TELECOMMUNICATION AND COMPUTER SYSTEMS: TELECOMMUNICATION NETWORKS AND DEVICES

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Abstract

In recent times, information and communication technologies (ICT) and computer systems play a foundational role in the information environment. This article analyzes the concept of telecommunication, the development stages of networks, the functional role of telecommunication devices, and their integration with computer systems. The rapid development of telecommunication technologies has not only met society's growing information demands but has also led to significant innovations in the economy, education, healthcare, and security sectors. Furthermore, the use of wireless communication, fiber-optic lines, satellite communications, and cloud-based network technologies in modern telecommunication networks is examined.

Keywords: Telecommunication, computer systems, networks, communication devices, information technologies.

Introduction

Telecommunication derives from the Greek prefix *tele-* meaning "distant" and the Latin verb *communicare* meaning "to share." The latter word's modern form was adapted from French, since its written use was recorded in 1904 by the French engineer and writer Édouard Estaunié. According to the Etymological Dictionary of the Azerbaijani language, the word "communication" manifests as "the exchange of information in interpersonal relations."

The concept of telecommunication has played an important role in the development of human communication throughout history. While in early times simple signals and mechanical methods were used, in the 20th and 21st centuries this field has undergone rapid transformations [4].

Telecommunication is the process of transmitting information through wire, radio, optical, or other electromagnetic systems using various technologies. It arose from the desire to communicate over distances greater than those possible by human voice, yet with a comparable level of practicality. For this reason, systems such as postal service are excluded from this field. In telecommunication, transmission methods have evolved through numerous technological stages, from lighthouses and other visual signals (e.g., smoke signals, semaphore telegraphs, signal flags, and optical heliographs) to electrical cable and electromagnetic radiation. These transmission paths are often divided into communication channels, providing the advantage of multiplexing many parallel communication sessions.

Other examples of long-distance communication developed before the modern era include coded rhythms on drums, horns used as musical instruments, and loud whistles serving as sound messages.

For long-distance communication, the technologies of the 20th and 21st centuries generally encompass electrical and electromagnetic technologies. These include telegraph, telephone, television, and teleprinter, as well as networks, radio, microwave transmitters, optical fiber, and communication satellites.

The initial telecommunication networks were created with metal wires as the physical medium for signal transmission. For many years, these networks were used for telegraph and voice services. The revolution in wireless communication began in the first decade of the 20th century, with pioneering innovations in radio communication introduced by Guglielmo Marconi, who was awarded the Nobel Prize in Physics in 1909, as well as by other prominent inventors in the field of electrical and electronic telecommunications. These include Charles Wheatstone and Samuel Morse (inventors of the telegraph), Antonio Meucci and Alexander Graham Bell (some of the inventors and improvers of the telephone), Edwin Armstrong and Lee de Forest (inventors of radio), as well as Vladimir Zworykin, John Logie Baird, and Philo Farnsworth (some of the inventors of television).

Telecommunication is the process of transmitting information (voice, text, image, or video) over long distances. This system enables connections between people and devices and is one of the main pillars of the modern information society. Today, telecommunication is not limited to telephone and internet services alone; it also encompasses a wide range of technologies, including mobile communication, satellite connections, cloud technologies, and artificial intelligence.

Telecommunication and computer systems are two fundamental technology fields that complement each other. Computer systems perform the processing, storage, and analysis of data, while telecommunication ensures the rapid transmission of that data from one point to another. In modern times, the development of the internet has been the result of the integration of these two technologies [3]. Internet services are delivered through telecommunication and used via computers. Cloud technology, network security, online education, and work systems represent the unity of these two areas.

When gathering information materials from external processes, data are processed and transmitted to devices. Telecommunication equipment, in turn, enables rapid transmission processes. Telecommunication networks are among the most essential systems of this field. These networks are classified into several categories, including communication networks, data networks, and integrated networks. Communication networks include telephones and various mobile operator systems. Data networks mainly consist of systems that provide data exchange between computers, encompassing LAN and WAN technologies.

Network infrastructure is the collection of physical and logical elements that enable computers, servers, devices, and other technologies to communicate with one another. This infrastructure serves as the foundation for the transmission, storage, processing, and security of data. The functions of network infrastructure include: Ensuring data exchange between devices.

Providing access to servers and databases. Allowing the sharing of the Internet and printers. Supporting security and control mechanisms. Accelerating work processes and facilitating communication. Integrated networks are systems that ensure the transmission of voice, video, and data. The main components of network infrastructure are: Hardware: Router its main function is to manage data flow between networks. Switch connects devices within the same network. Modem the device that transmits the Internet to a computer. Servers powerful computers where data are stored and managed. Network cables (LAN, fiber-optic) used for the physical transmission of data. Wi-Fi access points provide wireless network connections.

In modern times, fiber-optic technologies, 5G mobile networks, and cloud-based communication solutions form the basis of these networks [1]. When it comes to telecommunication devices, these are the essential tools used in telecommunication systems. The most common ones include routers, modems, satellite antennas, base stations, and fiber-optic transmission devices. Routers are mainly involved in the processes of directing information packets. Modems are responsible for converting signals from analog to digital form. Satellite antennas and base stations are key devices that provide global communication and mobile connectivity. Fiber-optic transmission devices enable high-speed data flow. These devices determine the stability and efficiency of telecommunication infrastructure.

In the field of telecommunication, artificial intelligence (AI), the Internet of Things (IoT), and 5G/6G technologies are among the most important directions of near-future development. These technologies enable real-time processing of large volumes of information and play a crucial role in creating new opportunities in both economic and social spheres. The use of information technologies across all social and economic sectors has already shaped the transition into the information technology era.

Telecommunications have specific functions. They are among the main tools that ensure communication and interaction. They provide the instantaneous and accurate dissemination of information and play a vital role in emergency and security services. At the same time, supporting the development of the economy, education, and business is one of their essential characteristics.

Communication devices are technical tools used for the transmission, reception, and processing of information (voice, text, video, signals, etc.). These devices form the basis of information and communication technologies (ICT) to create connections between people and systems. Telephone and mobile phone: Used for voice and text communication. Mobile phones also provide internet access, video calls, and file sharing. Modem: Converts internet signals into a form understandable by devices. It can operate with DSL, cable, or mobile internet. Router: Distributes the internet signal to multiple devices (providing Wi-Fi at home). Used to create local networks. Switch: Connects devices within the same network and directs data packets to the correct destination. Access Point: Extends wireless internet coverage over a wider area. Works with a router to increase Wi-Fi range. Antenna and satellite communication devices: Used to transmit signals over long distances. Applied in television broadcasting, mobile networks, and satellite internet. Radio stations: Used for short-range voice communication, particularly effective in emergencies and field operations.
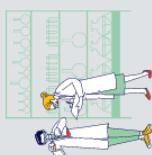
Communication devices are used in education, healthcare, business, entertainment, military, and security sectors. In education, they are mainly applied in online classes and videoconferencing. In healthcare, they are primarily used for remote diagnostics. They are also used in international communication and other internal office processes.

Conclusion:

The integration of telecommunication and computer systems forms the foundation of the modern world's information infrastructure. These technologies have become one of the primary priorities of today, playing a leading role not only in economic and social spheres but in virtually all processes. Telecommunication networks and devices are essential elements that ensure not only daily communication but also the development of the economy, education, and science. The application of innovative technologies indicates that this field will continue to grow and advance in the future.

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