Computer Network it's Architecture and Design Paradigm

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Abstract

This paper attempts to study how **Computer Network Architecture Computer networks can be defined as the exchange of network packets between computing machines across the world with the help of data lines like wire cables, optical fibers, etc.** The Internet is a kind of computer network. Two or more computers connected that allows sharing their data, resources, and application is called a computer network. The vital computer network is divided into four types based on their size and functions. They are LAN, MAN, PAN, and WAN. Here LAN stands for Local Area Network, MAN stands for Metropolitan Area Network, Personal Area Network is abbreviated into PAN whereas WAN is expanded as Wide Area Network. PAN is further divided into Wired Personal Area Network and Wireless Personal Area Network. There are many applications based on the computer network and each of the broadly divided networks has unique features that are to be applied accordingly for effective purpose.Communication over networks can be likened to moderated debates, as such, it is the work of the session layer to make sure that the communication is kept alive, some of the functions include; starting dialogs, keeping them active, and where necessary restart them if they are inactive or idle. Network functions traditionally realized in specific hardware can now be abstracted and virtualized on any equipment.

Key words: Communication over networks, hardware, Local Area Network, Wide Area Network.

Introduction

Network architecture generally refers to design of computer network or communications network. It simply describes allocation task between all of computers in network. It is simply way in which all network devices and services are organized and managed to connect clients like laptops, tablets, servers, etc. and also how tasks are allocated to computer. It also facilitates system-level functionality even robustness, extensibility, and evolvability. It is basically defined and described as physical and logical design of software, hardware, protocols, and media of data transmission. The **Network** allows computers to **connect and**

communicate with different computers via any medium. LAN, MAN and WAN are the three major types of the network designed to operate over the area they cover. There are some similarities and dissimilarities between them. One of the major differences is the geographical area they cover, i.e. **LAN** covers the smallest area; **MAN** covers an area larger than LAN and **WAN** comprises the largest of all. There are other types of Computer Networks also, like :

- PAN (Personal Area Network)
- SAN (Storage Area Network)
- EPN (Enterprise Private Network)
- VPN (Virtual Private Network)

Local Area Network (LAN) – LAN or Local Area Network connects network devices in such a way that personal computer and workstations can share data, tools and programs. The group of computers and devices are connected together by a switch, or stack of switches, using a private addressing scheme as defined by the TCP/IP protocol. Private addresses are unique in relation to other computers on the local network. Routers are found at the boundary of a LAN, connecting them to the larger WAN.

Data transmits at a very fast rate as the number of computers linked are limited. By definition, the connections must be high speed and relatively inexpensive hardware (Such as hubs, network adapters and Ethernet cables). LANs cover smaller geographical area (Size is limited to a few kilometers) and are privately owned. One can use it for an office building, home, hospital, schools, etc. LAN is easy to design and maintain. A Communication medium used for LAN has twisted pair cables and coaxial cables. It covers a short distance, and so the error and noise are minimized. A split between control and data path nodes is performed, so a centralized controller has a global view of the network while the data plane includes devices which simply forward packets following rules expressed by the controller. In order to communicate between these two layers, an open standard protocol is employed. This separation between the two layers simplifies the network management and help to simply program network control.

Early LAN's had data rates in the 4 to 16 Mbps range. Today, speeds are normally 100 or 1000 Mbps. Propagation delay is very short in a LAN. The smallest LAN may only use two computers, while larger LANs can accommodate thousands of computers. A LAN typically relies mostly on wired connections for increased speed and security, but wireless connections can also be part of a LAN. The fault tolerance of a LAN is more and there is less congestion in this network. For example : A bunch of students playing Counter Strike in the same room (without internet).

Metropolitan Area Network (MAN) –

MAN or Metropolitan area Network covers a larger area than that of a LAN and smaller area as compared to WAN. It connects two or more computers that are apart but resides in the same or different cities. It covers a large geographical area and may serve as an ISP (Internet Service Provider). MAN is designed for customers who need a high-speed connectivity. Speeds of MAN ranges in terms of Mbps. It's hard to design and maintain a Metropolitan Area Network.

The fault tolerance of a MAN is less and also there is more congestion in the network. It is costly and may or may not be owned by a single organization. The data transfer rate and the propagation delay of MAN is moderate. Devices used for transmission of data through MAN are: Modem and Wire/Cable. Examples of a MAN are the part of the telephone company network that can provide a high-speed DSL line to the customer or the cable TV network in a city.

Wide Area Network (WAN) –

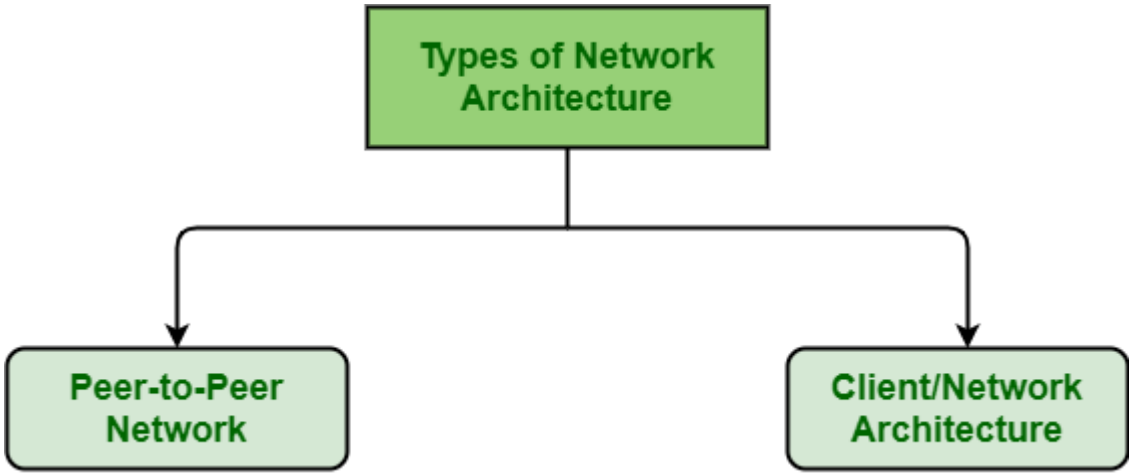
WAN or Wide Area Network is a computer network that extends over a large geographical area, although it might be confined within the bounds of a state or country. A WAN could be a connection of LAN connecting to other LAN's via telephone lines and radio waves and may be limited to an enterprise (a corporation or an organization) or accessible to the public. The technology is high speed and relatively expensive.

There are two types of WAN: Switched WAN and Point-to-Point WAN. WAN is difficult to design and maintain. Similar to a MAN, the fault tolerance of a WAN is less and there is more congestion in the network. A Communication medium used for WAN is PSTN or Satellite Link. Due to long distance transmission, the noise and error tend to be more in WAN.

WAN's data rate is slow about a 10th LAN's speed, since it involves increased distance and increased number of servers and terminals etc. Speeds of WAN ranges from few kilobits per second (Kbps) to megabits per second (Mbps). Propagation delay is one of the biggest problems faced here. Devices used for transmission of data through WAN are: Optic wires, Microwaves and Satellites. Example of a Switched WAN is the asynchronous transfer mode (ATM) network and Point-to-Point WAN is dial-up line that connects a home computer to the Internet.

Classification of Network based on use of computer nodes :

Network architecture is classified into following categories :



Objective:

This paper intends to explore and analyze **computer network t**hat designs all kinds of data communication networks – from small ones (e.g., LANs) to extensive networks connecting whole areas(WAN) and how packet transmission occurs across network .

Defining Computer Network Architecture

Network architecture is the logical and structural layout of the network, consisting of transmission equipment, software and communication protocols, and infrastructure (i.e. wired or wireless) transmission of data and connectivity between components. The two types of widely used network architectures are **peer-to-peer** aka **P2P** and **client/server** aka **tiered**.

Peer-to-Peer Architecture

In a peer-to-peer network, tasks are allocated to every device on the network. Furthermore, there is no real hierarchy in this network, all computers are considered equal and all have the same abilities to use the resources available on this network. Instead of having a central server which would act as the shared drive, each computer thats connected to this network would act as the server for the files stored on it. In a **peer-to-peer** or **P2P** network, the tasks are allocated among all the members of the network. There is no real hierarchy among the computers, and all of them are considered equal. This is also referred to as a distributed architecture or workgroup without hierarchy. A peer-to-peer network does not use a central computer server that controls network activity. Instead, every computer on the network has a special software running that allows for communications between all the computers.

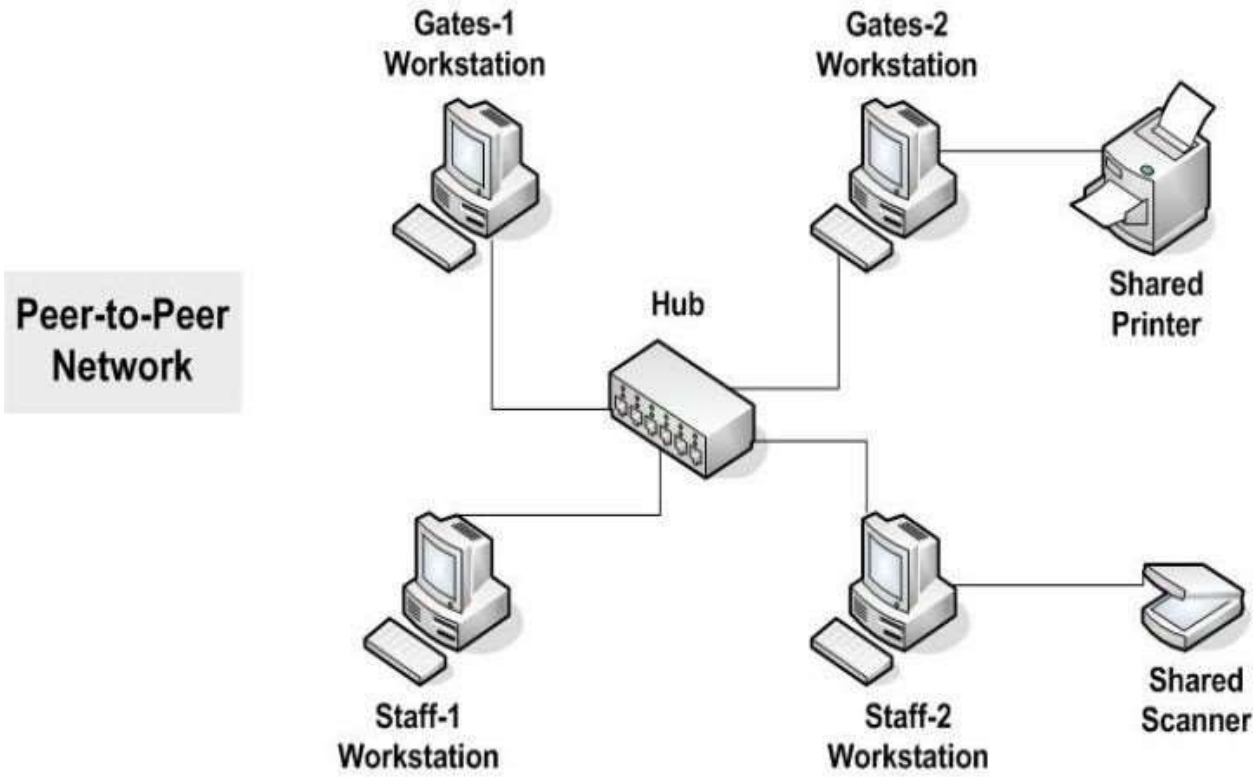
Peer-to-peer is mostly used for file sharing. Here is how file sharing works: One computer user makes some of the files on the hard disk drive available for sharing. Information on these files is made available to the

rest of the users so they can decide if they want to download one or more of these files. Once a second user has downloaded a file, this can also be made available to the rest of the users. So now there are two possible sources from which to download the same file. This is how files can be spread over thousands of users, one download at time.

One of the earliest peer-to-peer file sharing networks was Napster. One of the more recent protocols for sharing files is BitTorrent. This protocol is used by the many users who provide links to their files on websites, such as The Pirate Bay.

A peer-to-peer network is robust in the sense that if one or several of the individual computers stop working for some reason, the network continues to function. On the other hand, the quality of the network depends completely on the contribution of individual participants. For example, in the case of file sharing, if very few people make their files available, there is very little for users to download.

While there are a number of different applications of peer-to-peer network architecture, file sharing is by far the most popular. This also includes file sharing networks that distribute copyrighted material, such as movies, music and books, without permission. This is against the law in most jurisdictions. Since peer-to-peer networks lack a central control system, such file sharing systems present a serious challenge to agencies trying to prevent this type of sharing.



Peer — to — Peer Model

Advantages of a peer-to-peer network

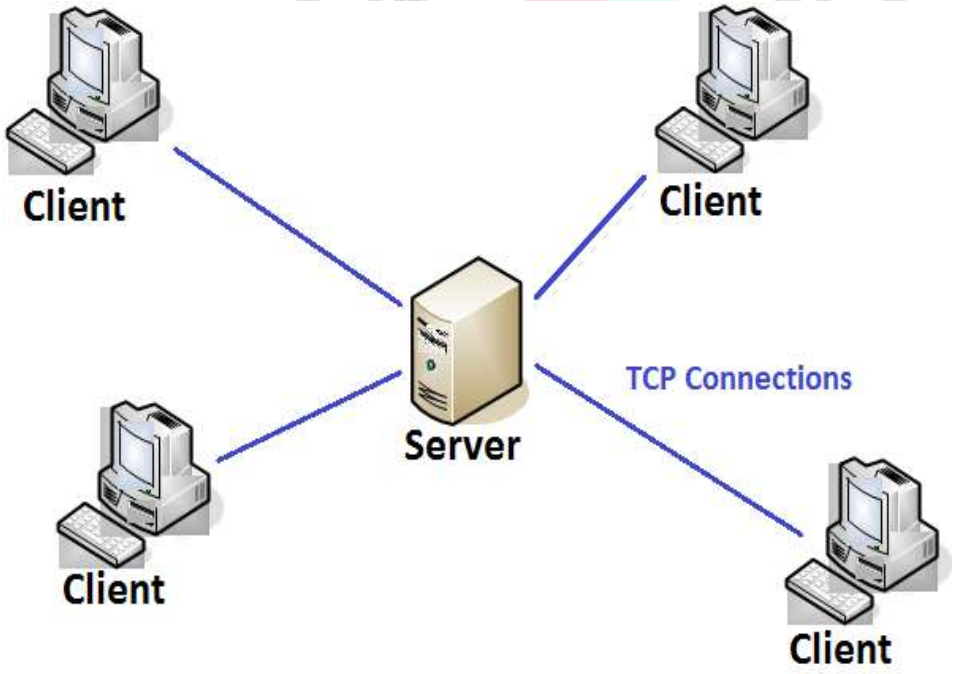
- Does not require a dedicated server which means its less costly.
- If one computer stops working, the other computers connected to the network will continue working.
- Installation and setup is quite painless because of the built-in support in modern operating systems.

Disadvantages of a peer-to-peer network

- Security and data backups are to be done to each individual computer.
- As the numbers of computers increases on a P2P network… performance, security, and access becomes a major headache.

Client/Server Architecture

Client-server architecture, architecture of a computer network in which many clients (remote processors) request and receive service from a centralized server (host computer). In a client/server network, a centralized, really powerful computer(server) acts as a hub in which other computers or workstations(clients) can connect to. This server is the heart of the system, which manages and provides resources to any client that requests them.



Client/Server Model

In a client/server network, a number of network clients or workstations request resources or services from the network. One or more network servers manage and provide these resources or services. The clients are computers that depend on the server for data and software. Network servers are also referred to as computer

servers, or simply servers. Sometimes a server is described in terms of the specific service it provides, such as e-mail server, print server or storage server. Some servers, however, can provide all these services.

Servers are typically computers with more processing speed, memory and hard disk space than a regular desktop computer. The network servers run their own operating system that manages the various network tasks as well as services that run on the network. Depending on the need for network storage and services, a single network may only use one or a large number of servers.

Clients are hardware devices which provide end users with access to data and services on the server. You can use these devices more or less independently. For example, you can open up software applications, create and edit documents and save files on the local storage medium, such as a hard disk. However, in a typical client/server network, a number of essential tasks are not performed by the client alone. Some typical examples are:

- Resources and data security are controlled through the server.
- Not restricted to a small number of computers.
- Server can be accessed anywhere and across multiple platforms.

  Disadvantages of a client/server network
- Can become very costly due to the need of a server as well as networking devices such as hubs, routers, and switches.
- If and when the server goes down, the entire network will be affected.
- Technical staff needed to maintain and ensure network functions efficiently.

Conclusion

Most computer network architects are employed by computer systems design and related services, telecommunications, finance and insurance, and various companies and enterprises. Computer network architects typically work full time, and spend most of their time in offices. They occasionally work in server rooms where they have access to the hardware that make up an organization's computer and information network. There are many advantages of LAN over MAN and WAN, such as LAN's provide excellent reliability, high data transmission rate, they can easily be managed, and shares peripheral devices too. Local Area Network cannot cover cities or towns and for that Metropolitan Area Network is needed, which can connect city or a group of cities together. Further, for connecting Country or a group of Countries one requires Wide Area Network.

References

1. "Definition of: SaaS". PC Magazine Encyclopedia. Ziff Davis. Retrieved 14 May 2014.
2. Hamdaqa, Mohammad. A Reference Model for Developing Cloud Applications (PDF).
3. Chou, Timothy. Introduction to Cloud Computing: Business & Technology.
4. "HVD: the cloud's silver lining" (PDF). Intrinsic Technology. Archived from the original (PDF) on 2 October 2012. Retrieved 30 August 2012.
5. Sun, Yunchuan; Zhang, Junsheng; Xiong, Yongping; Zhu, Guangyu (2014-07-01). "Data Security and Privacy in Cloud Computing". International Journal of Distributed Sensor Networks. 10 (7): 190903. doi:10.1155/2014/190903. ISSN 1550-1477. S2CID 13213544.
6. Carney, Michael (2013-06-24). "AnyPresence partners with Heroku to beef up its enterprise mBaaS offering". PandoDaily. Retrieved 24 June 2013.
7. Alex Williams (11 October 2012). "Kii Cloud Opens Doors For Mobile Developer Platform With 25 Million End Users". TechCrunch. Retrieved 16 October 2012.
8. Aaron Tan (30 September 2012). "FatFractal ups the ante in backend-as-a-service market". Techgoondu.com. Retrieved 16 October 2012.
9. Dan Rowinski (9 November 2011). "Mobile Backend As A Service Parse Raises $5.5 Million in Series A Funding". ReadWrite. Retrieved 23 October 2012.
10. Pankaj Mishra (7 January 2014). "MobStac Raises $2 Million in Series B To Help Brands Leverage Mobile Commerce". TechCrunch. Retrieved 22 May 2014.
11. "built.io Is Building an Enterprise MBaas Platform for IoT". programmableweb. 2014-03-03. Retrieved 3 March 2014.
12. Miller, Ron (24 Nov 2015). "AWS Lambda Makes Serverless Applications A Reality". TechCrunch. Retrieved 10 July 2016.
13. "bliki: Serverless". martinfowler.com. Retrieved 2018-05-04.
14. Sbarski, Peter (2017-05-04). Serverless Architectures on AWS: With examples using AWS Lambda (1st ed.). Manning Publications. ISBN 9781617293825.
15. "Self-Run Private Cloud Computing Solution – GovConnection". govconnection.com. 2014. Retrieved April 15, 2014.
16. "Private Clouds Take Shape – Services – Business services – Informationweek". 2012-09-09. Archived from the original on 2012-09-09.
17. Haff, Gordon (2009-01-27). "Just don't call them private clouds". CNET News. Retrieved 2010-08-22.
18. "There's No Such Thing As A Private Cloud – Cloud-computing -". 2013-01-26. Archived from the original on 2013-01-26.
19. Rouse, Margaret. "What is public cloud?". Definition from Whatis.com. Retrieved 12 October 2014.
20. "FastConnect | Oracle Cloud Infrastructure". cloud.oracle.com. Retrieved 2017-11-15.