

NETWORKS AND TELECOMMUNICATIONS

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Purposes:

to gaining knowledge of the fundamentals of construction, operation and use of computer networks of varying size, possibilities of their implementation on the basis of the underlying technologies and standards.



Plan of Lecture:

1. Network topologies, IP-addressing.
2. Stack protocols: TCP / IP, OSI. LANs and WANs.
3. Wired and wireless networking technologies.
4. Internet-Based Services.



Glossary:

English	Russian	Kazakh
Networks and Telecommunications	Сети и телекоммуникации	Желілер және телекоммуникациялар
Network	Сети	Желі
Computer network	Компьютерные сети	Компьютерлік желі
Global computer network(GCS)	Глобальная компьютерная сеть	Ғаламдық компьютерлік желі
Regional Networking (RCC)	Региональная компьютерная сеть	Аймақтық компьютерлік желі
Local area network (LAN)	Локальная сеть	Жергілікті желі
Separate class represent corporate computer networks (CCF)	Отдельный класс представляют собой корпоративную компьютерную сеть	Жекеленген корпоративтік желі
Broadcast network configuration	Конфигурация сети вещания	хабар жүргізудің желілік конфигурациясы

Brief description of terms:

Computer network set of nodes (computers, terminals, peripherals) having the possibility of information exchange with each other using a special communication hardware and software network with respect to peer access control to data paths in these networks distributed among the nodes.

Network analyzer interception method as they move along the lines intranet connection

Any part of the network resource or a network of computers (such as disk, directory, printer, etc.) that can used by the application during operation.



COMPUTER NETWORK

A computer network or data network is a telecommunications network which allows computers to exchange data.

In computer networks, networking devices exchange data with each other using a data link. The connections between nodes are established using either cable media or wireless media. The best-known computer network is the Internet.



Network computer devices that originate, route and terminate the data are called network nodes.

Computer networks differ in the transmission medium used to carry their signals, communications protocols to organize network traffic, the network's size, topology and organizational intent.

In the late 1950s early networks of computers included the military radar system Semi-Automatic Ground Environment (SAGE).

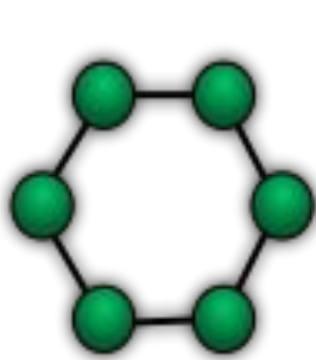
In 1976 John Murphy of Datapoint Corporation created ARCNET, a token-passing network first used to share storage devices.

In 1995 the transmission speed capacity for Ethernet increased from 10 Mbit/s to 100 Mbit/s. By 1998, Ethernet supported transmission speeds of a Gigabit. Subsequently, higher speeds of up to 100 Gbit/s were added (as of 2016).

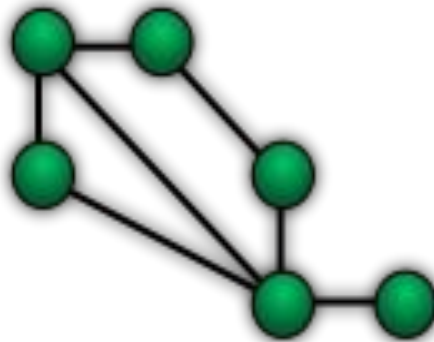


Network topology

Network topology is the layout or organizational hierarchy of interconnected nodes of a computer network.



Ring



Mesh



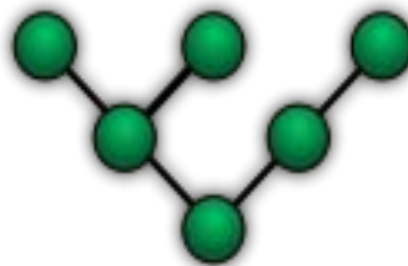
Star



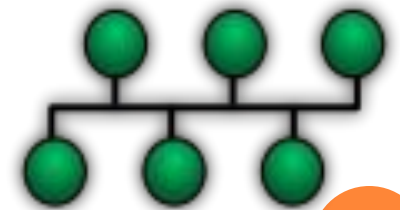
Fully Connected



Line



Tree



Bus



Common layouts are:

1. *A bus network*: all nodes are connected to a common medium along this medium. This was the layout used in the original Ethernet, called 10BASE5 and 10BASE2.
2. *A star network*: all nodes are connected to a special central node. This is the typical layout found in a Wireless LAN, where each wireless client connects to the central Wireless access point.
3. *A ring network*: each node is connected to its left and right neighbour node, such that all nodes are connected and that each node can reach each other node by traversing nodes left- or rightwards. The Fiber Distributed Data Interface (FDDI) made use of such a topology.
4. *A mesh network*: each node is connected to an arbitrary number of neighbours in such a way that there is at least one traversal from any node to any other.
5. *A fully connected network*: each node is connected to every other node in the network.
6. *A tree network*: nodes are arranged hierarchically.



IP address

An **Internet Protocol address (IP address)** is a numerical label assigned to each device (e.g., computer, printer) participating in a computer network that uses the Internet Protocol for communication.

The designers of the Internet Protocol defined an IP address as a 32-bit number and this system, known as Internet Protocol Version 4 (IPv4), is still in use today.

IP addresses are usually written and displayed in human-readable notations, such as 172.16.254.1 (IPv4), and 2001:db8:0:1234:0:567:8:1 (IPv6).



A telecommunications network is a collection of terminal nodes, links are connected so as to enable telecommunication between the terminals.

The Open Systems Interconnection model (OSI model) is a conceptual model that characterizes and standardizes the communication functions of a telecommunication or computing system without regard to their underlying internal structure and technology.

The model is a product of the Open Systems Interconnection project at the International Organization for Standardization (ISO), maintained by the identification ISO/IEC 7498-1.



OSI Model

Layer		Protocol data unit (PDU)	Function
Host layers	7. Application	Data	High-level APIs, including resource sharing, remote file access
	6. Presentation		Translation of data between a networking service and an application; including character encoding, data compression and encryption/decryption
	5. Session		Managing communication sessions, i.e. continuous exchange of information in the form of multiple back-and-forth transmissions between two nodes
	4. Transport	Segment (TCP) / Datagram (UDP)	Reliable transmission of data segments between points on a network, including segmentation, acknowledgement and multiplexing
Media layers	3. Network	Packet	Structuring and managing a multi-node network, including addressing, routing and traffic control
	2. Data link	Frame	Reliable transmission of data frames between two nodes connected by a physical layer
	1. Physical	Bit	Transmission and reception of raw bit streams over a physical medium

The Transmission Control Protocol (TCP) is one of the main protocols of the Internet protocol suite. It originated in the initial network implementation in which it complemented the **Internet Protocol (IP)**.

Therefore, the entire suite is commonly referred to as TCP/IP.



There are many different network structures that TCP/IP can be used across to efficiently route messages, for example:

1. wide area networks (WAN)
2. metropolitan area networks (MAN)
3. local area networks (LAN)
4. Internet area networks (IAN)
5. campus area networks (CAN)
6. virtual private networks (VPN)



LAN (local area network) is a group of computers and network devices connected together, usually within the same building.

MAN (metropolitan area network) is a larger network that usually spans several buildings in the same city or town.

WAN (wide area network), in comparison to a MAN, is not restricted to a geographical location, although it might be confined within the bounds of a state or country.



Wired technologies

The orders of the following wired technologies are, roughly, from slowest to fastest transmission speed.

1. Coaxial cable is widely used for cable television systems, office buildings, and other work-sites for local area networks.
2. ITU-T G.hn technology uses existing home wiring (coaxial cable, phone lines and power lines) to create a high-speed (up to 1 Gigabit/s) local area network.
3. Twisted pair wire is the most widely used medium for all telecommunication.
4. An optical fiber is a glass fiber. It carries pulses of light that represent data.



Wireless technologies

1. Terrestrial microwave – Terrestrial microwave communication uses Earth-based transmitters and receivers resembling satellite dishes.
2. Communications satellites – Satellites communicate via microwave radio waves.
3. Cellular and PCS systems use several radio communications technologies.
4. Radio and spread spectrum technologies – Wireless local area networks use a high-frequency radio technology similar to digital cellular and a low-frequency radio technology.
5. Free-space optical communication uses visible or invisible light for communications. In most cases, line-of-sight propagation is used, which limits the physical positioning of communicating devices.

Internet-based Self-services (ISS) are a subtype of services driven by self-service technologies which provide technological interfaces allowing customers to use services independently of the involvement of direct service employee. Self-ticket purchasing and self-check-in for a flight using the Internet are examples of Internet-based self-services.



QUESTIONS

1. How long is an IPv6 address?
2. What flavor of Network Address Translation can be used to have one IP address allow many users to connect to the global Internet?
3. What are the two main types of access control lists (ACLs)?
4. Which WLAN IEEE specification allows up to 54Mbps at 2.4GHz?
5. Which of the following is the valid host range for the subnet on which the IP address 192.168.168.188 255.255.255.192 resides?
6. What protocol does PPP use to identify the Network layer protocol?
7. Which protocol does DHCP use at the Transport layer?
8. Where is a hub specified in the OSI model?



Thanks for attention!

