

GENERAL INFORMATION ABOUT COMMUNICATION NETWORKS

Bozorova Irina Jumanazarovna

Acting Associate Professor, PhD at Karshi State University,

Orcid ID: 0009-0009-0699-0125

i.bozorova667@gmail.com

Annotation. *The article examines the modern stage of the formation and development of science and technology, which is characterized by the rapid development of information technologies, in which a prominent place is given to the transmission of information.*

Key words: *technical means, information and communication technologies, messages, signals, digital signals.*

The current stage of development of science and technology is characterized by the rapid development of information technologies, in which a prominent place is given to the transfer of information. Information is understood as a set of information about any processes, events, facts or objects. A person receives information through the senses (vision, hearing, etc.), and the physiological capabilities of a person do not allow the transmission of large amounts of information over significant distances.

Technical means that ensure the transmission and reception of information are united by the concept of communication (from the Latin communication - connection, telecommunications - means for organizing communication at a distance). In accordance with the nature of the technical means used, communications are divided into postal and electrical (telecommunications).

In communication theory, a collection of information intended to be transmitted and presented in a certain form is called a message. Thus, a message is the text of a letter, telegram, advertisement, radio or television broadcast, etc. Various signs (symbols) are used as a material medium for transmitting messages in communications technology. These can be letters, numbers and other characters in a text message, special signs on various diagrams and diagrams, for example, traffic signs and so on. In telecommunications technology, each message is associated with a set of electrical signals.

A signal is a physical process that represents a message being transmitted. The correspondence of the process to the transmitted message is ensured by a change in any physical quantity characterizing this process. There are telegraph signals, speech signals, video images or data for computer systems, etc. Thus, telecommunication refers to the transmission of information through electrical signals.

Based on the nature of the impact of transmitted messages on the senses, types of electrical communication can be divided into those intended for the transmission of audio or optical messages (that is, perceived by the organs of hearing or vision). Depending on the delay in delivery of transmitted messages, types of electrical communications are classified: for real-time operation and for delayed delivery of messages. Depending on the extent of coverage and purpose of messages, all types of electrical communications can be divided into

those intended for transmission: messages of an individual nature (to a specific subscriber), or messages of a mass nature (to a wide range of users).

Depending on the signal propagation medium, a distinction is made between wired telecommunications, in which signals propagate through wires and electrical and optical cables, and wireless telecommunications using radio signals. Some of the main types of telecommunication are telephone, telegraph, facsimile, data transmission, radio communication, radio broadcasting and television.

Telecommunication systems can also be classified according to other criteria. At the same time, in the modern era there is a tendency to combine types of telecommunications into a single integrated system. The basis of the unification is the conversion of signals of any type into digital form with subsequent transmission of universal digital signals through communication systems.

A clear example of the universal use of digital signals for transmitting messages of any nature are computer technologies that combine the simultaneous transmission of both text documents and visual images and voice messages.

Communication networks are a set of technical means that ensure the transmission and distribution of messages. Depending on whether special switching devices are present or absent in the network, switched and non-switched networks are distinguished. The rules for constructing networks depend on the method of distribution and the type of messages transmitted.

Among non-switched networks, the most common methods of organizing networks are: “common bus”, “ring”, fully connected network (“everyone with everyone”). Such configurations are most typical for computer networks.

Each method of organizing networks has its own advantages and disadvantages. Thus, in the common bus and ring structures, all network participants use a common signal propagation medium and have unique characteristics that are characteristic only of a given subscriber and are called an address. This address is necessarily present in the transmitted message, and by this address the receiving party judges whether this message is intended for it or another network participant.

The advantage of such networks is the simplicity of organization. The disadvantages of such structures are as follows. If the communication line is broken anywhere, communication becomes impossible for an entire group of users. In addition, in such networks, only one pair of network participants can transmit a message at any given time.

Organizing a network on the principle of “everyone to everyone” requires a significantly larger number of connecting lines. But on the other hand, the network is distinguished by the best efficiency: communication between any pair of subscribers can be established at any time. In general, such a network is more reliable: failure of one line will disrupt the communication of only one pair of subscribers. The rest of the network participants will continue to work under the same conditions.

For these reasons, the networking structures listed above work most effectively only with a small number of subscribers. As the number of subscribers increases, the complexity of such organizing networks increases, or the time available to each subscriber to use shared

resources decreases, or as the number of subscribers increases, the number and length of lines connecting them rapidly increases.

When the number of network participants increases, switched networks turn out to be the most effective. In such networks, subscribers are divided into groups, and in each group, each subscriber is connected to a special switching node by communication lines, called subscriber lines. At switching nodes, flows from individual subscribers are combined and transmitted to other switching nodes along communication lines, called trunk lines, and capable of carrying larger volumes of information than subscriber lines. The total length of necessary communication lines in such networks is reduced.

By introducing a special device - a switching node - the number of necessary lines for connecting subscribers and their total length can be reduced. At the same time, the network maintains high efficiency and fairly high reliability associated with disruptions in the operation of communication lines: if the subscriber communication line is broken, only one user is denied communication services. But in such structures, high responsibility falls on the switching nodes: disruptions in its operation can lead to a breakdown in communication of the entire network.

In a switched network, to ensure the transmission of messages intended for a specific user, subscriber terminals are pre-connected using switching nodes and trunk lines. An electrical circuit (channel) consisting of several sections is called a connecting path.

The process of selecting electrical circuits and combining them into a connecting path is called circuit switching. A network that provides circuit switching is called a circuit-switched network. After establishing a connection in such a network, information from the source to the recipient arrives in real time, taking into account only the physical delays in signal propagation along the circuit. This is the advantage of such networks. The disadvantage of this mode of network operation is the following. While the shared network resource (switching nodes and trunk lines) is occupied by one pair of network users, other subscribers cannot use the network during this time interval, even if no information is transmitted over it.

In communication networks, other operating modes are also possible. The transmission of documentary messages can be carried out not only after the entire connecting path has been established (“from end to end”), but in stages, from one switching node to another. At each subsequent node, the received message is queued and sent to the next node as the line becomes free. This organization of information delivery is called message switching, and the network that provides message switching is called a message switching network. “Downtimes” of connecting lines in such a network are less long, and in general such a network can transmit a larger volume of information.

A variant of a message switched network is a packet switched network. In such a network, sent messages are divided into blocks (packets) of a fixed size. Over the network, each such packet is transmitted as an independent message. At the receiving location, the original message is reconstructed from the set of received packets. The efficiency of this mode of network operation is even higher. In practice, the most commonly used methods are circuit switching and packet switching.

Based on hierarchical characteristics (scale of territory coverage and number of participants), networks are divided into global (worldwide) and regional (national, zonal or local). Examples of global networks are Internet computer networks, GSM cellular networks, etc. Regional networks serve the territory of the corresponding region. On this basis, computer networks are classified into global networks and local networks.

Based on their functional characteristics, communication networks are divided into transmission networks (backbone networks), distribution networks (switching systems) and control networks.

Based on the type of messages transmitted, networks are divided into: telephone networks, telegraph networks, radio and television broadcast networks, cellular networks, discrete message transmission networks, newspaper transmission networks, etc.

The telephone network is one of the most extensive networks and is built on a radial-node principle. The terminal devices of the telephone network are telephone sets and fax modems.

The telegraph network is also built on a radial-node principle, taking into account the administrative division of the country. The terminal devices of the telegraph network are telegraph devices of post offices or other users.

Cellular networks are also built on a radial-node principle, taking into account the characteristics of radio wave propagation.

Discrete message transmission networks have a similar structure and are one of the most dynamically developing participants in the information transmission process.

Newspaper transmission networks provide transmission of newspaper information by facsimile.

The most important networks for transmitting mass messages are broadcast networks. Broadcasting is the process of simultaneous transmission of general messages to a wide range of subscribers using technical means of communication.

A broadcast program is a time-sequential transmission of various messages. Broadcasting technology includes both the preparation of broadcast programs and the delivery of these programs to subscribers. The main requirements for broadcast networks are high quality of transmitted programs, reliability and efficiency in broadcasting coverage of the entire population of the country.

Radio and television broadcasting networks are built on a radial-node principle. Distribution of programs in radio and television broadcasting networks is carried out via communication channels, branching is carried out at special nodes. Based on the method of delivering broadcast programs to subscribers, a distinction is made between radio broadcasting (including terrestrial television) using transmitting radio and television stations and wire broadcasting (including cable television).

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