INTRODUCTION TO COMPUTER NETWORKS

Short history

The advent and expansion of the use of microprocessors in personal computers (PCs) has allowed them to be practically available to every user, who can thus use directly and immediately the software it needs, as well as managing and managing applications as desired. However, these personal, independent, offline computers provide direct access only to locally located data, ie on the respective computer. Personal computer networks (LAN - Local Area Network) are an attractive alternative to data processing modes with independent computers or centralized networks.

The widespread and rapid expansion of computer networks has made electronic data processing an important place in all areas of life.

The computer network (network) is a set of computers interconnected by means of communication media (coaxial cable, twisted cable, fiber optics, telephone lines, wireless, satellite) in order to use sharing of hardware and software resources made available on networked computers.

The advantages of using computer networks are:
provide an efficient interface between users and information;
the possibility of communication between users;
ensuring data security;
centralized data management and control;
shared use of software resources (publishers, databases, etc.) and
expensive hard resources (hard disks, high capacity, laser or color printers, digitizers, scanners, modems, fax cards, etc.);
data protection and regular backup of data from a single location;
managing and monitoring the access of a large number of users;
the possibility of adding various new modules and functions;
the possibility to quickly update the programs on the client stations;
low cost of installing programs;
hardware limitation to user needs by using stations with minimal resources (586 processor, 64 Mb RAM)
Components of a local network:

A network of LAN computers consists of two or more PCs connected to each other by cables. One of these computers is the file server (FS), and the other computers are workstations (WS).

1. The file server (FS) is the core of the local network. The computer chosen to become a server must have very high performance (internal memory> 1Gb, hard disks of the order of Gb, high working speed (high-performance processor or processors), encryption methods and data security.

2. The workstation (WS-WorkStation) is an ordinary PC computer running a WinX, XP, 2000, etc. operating system. And the Network Shell (communication software in the local network). It also contains a network card (NIC-NetWare Interface Card) that connects with the rest of the network components.
Workstations can be:

- unintelligent (uses only the resources on the FS)
- intelligent (with hardware and software resources independent of the FS).

WS (terminals) are computers that have their own operating system (Win9x, XP, NT, Linux, etc.) and that can access shared resources. The interface between the station and the network is done through a NIC (Netware Interface Card) network card and based on a network protocol (TCP / IP, etc.)

Types of users:

In a local network the users are:

- ADMINISTRATOR (with full rights)
- GUEST (with the fewest rights - has only the right to consult)
- users defined by the administrator
- user groups: EVERYONE (predefined group of all users)
- groups defined by the administrator (are the groups that have shared access to the same resources eg: Documentation, Exchange, References, etc.)

Shared resources are the resources to which all stations in the network have access:

physical resources - equipment - disk drives, printers, scanners, CD-ROM towers, etc.
logical resources - software and applications provided by network servers information
resources - databases and data files (documents, images)

information resources can be stored on the server or in an intermediate place from where they can be accessed or sent directly to other computers

Types of networks:

From the point of view of geographical extent, there are three types of networks:

LAN (Lan Area Network) - local networks that extend over distances up to 1000m at the level of a building or group of buildings;
WAN (Wide Area Nertwork) territorial networks that stretch for distances of thousands of kilometers and connect local networks in different geographical locations;
MAN (Metropolitan Area Network) public networks that reach worldwide and connect various networks between them

Topology of local networks:

The way in which the hardware components (computers) of the network are physically connected, determines the path on which the information flows and bears the name of the network topology. There are three types of connection topologies:
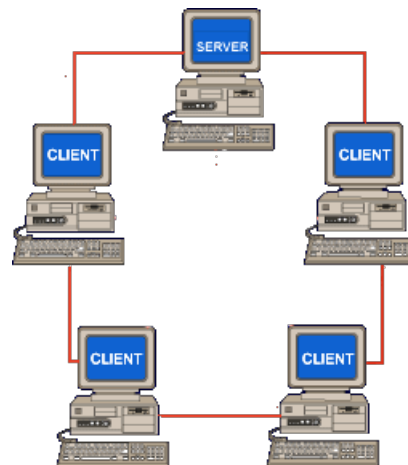
1. common bus (bus) - the computers are connected in series on the same cable (fig. 1)
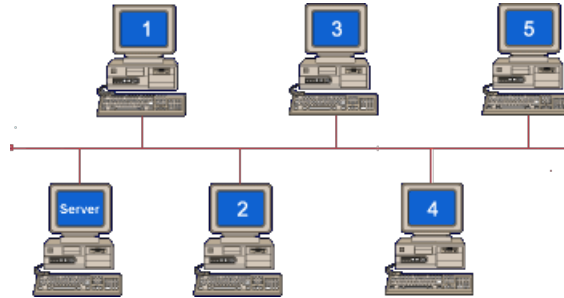
2. radial or star - the WSs are connected In the FS star (fig.2)
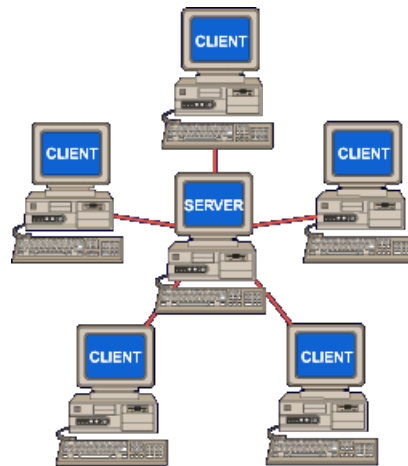
3. ring or WS - the WSs are connected together with the FS by cable segments that go from one component to another. (Figure 3)

The information encoded according to the modulation techniques used in the network circulates bit by bit, from the source computer to the destination computer. The transmission speed for an Ethernet network can be 10 Mbytes /s, 100Mb /s or of the order of Gb.

Several network topologies have been standardized :

The Ethernet network has a bus-type topology and can be made with a thin cable, the maximum length of the network being 925 meters. or with thick cable, the maximum network length is 2500 m

. The RX-Net network when using passive or active distributors (hubs) (which also amplify the signals). For these, the distance between the passive hub and a station is 31 m, the distance between an active device and a station is 610 and the maximum number of stations is 255.

IBM Token Ring Network is a network standard for computers IBM has a ring topology (all distributors must be connected in a closed loop). And IBM special equipment is used for interconnection.

Other important networks:

USENET for UNIX machines, used for e-mail or EUNET version for Europe.
CSNET is a large US network that links computers used in the field of scientific research.
BITNET network that connects computers used in different fields.
INTERNET the largest computer network that makes the connection between all other types of networks.

Another classification of networks according to complexity:

- 2 PCs connected directly via serial or parallel ports for data transfer from one computer to another and involving the use of a parallel cable and the installation of a data transfer application;

- networks with FS and WS and which require the use of connection equipment and management software (eg NetWare - Novell network);

- peer to peer networks in which all computers are treated the same. These networks consist of up to 10 computers and do not require high security or future development (win NT and win 95 operating systems include peer-to-peer functionality);

- the client / server networks in which the servers are dedicated and have the role of serving the requests of the stations considered client ensuring the security of the network and the communications between the workstations. They are the most widespread.

Combined networks are networks with dedicated servers and where there may be multiple servers on the network having different operating systems (Linux, Unix, Windows NT, Windows 200, Windows 2003, etc.) the workstations (client) being able to share their own resources.

Network architecture represents its global structure, respectively the hardware and software components that make it functional.

Network protocols are a set of rules and procedures for communication and transmission of data over the network. They provide so-called client services, ie the connection services that deal with addressing, routing, checking errors. And requests for data transmission.

The most used are TCP / IP, NetBEUI, X.25, IPX / SPX, NWLink, OSI, etc. In a network several protocols must work together to ensure the preparation, transfer, reception and information processing.

Computer identification

To specify the computer name and workgroup name, follow these steps:
1. Use the Network dialog box. It opens by clicking Start, choosing Settings, clicking Control Panel and then double-clicking Network (you can also access the Control Panel from the My Computer icon).
2. From the Network box, click Identification.
3. The name of the computer (which is unique) and the working group of the computer in the network.

The data corresponding to the Internet and network connection can also be found in the Network dialog box by clicking on Configuration
To find out the IP address of the computer, select it from the TCP / IP list and then click on Properties. The IP address will appear as in the image below (fig.5). From here you can also get DNS (Domain Name Server) and Gateway data.

Networking

Browsing the web is similar to searching a local hard drive and is done using the Network Neighborhood application. This is accessible from the work screen.

A. Resource sharing

For copying a document from another computer on the network or from the server, the sharing facility is used. This means that we can give access to folders, partitions, a CD drive or computer-bound printer, to colleagues who are in the same network with us.
To share a folder or disk drive, follow these steps:

1. In Windows Explorer we position ourselves on the folder or drive on which are documents that we want to be able to access from the network by colleagues.
2. Right-click to open a window in which the SHARING option appears.
3. Click on sharing and open a window as in fig.6. As noted, there are two options: Not shared and Shared.

Access to resources can be of the type:

- read only (network users can see the content of resources without deleting something)
- full (network users can do any operation in the shared area)
- depends on password, depending on where we put the password, read only (read only) or full access (I can do anything in the shared area)

We recommend you to choose the read only option in order not to expose yourself to a virus or data loss. Check what resources you have shared on your computer and with what options.
Be very careful when choosing the option for full access!

As you can see, after sharing the C: disk drive as in Fig. 6, only users who know the password set by the computer owner will have access to the data on C: ca.
If sharing cannot be done, check if we have the sharing facility activated. This is done from the Control Panel and then click on Network and Configuration (see fig. 4) you can see if the sharing part (File and Print Sharing) is installed.

B. Mapping

Mapping allows the creation of links to disk drives in the network and the automatic connection to network resources when the computer is started.

Click on the Network Neighborhood icon and choose the computer or server to which we want a connection while we are connected in the network.

1. Select the disk drive and the folder in which the application or documents we need are right-clicked and choose the Map Network Drive option.

2. Choose the letter that is attached to the folder and check the Reconnect at logon option if we want this link to remain valid for each reconnection in the network

According to the example (fig. 7) the Pop user wants a folder to his own folder on the network server. He knows that his folder is called POP and is in the HOME folder on the server named INFO. To do this, it will call the Network Neighborhood icon, then search for the Info server among the other computers on the network, click on it and then another click on the HOME folder. It will be positioned on the POP folder and will give a right click to call the mapping window from where it will select the letter that is attached to the chosen paths, in our case E (Drive box). From this moment he can choose the letter he wants to attach to the path // INFO / HOME / POP, he will select Reconnect at logon if he wants this map to be valid every time he connects to the network.

Canceling the link is done in a similar way to network mapping, searching in Windows Explorer created map E and right-clicking on it. Then the Disconnect network map option will appear and click on it.