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Telecommunications and Network Security

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Abstract: *The process of connecting computers to a network involves a lot of operations, which means that the transfer of information from computer to computer is fully ensured. Of course, it doesn't matter what happens to the user working with any application. All you have to do is have another application or other computer resources on the network. In fact, all transmitted information goes through many stages of processing. First of all, it is divided into blocks, each of which is provided with separate management information.*

Keywords: ISO, OSI, data cables, cable connectors, adapter terminators, network adapters, repeaters, transceivers, hubs, bridges, routers, gateways.

INTRODUCTION

1. Communication reference model

2. Local area network management architecture

The process of connecting computers to the network involves a lot of operations, that is, the complete transfer of information from computer to computer. Of course, it doesn't matter what happens to the user working with any application. All you have to do is have another application or other computer resources on the network. In fact, all transmitted information goes through many stages of processing. First of all, it is divided into blocks, each of which is provided with separate management information. The resulting blocks are equipped as packets, which are coded, and then using electrical signals or light signals

The selected acquisition method is transmitted over the network, that is, the received blocking information is restored, the blocks are connected in the form of information, and only then it is ready for use in another application. This will make the process much simpler. Some of this work is done by software, and some by devices.

It is the network models that must perform all the listed and to-be-performed procedures (procedures) that communicate with each other, step-by-step and step-by-step. These models allow for the correct organization of communication between subscribers within the network and at different stages of communication between different networks. The most widely used and well-known OSI (Open System Interconnection) is the reference model of information exchange in an open system. In this case, the term "open system" refers to a system that is not self-contained, that is, a system that can communicate with any other system (relative to a closed system).

METHODS

Communication reference model

The OSI model was introduced in 1984 by the International Standards Organization (ISO). Since then, all network products have been used by manufacturers. Like any universal model, the OSI model is much rougher. It is difficult to make quick changes, so the real network tools offered by different forms do not follow the distribution of accepted tasks very well.

But getting acquainted with the OSI model will help you better understand the process taking place in the network. The tasks (functions) performed in the whole network are divided into 7 stages in the model (Figure 1). The upper echelons are more complex and deal with global issues. To do this, they use the following steps for their own purposes and control them. The purpose of the lower levels is to serve the higher levels, and the order in which the smaller parts of the service are performed for the higher levels does not matter.

The steps below perform much simpler, more precise tasks. Ideally, each stage communicates with the upper and lower stages. The upper stage deals with the application, which is currently working on the application, while the lower stage has to transmit the signal through the communication channel. The step function shown in Figure 1 is performed by each of the network subscribers.

Each stage of one subscriber works on Sunday, as if it is connected with the same stage of another subscriber, that is, there is a virtual between the stages of the same name of network subscribers. Real communication between subscribers of the same network exists only in the lowest first stage (physical stage). In a subscriber transmitting information, the information starts from all stages and ends at the lower stage. In the receiving subscriber, the received information moves in the opposite direction, from the lower level to the higher level.

Let's look at the tasks at each stage.

Application stage (Application, application level) or application stage, which performs the following services: personally confirms the user's application, for example, a file to have a database of transmission software, e-mail, server registration service. This phase manages the remaining 6 phases.

The presentation stage (Presentation, презентативый уровень) is the stage of information presentation, at which stage the information is identified and the format of the information changes the syntax of the view to the network, ie acts as a translator. Here the information is encrypted and decrypted, and compressed if necessary.

The communication time management phase (Session, session level) manages the communication time (i.e. establishes, confirms, and terminates the communication). At this stage, the tasks of recognizing the logical names of subscribers and controlling the right to own them are also performed.

The Transportation Stage (Transportation) ensures that the package is delivered in the required sequence without error or loss. Here again the transmitted information is divided into blocks to be placed in the packet and the received information is restored.

The Network stage is responsible for addressing packets, changing logical names to physical distribution addresses, and vice versa, as well as selecting the direction of sending the package to the desired subscriber (if there are multiple subscribers in the network).

The channel link, or data link stage, is responsible for creating a standard view packet and placing the start and end control fields in the packet. This again detects errors in the transmission of network access, and again manages the redirection of packets that have sent the error to the receiving device.

Physical level (Physical level) is the lowest stage of the model, which encodes the transmitted information to the size of the signal, responsible for the reception of the transmission medium and the implementation of reverse coding. Here again, the requirements for connection devices, sockets, electrical adjustment and grounding and protection from interference, etc. are defined.

The function of the lower two stages (1 and 2) of the model is usually performed by the devices (part of the function of the 2nd stage is performed by the software driver of the network adapter). It is at these stages that the network topology, transmission speed, information exchange management method, and packet format (size), indicators corresponding to the type of network are determined (Ethernet, Token-Ring, FDDI). The upper stages do not work directly with any specific device, although steps 3, 4 and 5 can take into account the characteristics of the device. Steps 6 and 7 have nothing to do with the devices at all. Even when you switch from one network device to another, they never notice.

Phase 2 (channel phase) is divided into two phases:

-Logical Link Control (LLC - Logical Link Control) - this sub-level makes a logical connection, that is, installs a virtual communication channel (part of its function is performed by the driver program of network adapters).

- Media Access Control (MAC - Media Access Control, nijniy poduroven) - this sub-stage provides direct access to the communication medium (communication channel). It is properly connected to a network device.

In addition to the OSI model, there is also the IEEE Project 802 model, adopted in February 1980 (the number 802 is derived from the year and month). This model can be thought of as a defined, advanced model of the OSI model.

The standards defined by this model (specification 802) are divided into twelve categories, each of which is numbered. They are:

* 802-1 - merging networks.

* 802-2 - logical communication management.

* 802-3 - How to get CSSA / CD with "bus" topology Local area network and Ethernet.

* 802-4 - local area network with "bus" topology, possession of a marker.

* 802-5 - local area network with "ring" topology, possession of markers.

* 802-6 - Metropolitan Area Network (MAN).

* 802-7 - technology of large-scale communication (shirokoveshchatelnaya technology).

* 802-8 - fiber optic technology.

* 802-9 - integrated network with the ability to transmit sound and information.

* 802-10 - network security.

* 802-11 - wireless network.

* 802-12 - local area network (100 VG-Any LAN) with the management of the "star" topology center.

Standards 802-3, 802-4, 802-5, 802-12 correspond to the sub-phase structure of the MAC belonging to the second (channel) stage of the OSI model standard. The remaining 802 specifications address common network issues.

Local area network management architecture

Local area network devices provide real communication between subscribers. The choice of devices is very important at the network design stage, as the cost of the devices makes up a large part of the total network cost. Changing communication devices is not the only option ‘Requires more money and more hard work. Local area network devices include:

Kabelcables for data transmission;

□□cables for connecting cables;

□□compatible terminators;

ArmoqNet adapters;

□□repiters;

Ranstransmitters;

□□concentrators;

□□bridges;

□□ Routers;

Gateways.

Let's look at some of them.

Network adapters are also referred to in various publications as controllers, cards, motherboards, interfaces, and NIC (Network Interface Card). These devices are the main part of the local network, without which it is impossible to create a network. The function of network adapters is to connect a computer (or other subscriber) to the network, and again to exchange information between the computer and the communication channel in accordance with the accepted rules. It is these devices that perform the functions that the lower stages of the OSI model must perform. Typically, network adapters are manufactured in the form of a board and the computer is installed in a socket (usually ISA or PCI) to extend the system trunks. The network adapter board also usually has one or more external connectors to which network cables are connected.

All functions of network adapters are divided into two: trunk and network. Trunk tasks include exchanging between the adapter and the computer's system bus (i.e., recognizing its bus address, transmitting and receiving information from the computer, generating an interrupt signal for the computer, etc.). Network functions are to allow adapters to communicate with the network.

In order for the adapter board to work properly in a computer, its basic parameters must be set correctly:

v is the base address of the I / O port (ie the start address of the address field through which the computer communicates with the adapter);

v the interrupt number used (ie the number of the interrupt path through which the adapter informs the computer about the need to exchange information with itself);

v is the base address of the buffer and boot chores (that is, for the computer that is part of the adapter to communicate with this memory).

These parameters can be set by the user selectively using the connector (jamer) on the adapter, but can also be set using a special adapter that initializes the motherboard. When selecting all indicators (address and interrupt number), make sure that they are different from the indicators installed on other devices of the computer. Modern network adapters often use the Plug-and-Play mode, which means that the indicators do not need to be set by the user, and the settings are made automatically when the computer is connected to a power source.

The main network functions of the adapter include:

v galvanic disconnection of the computer and local area cable (for this purpose the signal is usually transmitted through a pulse transformer);

v conversion of logic signals to network signals and vice versa;

v coding and decoding of network signals;

v Selecting and receiving packages addressed to the same subscriber from the received packages;

v change the parallel code to a serial code when transmitting information and vice versa when receiving information;

v record the information transmitted and received in the buffer memory of the adapter;

v arranging access to the network by managing the received information exchange;

v Calculate the sum of the control bits of the packets when receiving and transmitting information.

Typically, the adapter board is small in size and inexpensive, as all network functions are performed using special large integrated circuits.

If the network adapter can work with more than one type of cable, another indicator is added that needs to be adjusted (select cable type). For example, the adapter board may have a switch for connecting this or that type of cable.

With the exception of the adapter, all local area network devices are ancillary devices, and it is often possible to organize work without them.

Transmitters or transmitting and receiving devices (Transmitter-Receiver, priemoperedatchiki), which serve to transmit information between the adapter and the network cable, or perform the transmission of information between two parts (segments) of the network. The transducer amplifies the signal, changes the signal values, or changes the appearance of the signal (for example, an electrical signal to a light signal and vice versa). A transceiver is often referred to as a transceiver that is mounted on an adapter board.

A repeater or repeater performs a much simpler function than a transceiver. He just hunts to restore the attenuated signal shaft, i.e. the view (amplitude and appearance) at the time of transmission. The main purpose of signal recovery is to increase the network length. But repeaters often perform other functions, such as galvanic separation of parts connected to the network. Repeaters and transmitters never process the information that passes through them.

Routers are transmitters that select a convenient transmission path for each packet. To do this, you need to bypass the most loaded and broken parts of the network. They are usually used in a complex branch network, in which case there may be several communication lines between individual subscribers.

RESULTS

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