jKA5hz3dV-g&t=32s

Intranet

- Private network of computers within an organization with its own server and firewall
  - Unique address



Uses of intranet

- Easy communication
- Collaboration
- Platform independent
- Easy management
- Security
- Diff. devices connected
- Easy deployment of reqd. application
- Document sharing

Uses of intranet

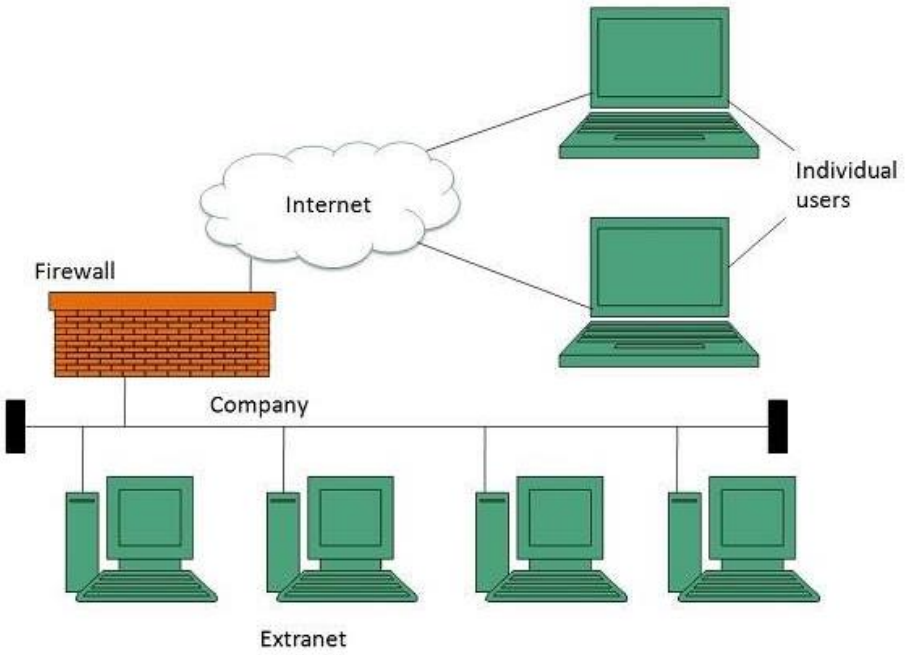
- **Communication** - Intranet offers easy and cheap communication within an organization. Employees can communicate using chat, e-mail or blogs.
- **Time Saving** - Information on Intranet is shared in real time.
- **Collaboration** - Information is distributed among the employees as according to requirement and it can be accessed by the authorized users, resulting in enhanced teamwork.
- **Platform Independency** - Intranet can connect computers and other devices with different architecture.
- **Cost Effective** - Employees can see the data and other documents using browser rather than printing them and distributing duplicate copies among the employees, which certainly decreases the cost.
- **Workforce Productivity** - Data is available at every time and can be accessed using company workstation. This helps the employees work faster.
- **Business Management-** It is also possible to deploy applications that support business operations.
- **Security** - Since information shared on intranet can only be accessed within an organization, therefore there is almost no chance of being theft.
- **Specific Users** - Intranet targets only specific users within an organization therefore, once can exactly know whom he is interacting.
- **Immediate Updates** - Any changes made to information are reflected immediately to all the users.

Applications of intranet

- Applications reside on local server
  - Document publication applications
  - Electronic resources applications
  - Interactive Communication applications
  - Support for Internet Applications

What is Extranet?

- refers to network within an organization, using internet to connect to the outsiders in controlled manner
- helps to connect businesses with their customers and suppliers and therefore allows working in a collaborative manner

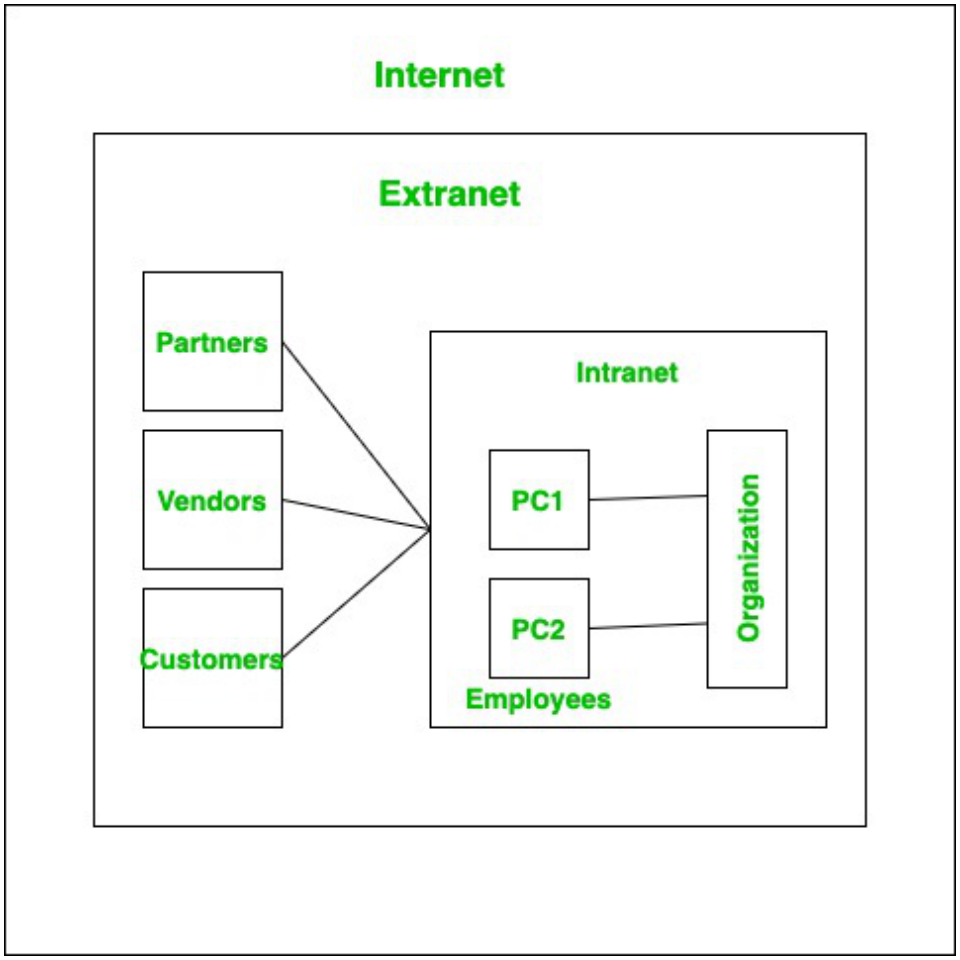


Working of internet

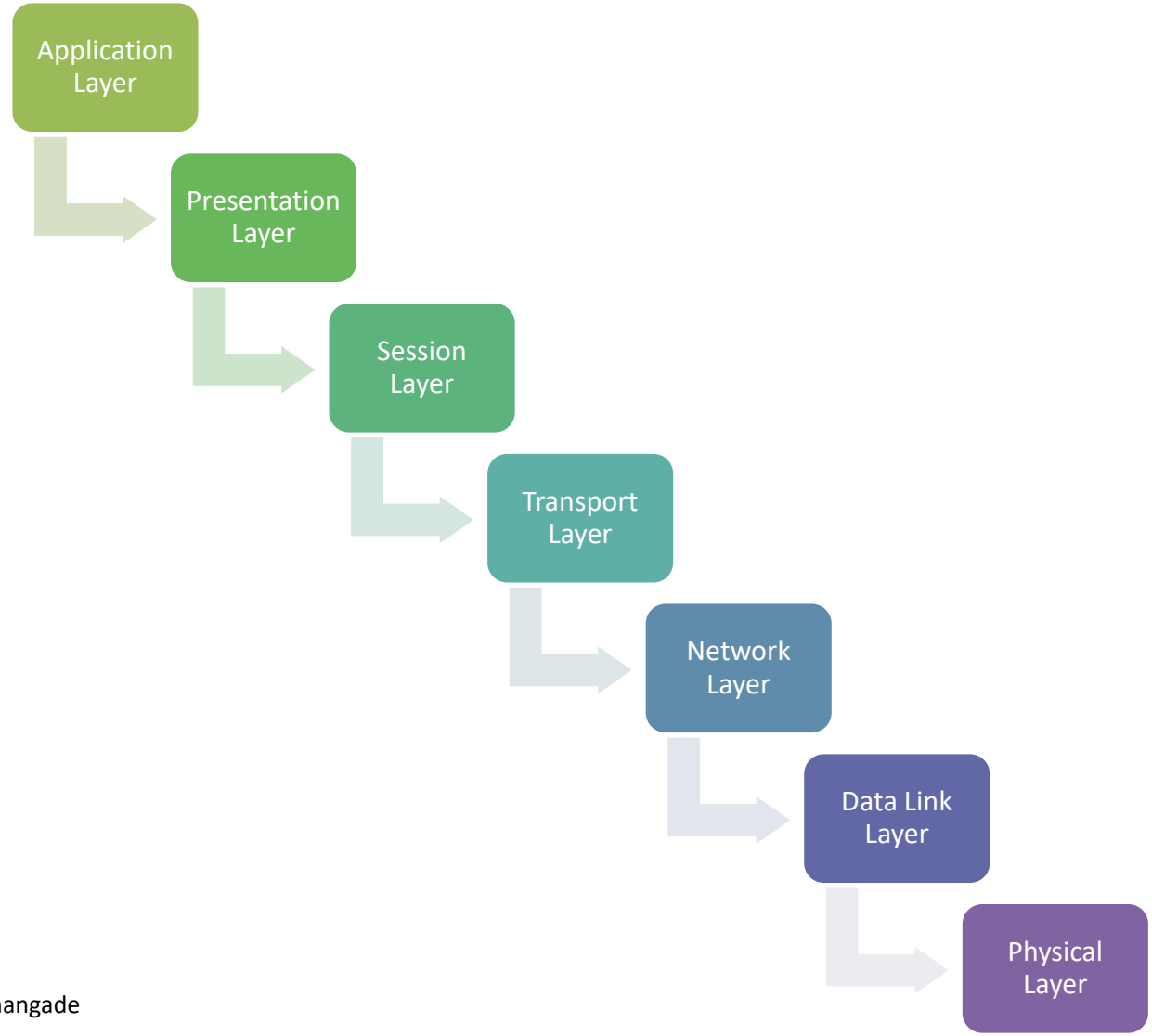
- Uses Internet Protocol (IP) and Transport Control Protocol (TCP)-based packet routing network
- Data delivered in the form of messages and packets
  - Message - piece of data delivered over the internet, but before it is sent, it is broken down into smaller pieces known as packets

What is a protocol?

- Protocols are sets 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.
- The TCP/IP suite of protocols can be understood in terms of layers (or levels).


Internet
Extranet
Partners
Vendors
Customers
Intranet
PC1
PC2
Employees
Organization

OSI Model (Open Systems Interconnection)



What is TCP/IP model?

- A practical model used in the internet
  - Acronym of **Transmission Control Protocol and Internet Protocol**

- IP address - phone number assigned to a smartphone.
- TCP is the computer networking version of the technology used to make the smartphone ring and enable its user to talk to the person who called them.

TCP

- defines how information moves from sender to receiver.
  - First, application programs send messages or streams of data to **Transmission Control Protocol** (**TCP**)
  - These protocols receive the data from the application, divide it into smaller pieces called *packets*, add a destination address, and then pass the packets along to the next protocol layer, the Internet Network layer.
  - The Internet Network layer encloses the packet in an **Internet Protocol** (**IP**) datagram, puts in the datagram header and trailer, decides where to send the datagram (either directly to a destination or else to a gateway), and passes the datagram on to the Network Interface layer.
  - The Network Interface layer accepts **IP** datagrams and transmits them as *frames* over a specific network hardware

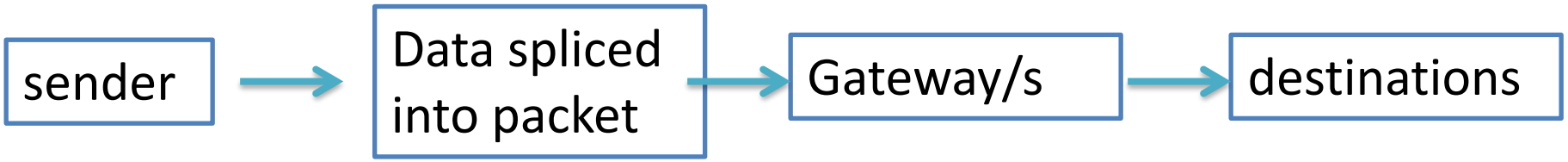
TCP

Hardware independence

- Used with IP to ensure that data is transferred in a secure and reliable manner
  - ensures that no packets are lost
  - packets are reassembled in the correct order and
  - there is no delay that degrades data quality
  - Also detects errors in sending process
    - If any packet missed, requests IP to re-transmit the packets to destination

IP

- IP - a set of rules that control how data is transmitted from one computer to another via internet
- IP - receives information about how the data to be transferred using IP address (numerical address)
- Functions similarly to a postal service



THE TCP/IP

- IP paired with TCP - internet protocol suite
- IP sends packets to their destinations
- TCP arranges the packets in the correct order, as IP sometimes sends packets out of order to ensure the packets travel the fastest ways
  - Open Shortest Path First(OSPF) - opens the shortest, or quickest, path first for packets

To summarize…

- TCP and IP
  - separate protocols that work together to ensure data is delivered to its intended destination within a network
- IP obtains and defines the address—the IP address—of the application or device the data must be sent to.
- TCP is then responsible for transporting and routing data through the network architecture and ensuring it gets delivered to the destination application or device that IP has defined.
- The two protocols are frequently used together and rely on each other for data to have a destination and safely reach it, which is why the process is regularly referred to as TCP/IP.

Protocols

- Several ways to retrieve information from the Internet called protocols
- Many Internet Web browsers allow users to access files using most of the protocols
  - File retrieval protocols – FTP, gopher, telnet
  - Communication protocols - email, newsgroups and chat
  - Multimedia Information Protocol - Hypertext transfer protocol (HTTP) alias "The Web"

FTP

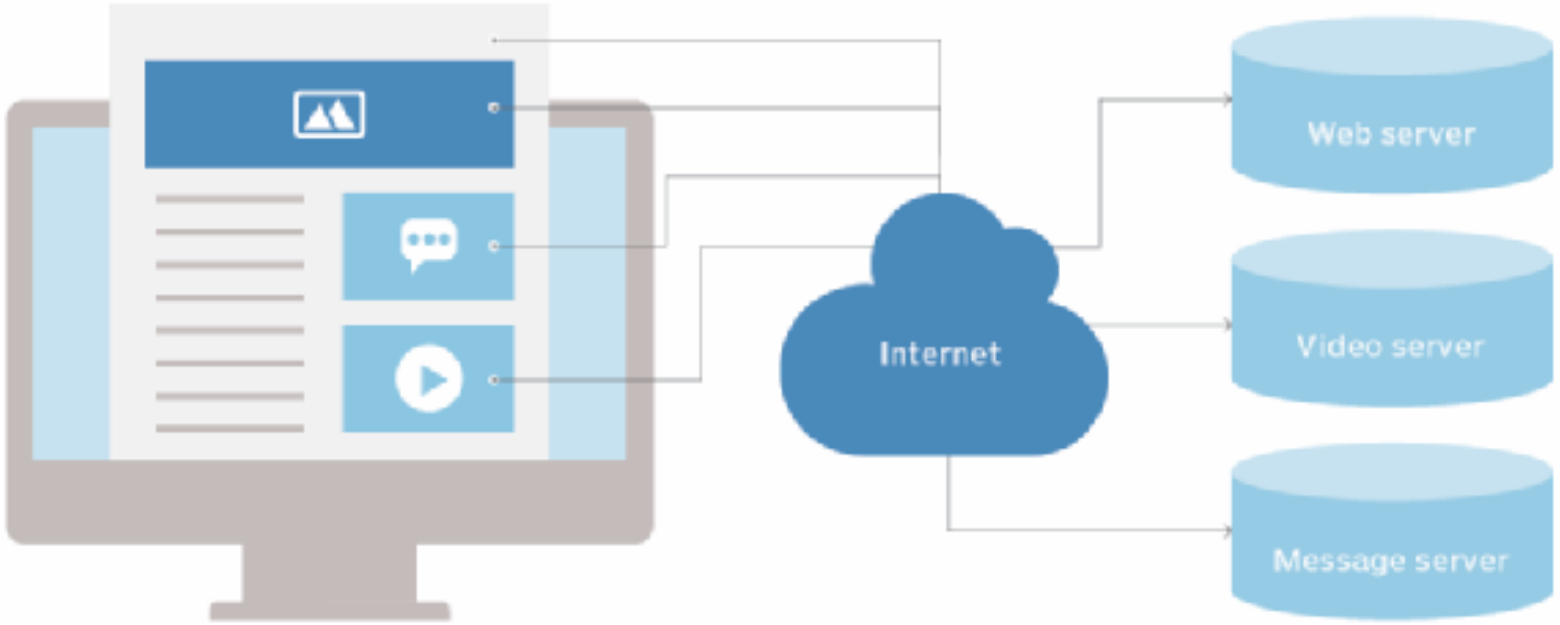
- A client-server protocol with which a client requests a file and the server supplies it
- FTP runs over TCP/IP -- a suite of communications protocols
  - requires a command channel and a data channel to communicate and exchange files, respectively

FTP

- Allows users to move files from one computer to another
- Using the FTP program, a user can
  - logon to a remote computer
  - browse through its files, and
  - either download or upload files (if the remote computer allows)
- User is only allowed to see the file name; no description of the file content is included
- Many sites that offer downloadable applications use the FTP protocol.

HTTP (Hypertext Transfer Protocol)

- A file sharing protocol like FTP
- Primarily works over web browsers and so easily recognizable by most users



Hypertext Transfer Protocol - HTTP

- The top-level protocol used to request and return data
  - E.g. HTML pages, GIFs, JPEGs, Microsoft Word documents, Adobe PDF documents, etc.
- The protocol which is used to access web application.
- It works on port 80 `and` runs on top of TCP/IP protocol.
- Stateless protocol

Communications Protocols

- allow users to communicate both
  - asynchronously (sender and receiver aren't required to both be connected to the Internet at the same time; e.g. email) and
  - synchronously (as with chatting in "real time")
- SMTP (Simple Mail Transfer Protocol)
  - most popular email protocol
  - part of the TCP/IP suite
  - controls how email clients send users' email messages
  - Email servers use SMTP to send email messages from the client to the email server to the receiving email server.

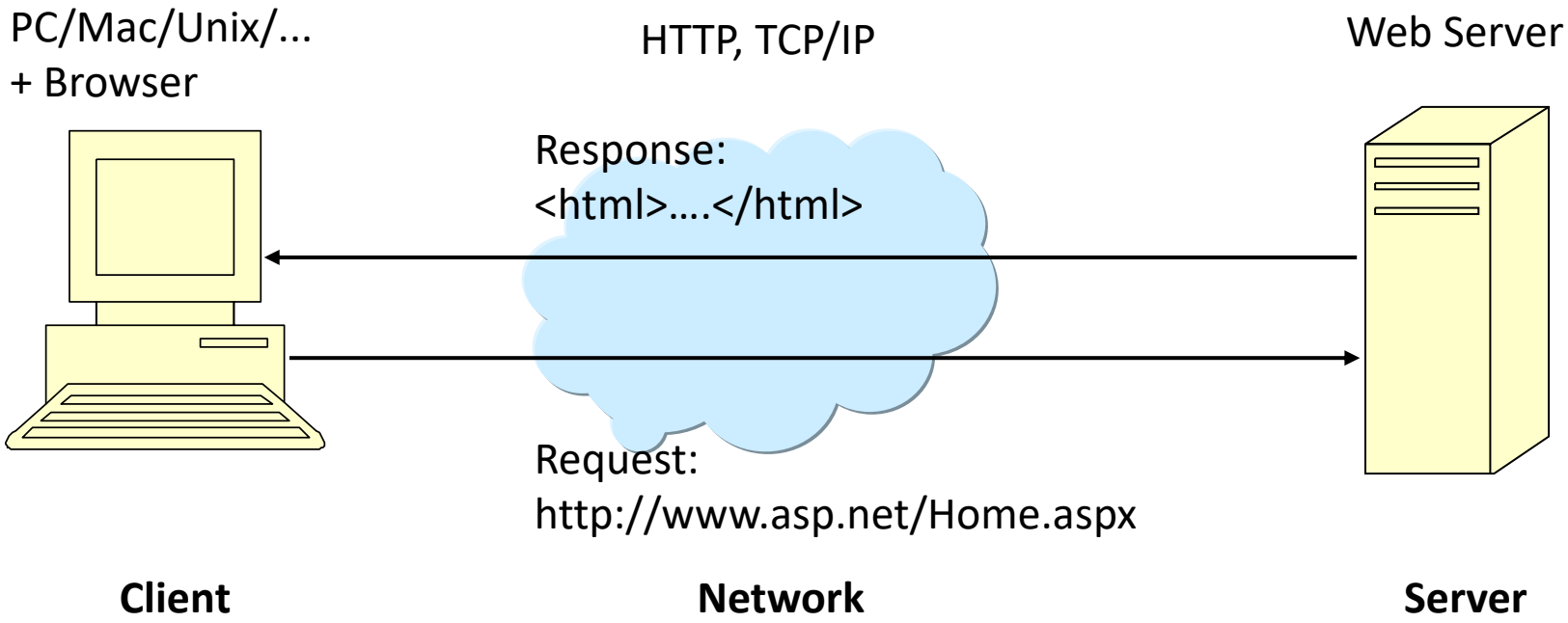
Communications Protocols

- Email
  - main computer acts as a "post office" by sending and receiving mail for those who have accounts
  - mail can be retrieved through any number of email software applications
  - provides the ability to access email lists

Multimedia Information Protocol

- HTTP
  - most popular way to provide and obtain information from the Internet
  - The Web offers not only access to files to download, but offers a way to jump from site to site through a series of connecting hyperlinks
  - distinguishing feature of the Web is the way that text is formatted
    - A series of "tags" is used to encode and format text, graphics, animation, sound, and other types of files.
    - These tags are called HTML (HyperText Markup Language)

Web Application Architecture



Web Application

- Hosted on Web server
- Web Server delivers the web pages in response to requests from the web site visitors.
- Features
  - Able to support a set of thousand users
  - Service available for 24x7x365
  - Accessed using internet connectivity
  - Secured access to the application resources

Web Application Architecture

- Popular Web Servers
  - IIS- Internet Information Server - Developed by Microsoft Corporation.
  - Apache Server - Developed by Apache Foundation.
  - ….. Etc.
- Popular Web Browsers
  - Google Chrome – by Google
  - Firefox Browser - by Mozilla
  - Opera Browser - by Opera Software
  - Internet Explorer(IE) - by Microsoft
  - …

Web Server

- a computer that hosts or provide a website on the internet
- contains webserver software and component files of a website
- communicates with a web browser using the Hypertext Transfer Protocol (HTTP)
- Used to
  - Send and receive emails.
  - Download the file transfer protocol or FTP request
  - Build and publish webpages.

Web Client

- the client (or user) side of the Internet
- the Web browser on the user's computer or mobile device is referred to as a Web client
- Could also apply to browser extensions and helper software that improve the browser's ability to support specific site services.

Web Browser

- A web browser is a software program software that searches for, retrieves, and presentations material which includes Web pages, photos, videos, and different files.
- Request – Response Model
- Renders HTML to client
- examples - Mozilla Firefox, Internet Explorer, Google Chrome, Safari, etc.

WWW

- Usually called Web
- A collection of different **websites** that can be accessed through the Internet.
- A **website** is made up of related text, images, and other resources.

Website

- group of online pages connected collectively through links and saved on an internet server

Web Page

- A Web page is a document for the World Wide Web that is identified by a unique Uniform Resource Locator (URL)
- A Web page is a representation of a document that is actually located at a remote site.
- Displayed through a web browser
- The Web browser is connected to the Web server, where the website's contents are hosted through HTTP.
- A webpage may contain text, links for other pages, graphics, videos, etc.

How the browser interacts with the servers ?

- There are few steps to follow to interacts with the servers a client.
  1. User enters the **URL**(Uniform Resource Locator) of the website or file. The Browser then requests the **DNS**(DOMAIN NAME SYSTEM) Server.
  2. **DNS Server** lookup for the address of the **WEB Server**.
  3. **DNS Server** responds with the **IP address** of the **WEB Server**.
  4. Browser sends over an **HTTP/HTTPS** request to **WEB Server's IP** (provided by **DNS server**).
  5. Server sends over the necessary files of the website.
  6. Browser then renders the files and the website is displayed. This rendering is done with the help of **DOM** (Document Object Model) interpreter, **CSS** interpreter and **JS Engine** collectively known as the **JIT** or (Just in Time) Compilers.

Domain Name System (DNS)

- a database that includes a website's domain name, which people use to access the website, and its corresponding IP addresses, which devices use to locate the website.
- DNS translates the domain name into IP addresses, and these translations are included within the DNS.
- Servers can cache DNS data, which is required to access the websites.
- DNS is important because it can quickly provide users with information, as well as access to remote hosts and resources across the internet.

URL

- Uniform Resource Locator or URL is the "address" of a computer connected to the Internet.
- Example:
  - http://www.google.com/
  - https://www.coursera.org/
  - https://www.coursera.org/for-university-and-college-students
  - **news.google.com**
  - https://www.coursera.org/for-university-and-college-students#newcourses
  - https://www.youtube.com/watch?v=7RlB1CJovTs

URL

http://www.mysite.com: 80/path/of/myfile.html?key1 = value1&key2=value2#linksomewhereindoc

Scheme
Domain name
Port
Path of the file
Parameters
Anchor

Domain suffix

- .com - a universal phrase in the English language.
  - means it is a commercial entity
- Sites on the Web are grouped by their URLs according to the type of organization providing the information on the site.
  - provides a clue about the purpose or audience of a Web site
  - might also give you a clue about the geographic origin of a Web site
  - .com, .edu, .gov, .org, .mil, .net

Search Engine

- websites that search on the internet on behalf of users and show a listing of results
- Excluding a word – hyphen
  - recipes vegeterian -paneer
- Quotation to make specific search
  - recipes vegeterian ”paneer”
- Use search suggestions

Limitations

- Addiction
- Cyber crime
- Access to personal information
- Authenticity of information
- Virus attacks
- Spam mails
- Easy access to unwanted information for children