INVESTIGATION INTO LOCAL NETWORKS: TRAITS, VARIETIES, AND TRANSPORT LAYER PROTOCOLS

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Annotation:*This article is a detailed overview of local networks, their main characteristics, types and levels of influence of data transfer protocols on the efficiency of data transfer. Various technologies are recovered, such as Ethernet, Wi-Fi, and Token Ring, as well as basic transport layer protocols, including TCP and UDP. The article also draws attention to the requirements for the transport method in various local network schemes and provides examples of their practical application. The study aims to provide readers relationship with transport layer protocols in modern networking environments.*

Key words: *local networks, investigation, traits, varieties, transport layer protocols, routing protocols, data integrity, network topology, network protocols*

Introduction

In the ever-evolving landscape of networking technologies, a comprehensive exploration into the realm of local networks becomes imperative. This article embarks on an in-depth investigation, delving into the distinctive traits and diverse types that characterize local networks. Beyond mere classification, it scrutinizes the intricate interplay of transport layer protocols, shedding light on their pivotal role in data transmission. Join us on this journey as we unravel the intricacies of local networks, unraveling their traits, exploring their varieties, and dissecting the nuances of transport layer protocols that underpin their functionality.

Characteristics of local networks and their types.

Creation of local computing networks is the selection of technologies, determination of the number of workstations, their mutual location, and the

determination of working groups of users depending on the type of activity. A local computing network (LCN) operates in a limited area, and special twisted pair or coaxial cables are usually used to create it. In some cases, optical fiber cables are used to provide communication over long distances or when high protection requirements are impose. For local networks, the cable plays the role of a mono channel used by many subscribers at the same time.

Today, the network is divide into 5 types, as follows:

LAN (Local-Area Network) local network;

CAN (Campus-Area Network) - a campus network, a computer local network connected to each other by telephone or modems, but located far enough from each other;

MAN (Metropolitan-Area Network) is an expanded network that transmits information to a large radius with the possibility of high-speed communication transmission (100 Mbit/s);

WAN (Wide-Area Network) is a large network connecting separate networks provided with large-scale special devices and programs;

GAN (Global-Area Network) global network;

Local network topologies:

Star topology. Advantages of star topology:

• centralized management of the network through a central hub or node;

• the ability to easily add or remove a new node to the topology;

• failure of one computer node does not affect the work of the others;

• it is possible to easily determine the interruption in the network and allows to easily eliminate the problem.

Disadvantages of star topology:

• a break in the central point affects the entire topology;

• using a router or switch as a central point increases the cost of network implementation;

• adding a new node to the network depends on the capacity of the central node.

Bus topology. Advantages of bus topology:

• it is very easy to add a new node to the bus network;

• low cost of implementation;

• works well in small networks;

• less cabling is required than star topology.

Disadvantages of bus topology:

• entering a new node depends on the length of the cable;

• any damage to the main cable affects the entire network;

• the cable must have a terminator on both sides;

• the price of service is high;

• not suitable for high-speed networks;

• as all nodes receive the signal transmitted from the source, it affects the security of the network.

Ring topology. Advantages of ring topology:

• one-way traffic flow;

• each node can transmit information only when it is free;

• no centralized network server is required;

• ease of implementation compared to bus topology;

• all nodes have the same opportunity to use information;

• adding a new node in the network does not affect the entire network change.

Disadvantages of ring topology:

• signal transmission from each node in the network is a slow process;

• failure of an arbitrary node leads to failure of the entire network;

• a lot of cables are required to connect the nodes and this requires excessive costs;

• traffic is distributed for all nodes.

Mesh topology. Advantages of mesh topology:

• enables continuous data transfer;

• there is a possibility of passing high traffic;

• failure of one of the nodes does not affect the entire network;

• Network expansion is easy.

Disadvantages of mesh topology:

• high degree of redundancy due to the presence of many connections;

• high cost compared to other network topologies;

• requires a lot of time and administrative attention to build a network.

• This topology is hardly used in local networks, it is mainly used in wide networks such as the Internet.

Tree topology. Advantages of tree topology:

• it is useful to use star and bus topologies when it is difficult to implement them;

• allows for easy expansion of the network;

• designing a star topology in this topology easily nodes; allows management;

• provides error detection and correction features;

• each star cable is connected through the main cable;

• a network failure in a star topology does not interfere with the operation of other networks.

Disadvantages of tree topology:

• arbitrary damage to the main cable affects the entire network;

• easy expansion of this topology network;

• although it allows, managing the whole network is complicated;

• is a process;

• the opportunity to expand the network was used;

• depends on the type of main cable.

Hybrid topology. Advantages of hybrid topology:

• provides the ability to identify and correct errors without affecting the work of other sectors of the network;

• the ability to easily add additional nodes;

• allows organizations to design a network based on their needs;

• provides an opportunity to incorporate many topologies.

Disadvantages of hybrid topology:

• since it incorporates many topologies, it is required to design the architecture

very accurately;

• hybrid topology has a high price due to the use of a large number of network cables.

Transport layer protocols in data transmission networks.

The main goal of the transport layer is to provide its users with reliable, economical and useful services.

The function of the transport stage:

checking the correct delivery of information to the user;

connection, installation;

report on receipt;

resending lost or incorrectly sent data;

flow control.

It uses the protocol structure to verify the correctness of the recipient's address.

The most popular of the transport layer protocols are TCP and UDP protocols:

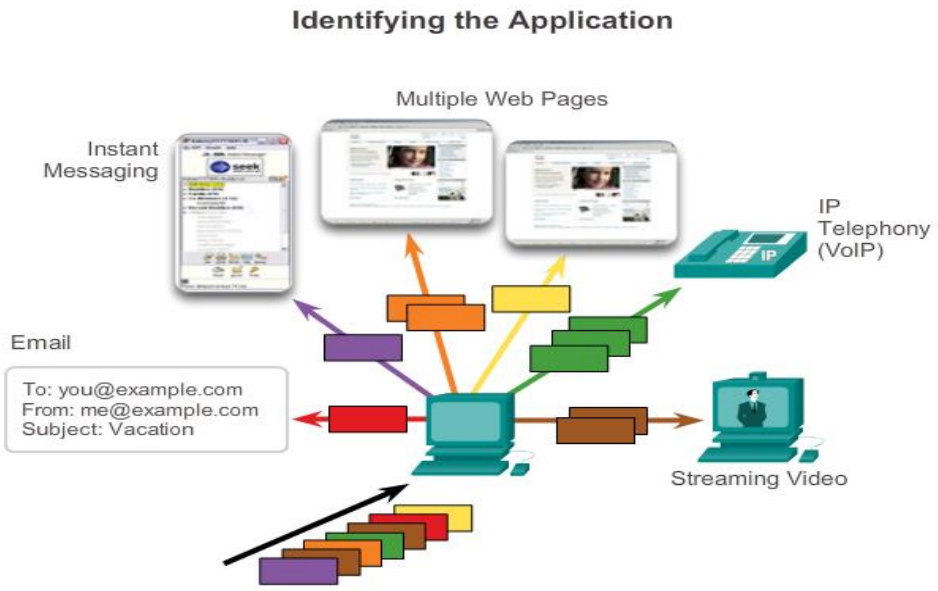
-The TCP protocol is a reliable protocol that guarantees an orderly data transfer sequence and provides network load management.

The UDP protocol, designed to work with messages, does not guarantee the sequence of data transmission, does not control network loads. But UDP protocol is a fast protocol and provides message limit.

The UDP protocol is appended to the UDP packet before calculating the checksums. Needed to verify delivery. It is not transmitted to the recipient;

UDP packet is filled from zero to 16 bits;

the receiver uses the received IP header, UDP header and data field based on the pseudo-header of the information when calculating the checksum.



Picture 1. Separation of applications at the transport stage

The transport layer ensures that multiple applications are received correctly when they are open on a device. TCP is a reliable transport protocol. This ensures reliable data transfer between applications by confirming delivery. When transmitting packets through the TCP protocol, the process from the source to the receiver is observed.

TCP performs the following 3 main functions to ensure reliability:

- tracking the transmission of data segments;
- confirmation of received information;
- retransmission of all unconfirmed data.

TCP divides messages into segments. Sequence numbers are assigned to these segments. After that, they are transmitted using the IP protocol to assemble them into a packet. TCP tracks transmitted segments to see if they reach one or another node. If the sender does not receive an acknowledgment within the specified time, then TCP considers these segments to be lost and resends them. Retransmission is performed only for the missing part of the message. The TCP protocol on the receiver side is responsible for reassembling the segments of the message and transmitting them to compatible applications.

Such processes of ensuring reliability lead to the loading of network resources.

Additional control information is transferred between the sender and the receiver to perform the above processes. This control information is contained in the TCP header. The extra load makes it less useful for some applications to ensure reliability and can be said to have poor performance.

UDP provides only basic functionality for transferring data segments between applications. It does this by using minimal resources and verifying data. UDP is a secure data transfer protocol. Unsecured delivery on computer networks is unreliable. UDP does not initiate any transport layer processes that confirm the successful delivery of data to the sender. The UDP protocol is similar to sending an unregistered letter from regular mail. The sender does not know that the recipient has received it, and the post office does not take responsibility for the control of the letter, notification of the sender and its arrival at the address.

Stream Control Information Transfer Protocol provides the transmission of signaling messages over an IP network between two endpoints with a high level of information delivery redundancy and reliability. For this, a standardized method is use, which is distinguish by the fact that high reliability of delivery of real-time information from several sources is establish in the protocol. Also the Internet connection operating according to this protocol has a self-shutdown function in case of overload.

The interface between SCTP and signaling applications is controlled by an adaptive layer. The adaptive layer creates an intermediate layer in which signaling protocols of a particular architecture at the top of the protocol stack should not change their interfaces with the transport environment and their internal functionality when a transport protocol other than SCTP is used instead. In other respects, the supporting architecture of the protocol stack must conform to the architecture of the Internet without breaking its rules.

Conclusions

In conclusion, network types, ownership types, and transmission protocols play crucial roles in shaping the modern digital landscape. Network types, such as local area networks (LANs), wide area networks (WANs), and wireless networks, enable

the connectivity and exchange of information between devices and systems. LANs provide localized connectivity within a limited geographical area, while WANs cover larger areas, often spanning multiple locations or even countries. Wireless networks have revolutionized communication by allowing devices to connect without physical cables, offering flexibility and convenience. Ownership types also significantly impact networks. Public networks, owned and operated by government or commercial entities, provide connectivity to a wide range of users and often span vast geographical areas. Private networks, on the other hand, are owned and maintained by individual organizations, allowing them to have full control over network resources and security. Hybrid networks combine elements of both public and private networks, offering greater flexibility and customization options.

The combination of network types, ownership types, and transmission protocols provides a diverse and interconnected digital ecosystem that facilitates communication, collaboration, and the exchange of information. These components continue to evolve and shape the future of technology, enabling advancements in fields such as IoT, cloud computing, and artificial intelligence.

Overall, understanding network types, ownership types, and transmission protocols is essential for individuals, organizations, and society as a whole. By leveraging these concepts effectively, we can harness the power of connectivity and drive innovation in the digital age.

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