COMPARATIVE ANALYSIS OF COMMON COMPUTER NETWORK TOPOLOGIES

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Abstract. *The article covered star topology, ring topology and bus topology. Definitions are given for each type of topology. An assessment was made of the advantages and disadvantages of each type compared to each other. The structure of a logical ring circuit is given.*

Keywords: *bandwidth, cable connection, network performance.*

INTRODUCTION

The concept of a star network topology (Fig. 1.) comes from the field of mainframe computers, in which the host machine receives and processes all data from peripheral devices as an active data processing node. This principle is applied in data communication systems such as RELCOM e-mail. All information between two peripheral workstations passes through the central node of the computer network.

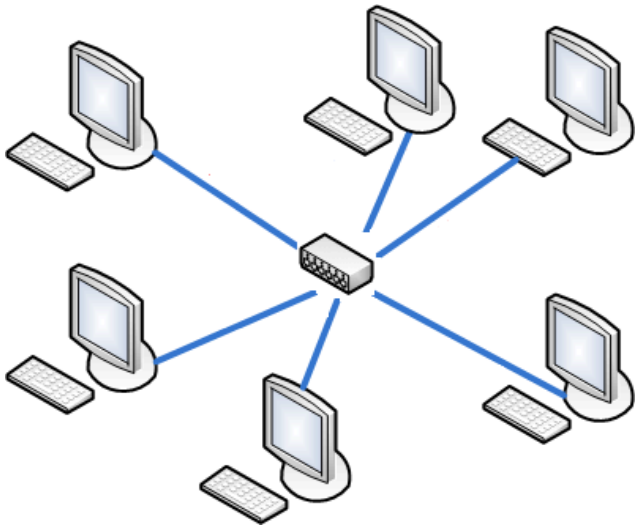

Fig.1. Topology in the type of Star

Network throughput is determined by the computing power of the node and is guaranteed for each workstation. Collisions of data do not occur.

The cable connection is quite simple as each workstation is connected to a node. Cabling costs are high, especially if the central site is not located geographically in the center of the topology.

RESEARCH TOOLS AND METHODS

When expanding computer networks, previously made cable connections cannot be used: a separate cable must be laid from the network center to the new workplace.

The star topology is the fastest of all computer network topologies, since data transmission between workstations occurs through a central node (with its good performance) over separate lines used only by these workstations. The frequency of requests for information transfer from one station to another is low compared to that achieved in other topologies. The performance of a computer network primarily depends on the capacity of the central file server. It can be a bottleneck in a computer network. If the central node fails, the operation of the entire network is disrupted.

The central control node - the file server shakes to implement the optimal protection mechanism against unauthorized access to information. The entire computer network can be controlled from its center.

With a ring topology of the network (Fig. 2.), workstations are connected to one another in a circle, i.e. workstation 1 with workstation 2, workstation 3 with workstation 4, etc. The last workstation is linked to the first. The communication link is closed in a ring.

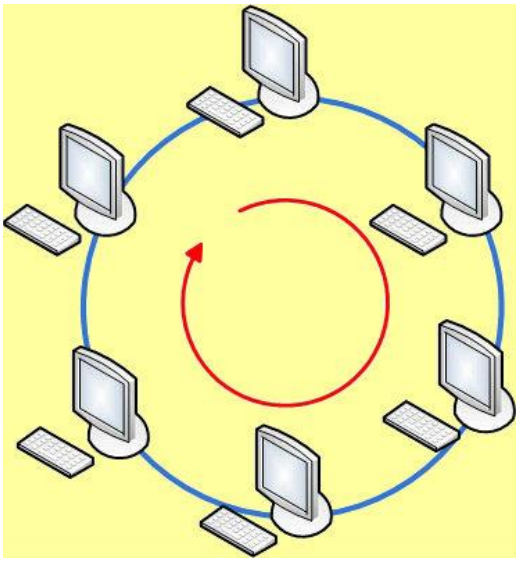

Fig. 2. Ring topology

Running cables from one workstation to another can be quite cumbersome and expensive, especially when the workstations are geographically distant from the ring (for example, on a line).

News regularly circulates in the circle. The workstation sends information to a specific end address after receiving a request from the ring. Message routing is very efficient because most messages can be sent sequentially "along the way" over the cable system. Calling all stations is very easy. The duration of information transfer increases in proportion to the number of workstations connected to the computer network.

The main problem with ring topology is that each workstation must actively participate in the transmission of information, and if even one of them fails, the entire network will be stopped. Faults in cable connections can be easily located.

Connecting a new workstation requires a short disconnection of the network, since the ring must be open during installation. The length of a computer network is unlimited, as it is ultimately determined solely by the distance between two workstations.

A special form of ring topology is the logical ring circuit (Figure 3). Physically, it is mounted as a connection of star topologies. Individual stars are switched on with the help of special switches (english Hub - concentrator), which in Russian is also sometimes called a “hub”. Depending on the number of workstations and the length of the cable between workstations, active or passive hubs are used. Active hubs additionally contain an amplifier for connecting from 4 to

16 workstations. The passive hub is exclusively a branching device (for a maximum of three workstations). The management of a single workstation in a logical ring is the same as in a normal ring. Each workstation is assigned an address corresponding to it, to which control is transferred (from the oldest to the youngest and from the youngest to the oldest). The disconnection occurs only for the downstream (nearest) node of the computer network, so that only in rare cases can the operation of the entire network be disrupted.

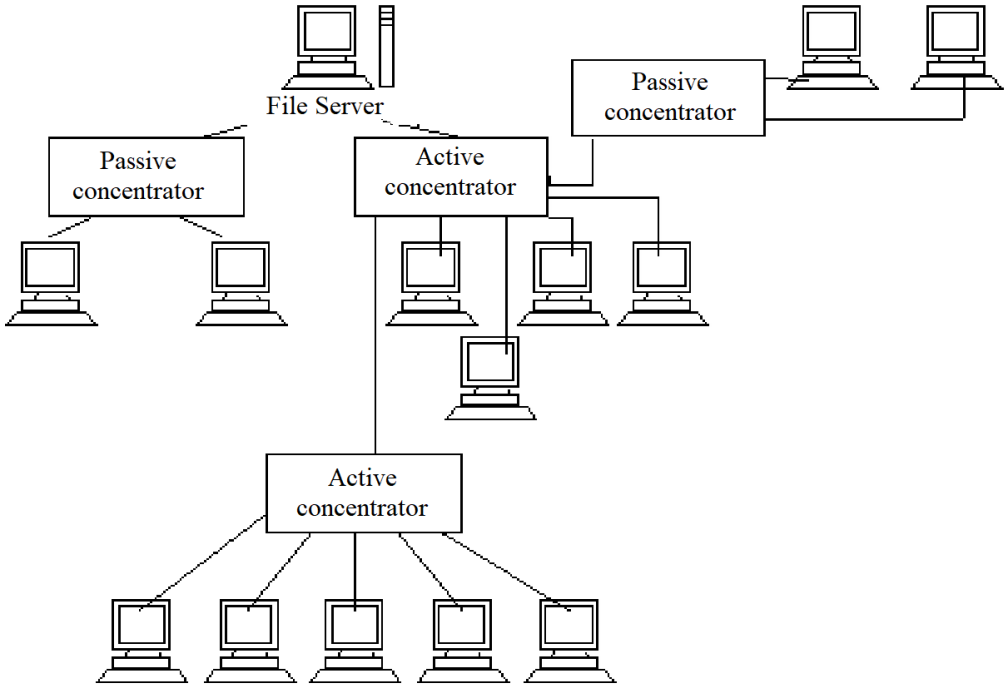

Fig. 3. Logic ring circuit

With a bus topology (Fig. 4.), the information transmission medium is presented in the form of a communication path, accessible to all workstations, to which they must all be connected. All workstations can communicate directly with any workstation on the network.

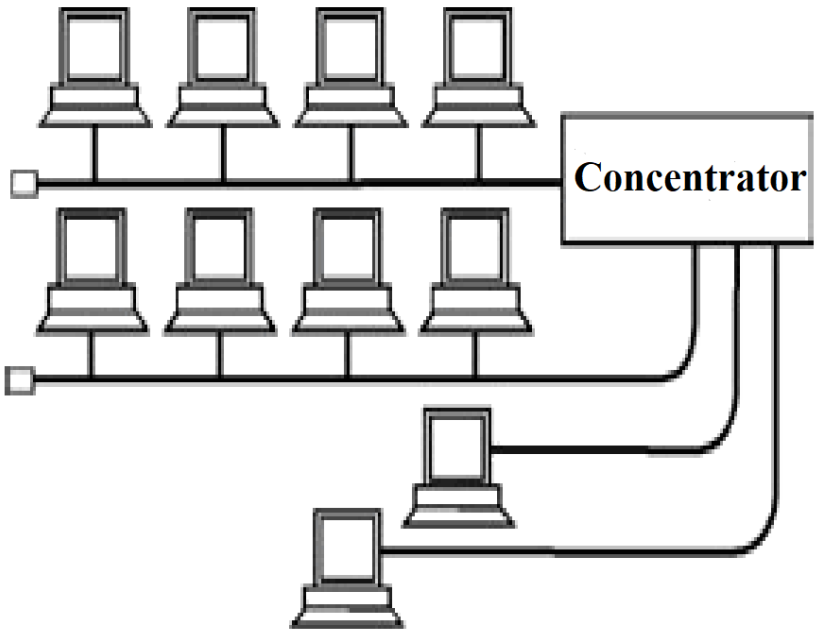

Fig. 4. Bus topology

Workstations can be connected or disconnected at any time without interrupting the operation of the entire computer network. The functioning of a computer network does not depend on the state of an individual workstation.

In a typical situation for an Ethernet bus network, a thin cable or a cheaper network cable with a T-connector is often used. Turning off and especially connecting to such a network requires a bus break, which leads to a disruption in the circulating flow of information and a system failure.

New technologies offer passive plugs that allow workstations to be turned off and/or turned on while a computer network is running.

Due to the fact that workstations can be turned on without interrupting the network processes and communication environment, it is very easy to eavesdrop on information, i.e. leakage of information from the transmission medium.

In a LAN with a direct (not modulated) transmission of information, there can always be only one station that transmits information. To prevent collisions, in most cases, a temporary separation method is used, according to which for each connected workstation, at certain points in time, the exclusive right to use the data transmission channel is granted. Therefore, the requirements for the bandwidth of a computer network with increased load are reduced, for example, when new workstations are introduced. Workstations are connected to the bus by means of TAP (Terminal Access Point) devices. TAP is a special type of connection to coaxial cable. The needle-shaped probe is introduced through the outer shell of the outer conductor and the dielectric layer to the inner conductor and is attached to it.

CONCLUSION

In a broadband modulated LAN, different workstations receive, as needed, the frequency at which these workstations can send and receive information. The transmitted data is modulated on the respective carrier frequencies, i.e. between the information transmission medium and the workstations there are respectively modems for modulation and demodulation. The technology of broadband communications allows to simultaneously transport a fairly large amount of information in a communication medium. For the further development of discrete data transportation, it does not matter what initial information is fed into the modem (analogue or digital), since it will be converted in the future anyway.

Characteristics of topologies of computer networks are given in the table.

Characteristics	Topology		
	Star	**Ring**	**Bus**
Expansion cost	Minor	Medium	Medium
Joining subscribers	Passive	Active	Passive
Failure protection	Minor	Minor	High
System dimensions	Any	Any	Limited
Eavesdropping protection	Good	Good	Minor
Connection cost	Minor	Minor	High
System behavior under high loads	Good	Satisfactory	Bad
Ability to work in real time	Very good	Good	Bad
Cable routing	Good	Satisfactory	Good
Service	Very good	Medium	Medium

Thus, one can come to the conclusion that there is no ideal type of topology for a network. Each type has the right to exist. Each user chooses a specific type depending on the task and their resources.

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