

Scientific Study of Types of Network Architecture and Discussing Advantages Disadvantages

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Abstract

This paper will explain the theory of network architecture. The concept of network architecture is the combination of different layers of the network infrastructure. Each layer has specific roles. This paper will also discuss about the challenges in the implementation of any type of network architecture. The two types of networks will be discussed. There are number of components which are used to implement the network

Keywords: - Network Architecture, Layers of Network, Types of Network Architecture, Challenges and advantages.

Introduction: - The process by which the communication is done between various devices in an organisation or the communicating of devices outside the business is done through a medium called network. For the process of communication, it is necessary that the devices or computers are connected to each other in such a way that the information can be shared among the employees of the organisation without any challenges. It is done through a network. A network is defined by the type of devices, protocols it follows, infrastructure, platform etc. It connects the hardware, software, protocols with each other through the connection medium. The OSI model explains the implementation of the different layers of the network. Each layer is meant to perform certain set of responsibilities and are supposed to follow certain rules and protocols.

Types of Computer Networks: - Basically there are two types of networks used to implement systems in the network: - [1]

1. **Peer-to-Peer:** - This type of network implementation is done in small private networks where information is shared only among few systems. All the systems are linked to one device from where the information will be shared in all the systems. The main disadvantage of this type of implementation is that if the main system is down then the whole network is disturbed and there will not be any communication.
2. **Client-Server Model:** - In this type of network implementation the devices are called as clients and these are linked to one source of information which is known as the server. The users can use these clients and the information will be shared from invoking the server. This means the query will be sent to the server and from there the server will send the necessary asked information. The server is responsible to perform security checks and then send the information. The disadvantage of this type of model is that it is costly to implement and it also requires separate dedicated team to monitor it

throughout the time. The speed of exchange of the information among the client and the server is higher as compared to peer-to-peer network.

Components of Network: - [2]

Following are the components of the network which builds the efficient network: -

- Client and Server: - This is the main component of the network system, as if there are clients who need to exchange information then only a network is needed. The clients can be computers, devices, phones, etc. Also, a server is needed in which all the information will be gathered at one place and which can also be accessed from any remote place.
- Hardware: - Network hardware is essential for the network to work. It consists of the elements like routers, switches, network cards, cables etc. All these elements are important to connect the devices with each other, to exchange information, in simple words hardware serves as a medium to connect the devices in the network.
- Software: - In order to communicate the information, the devices need to give commands which the server can understand and respond accordingly. The software in the network architecture helps to give instructions as how to communicate and exchange information. The protocols are such commands in the network.
- Medium: - Medium is required to connect all the devices and the network to function. The type of medium depends upon the type of network and the type of the devices present in the network. The connecting medium can be wired or wireless.

All the above-mentioned elements are important for the effective implementation of the network. If one of the mentioned elements is missing then the network architecture will not be completed and it will not be able to meet its responsibilities.

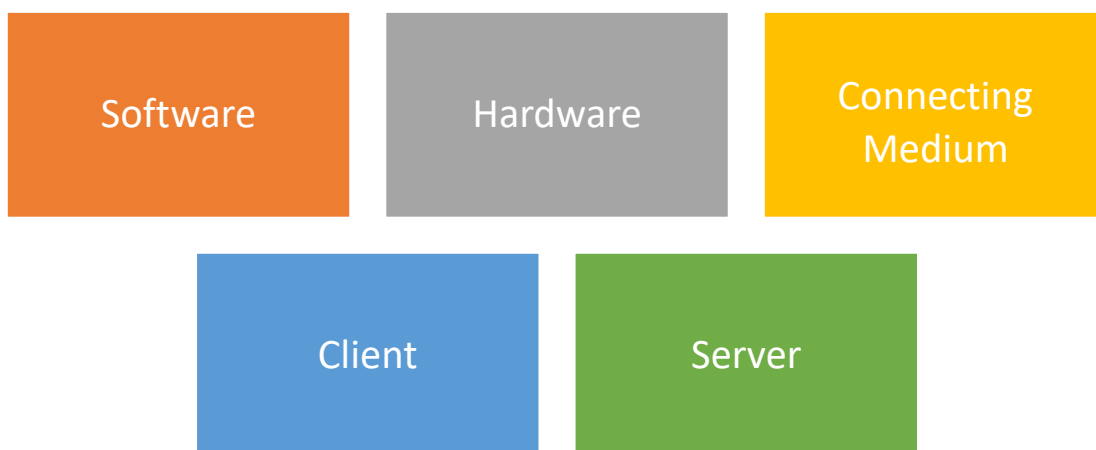


Figure 1 Components of Network

Layers of Network Architecture: - [3]

The OSI model explains the different layers of the network architecture. It is responsible for defining the rules and responsibilities of each layer present in the network. Each layer follows certain standards and protocols

in order to allow proper communication. The layers of the network allow for the proper implementation of the devices in a network.

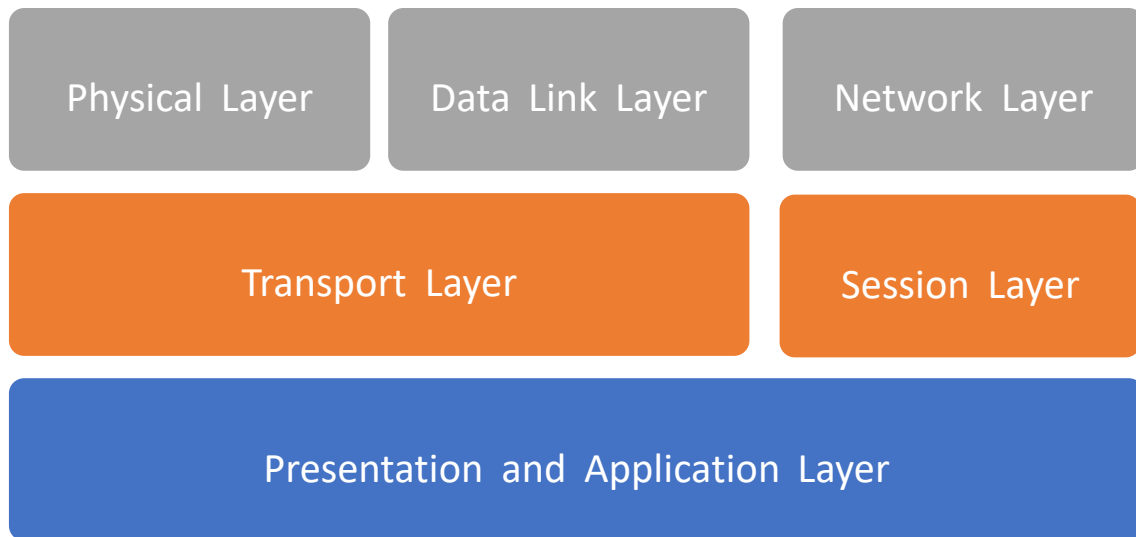


Figure 2 OSI Model Layers.

1. Physical Layer: - This layer is related to the physical architecture of the network. The responsibility of this layer is to transmit the data from the sender's end to the receiver's end. The physical layer consists of hardware devices like cables, routers, repeaters, switches etc. The data is in unstructured form and in this layer, it is decided at what frequency it will be send etc.
2. Data Link Layer: - This layer has two layers of its own: -
 - MAC: - This sub-node is media access control. The role of this layer is to control the data being transferred in the network.
 - LLC: - It is Logical Link layer whose role is to correct errors in the physical layer and over the MAC layer. It is responsible for the communication between multi nodes in the network.

The data in the data link layer is transferred in the form of packets.

3. Network Layer: - The role of this layer is to transmit the data received from the data link layer to the receiver of that data package. Each data packet will have the IP address with which it is identified that where it is supposed to be delivered. The network layer will receive the data packets from the previous layer and based on the IP address of the data packet it will search its receiver and transfer the data to that node. Routers plays important role in this layer.
4. Transport Layer: - This layer is responsible for actual transfer of the data between the systems. It will receive the data packets and the check it for any errors and the transfer to its respected receiver. It will also modify the size of the data packets. IT will also reject the unwanted data packets.
5. Session Layer: - The role of this layer is to check for the authorised and unauthorised data transferred between the applications. In order to do so this layer will place a header in the data packet with the help of which it will be recognised as the reliable data. If this layer finds any data in validity, then it can terminate the session of data exchange in the applications.

6. Presentation Layer: - The role of this layer is to present the data which means it is responsible to encode and decode the data, encryption of the data. First of all, this layer will perform compression of the data and then it will encrypt the data so that to avoid security issues. It is also responsible for the translation of the data once it reaches the receiver. In this layer the conversion of the protocol is also done.
7. Application Layer: - The responsibility of this layer is to determine the data and resources available and the software and then helps to exchange the data between the end user and the application using the software. Hence, the data is exchanged between the applications using the software.

Advantages of Network Architecture: - [4]

- It is the model which is used to implement the network model. Using this basic model as a tool, any simple or complex model can be implemented.
- It has the capability to implement any type of network whether it is connected or connectionless.
- Since there are layers in this model, so any modifications can be done in any layer without disturbing other layer.
- It also gives the facility to change the protocols in any layer at any point of time. The type of protocols used will depend upon the type of the network being implemented.

Disadvantages: -

- It is theoretical model which was given in initial days of the network architecture. There was no practical experiment of the model.
- Any layers of this model have very little functionality when implemented practically.
- The network implemented using this type of the model does not prove to be effective when implemented practically.
- Most of the layers has same functions due to which the data is duplicated many times which is not efficient.

Types of Network Architecture: -

- a. Peer-to-peer Architecture: - In this type of architecture all the devices are connected in a distributed system through which they will exchange the information. In this type of configuration, the same tasks are allocated and as a result of which if one device fails, the other devices can still serve the purpose and the communication will not fail.
- b. Tiered: - In this type of architecture, the devices are treated as client server. The computers known as clients are connected to a dedicated centralised system known as server. The server will have all the necessary information stored. It can have same type of data or also multiple type of data. When a client requests for the data then the server will respond to that client with the data. The main disadvantage of this type of architecture is that if the server is down then the data cannot be exchanged and the whole system will crash.
- c. Thin Client: - In this type of technique the thin clients are attached to the centralised server where the information is stored. The process of implementation of this type of architecture is less as the thin clients are efficient and reduce the cost of network implementation. The speed of response is faster as compared to linking systems to the server.

Benefits of Thin Client: -

- Increased efficiency rates
- Higher accuracy of data transfer
- Reduced error rate
- Higher security

Characteristics of Network Architecture: - [5]

- Rate of error: - The error rate will depend upon the type of configuration of the network. LAN will have less error rate as compared to WAN.
- Communication cost: - The cost of communication will also depend upon the type of the network. The network configuration where the error rate is less will have less communication cost. The cost of the communication will increase if the network implementation is done in large areas as it will require larger number of network elements like routers, switches etc.
- Data Rate: - The rate by which the data is transferred is called as data rate and it depends on the type of network. If there are no hinderances then the rate of data being transferred will be higher than the networks where the error rates are high.
- Security: - The network architecture uses various encryption methods which helps to make sure that the data transferred is secure. It is very important as there can be security attacks and the important data can be misused.

Conclusion: - It is seen that network is very important in an organisation to exchange the data among the users. There are seven layers of network architecture which defines the certain rules and protocols which should be followed while implementation of the network. There are several types of network architecture which can be implemented based on the type of organisation. The challenges and benefits of the network is discussed briefly.

References: -

1. <https://www.javatpoint.com/computer-network-architecture>
2. <https://smallbusiness.chron.com/four-fundamental-elements-network-65817.html>
3. <https://www.forcepoint.com/cyber-edu/osi-model>
4. <https://www.tutorialspoint.com/Advantages-and-Disadvantages-of-the-OSI-Model>
5. <https://www.vskills.in/certification/tutorial/network-characteristics/>