Fundamentals of Computer Networks

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As many of you might be aware that I started Professional Knowledge series (PK Series) for SBI SO and IBPS SO exam. In this series, today I am sharing important Computer Network concepts :-

What is a computer Network?

A computer network is a group of computers or computer like devices connected together to share the network resources like files, printers, network services etc. A typical computer network consists of users working in workstations (also called as clients, or desktops), running client Operating Systems like Windows 7 or Windows 8/8.1 and store their files inside a central network server.

Why we need computer networks?

Computer networks help users on the network to share the resources and in communication. Can you imagine a world now without emails, online newspapers, blogs, chat and the other services offered by the internet?

The following are the important uses and benefits of a computer network:
File sharing: Networking of computers helps the network users to share data files.

Hardware sharing: Users can share devices such as printers, scanners, CD-ROM drives, hard drives etc. Without computer networks, device sharing is not possible.

Application sharing: Applications can be shared over the network, and this allows implementing client/server applications.

User communication: Networks allow users to communicate using e-mail, newsgroups, and video conferencing etc.

Network gaming: A lot of network games are available, which allow multi-users to play from different locations.

Voice over IP (VoIP): Voice over Internet Protocol (IP) is a revolutionary change in telecommunication which allows to send telephone calls (voice data) using standard Internet Protocol (IP) rather than by traditional PSTN.

Client Operating Systems and Network Operating Systems (NOS):
What is a Client Computer? You can think a client as a computer in your network, where a network user is performing some network activity. For Example: Downloading a file from a File Server, Browsing Intranet/Internet etc. The network user normally uses a client computer to perform his day to day work.

What is a Server Computer? The client computer establishes a connection to a Server computer and accesses the services installed on the Server Computer. A Server is not meant for a network user to browse in internet or do spreadsheet work. A Server computer is installed with appropriate Operating System and related Software to serve the network clients with one or more services, continuously without a break.

Network Operating Systems (NOS): A Network Server computer offers its services to a group of Network Client devices. A Server computer typically has more computing resources like Processors & Processing Power, more Physical Memory (RAM), and more Storage Space etc. compared to client computers. The Server computer machine runs on Server Operating System, also called as Network Operating System (NOS), which normally has more features and processing capabilities compared with the client computer's Operating System. Some popular NOSs are –

Windows 2012 /Windows 2012 R2, UNIX (Oracle, Solaris, IBM, AIX, HP UX, FreeBSD, OpenBSD), GNU/LINUX (Red Hat, Debian, SUSE Enterprise, Ubuntu Server, Mandriva, Fedora etc)
Client Operating Systems (Workstation/Desktop operating systems): Most popular COSs are-
Windows 7, Windows 8/8.1, Ubuntu Desktop, SUSE Desktop, LinuxMint, Windows XP(Legacy)

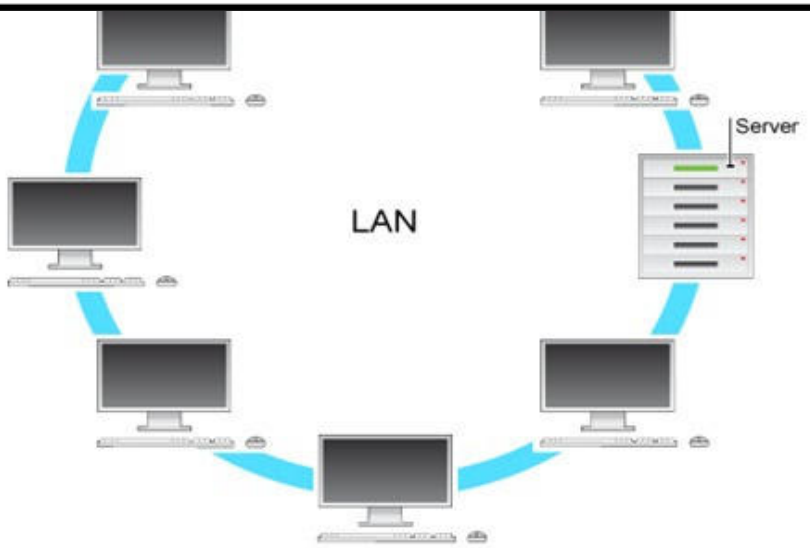
Common Network Application Software:
Web Browser: A web browser is a network application which enables the users to access the internet. Web browser interprets HTML (HyperText Mark-up language) files sent from a Web Server and displays the content in its screen. Web Browser is the most widely used network application. E.g.- Firefox, IE, Chrome, Opera, Safari.

E-mail Applications: E-mail (Electronic Mail) Applications are used for composing and sending e-mails within the same network or to outside the network. E.g. - MS Outlook, Gmail, Yahoo Mail, Hotmail, Mozilla Thunderbird.

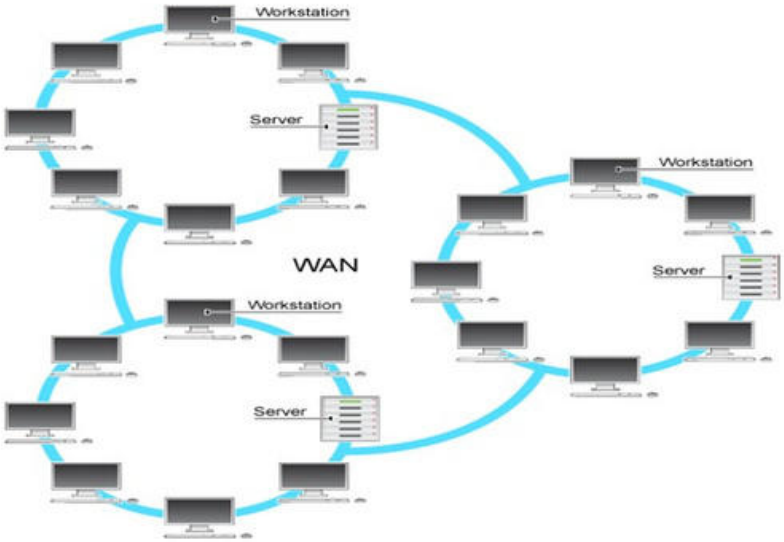
Instant Messaging Chat Applications: Instant Messaging Chat Applications are used these days for corporate communication and for general chat. E.g. - Apache open meetings, Cisco WebEx, MS Lync, and Yahoo Messenger.

Collaboration Applications: Collaboration network applications are mainly used inside a company for a group of employees to work together for a common task. Collaboration network applications allow employees to transfer their files to a central storage repository and work together on it. E.g. – MS SharePoint, IBM Lotus Notes, Oracle Beehive, Novell GroupWise

Local Area Network (LAN) & Wide Area Network (WAN):
LAN: Local Area Network (LAN) is a computer network, which is limited to a small office, single building, multiple buildings inside a campus etc. Typically a Local Area Network (LAN) is a private network owned and maintained by a single organization.



WAN: A Wide Area Network (WAN) spans over multiple geographic locations, which is composed of multiple LANs. It is nearly impossible for a small to medium organization (except Network Service Providers) to pull network cables between their two offices in two different countries located 1000s of kms away. Network Service Providers (also called as ISPs) provide the connectivity solutions for Wide Area Networks (WAN).



Differences between LAN and WAN:

- A Local Area Network (LAN) is a private computer network that connects computers in small physical areas. Example: A small office, A Single building, Multiple buildings inside a campus etc. Wide Area Networks (WAN) is type of computer network to connect offices which are located in different geographical locations. Wide Area Network (WAN) depends mainly on Internet Service Providers (ISPs) for connection solutions.
- Local Area Network (LAN) has higher bandwidth rates. Current Local Area Networks (LANs) runs on bandwidths of 100 Mbps, 1 Gbps or 10 Gbps. Wide Area Networks (WAN) has lower bandwidth rates compared with Local Area Network (LAN). Current Local Area Networks runs on bandwidths of 4 Mbps, 8 Mbps, 20 Mbps, 50 Mbps or 100 Mbps.
- Local Area Network (LAN) bandwidth rates are almost constant. Local Area

Network (LAN) bandwidth rates are dependent on characteristics of the LAN technology in use (Normally FastEthernet or Gigabit Ethernet). Since most of Wide Area Networks (WAN) connectivity solutions are dependent on Internet Service Providers (ISPs), budget related constraints affect the quality of WAN.

- Most of the current Local Area Networks (LANs) use Ethernet as the LAN Standard (FastEthernet 100 Mbps, or Gigabit Ethernet 1/10 Gbps). WAN uses technologies like VPN (Virtual Private Network) over Internet, MPLS, FrameRelay, or Leased Lines as WAN connectivity solutions.
- Since Local Area Networks (LANs) are private networks, managed by dedicated local network administrators, Local Area Networks (LANs) are more reliable and secure than Wide Area Networks (WANs). Since Wide Area Networks (WANs) involve 3rd party service providers, WAN networks are less reliable and secure.
- Initial set-up costs for Local Area Networks (LANs) are low as the devices required to set up the networks are cheap. Initial set-up costs for Wide Area Networks (WANs) are high, because of the devices (Routers, Firewalls etc), cables and manpower required.
- Local Area Networks (LANs) running costs are less Wide Area Networks (WANs) running costs are high. Wide Area Networks (WANs) normally have recurring monthly cost as Service Provider access fees.
- Wide Area Networks (WANs) are more congested than Local Area Networks (L ANs)

Other less used categories of networks are as follows:

Campus Area Networks (CAN): Campus Area Networks (CAN) is a computer network consisting of multiple LANs, which is connected together in a huge Campus. For example; inside a huge University, a huge Business Park or a huge Hospital, spanned over multiple buildings, spread over 100s of Acres of land area.

Metropolitan Area Network (MAN): Metropolitan Area Network (MAN) is larger than Campus Area Networks (CAN) when considering the area covered, but, smaller than a Wide Area Networks (WAN). Metropolitan Area Network (MAN) interconnects a number of LANs using a high-bandwidth backbone links inside a city.