

Computer network systems



In the modern world where technologies are improving significantly all the time, computer network systems are widely used to provide a connection between computers or networks. Using such networking systems, different companies or departments within one organization are able to keep easily in touch on a regular basis, which makes their cooperation more effective and convenient. Various types of computer network systems are used nowadays. They are as follows: Local Area Network (LANs), Personal Area Network (PANs), Metropolitan Area Network (MANs), Campus Area Network (CANs), Wide Area Network (WANs), and Global Area Network (GANs). It is important to have the general notions about networks physical and logical topology structure and basics of their operation. It is also useful to know how they are applied as the mentioned networking systems may be used by individual users as well as by the large governmental or commercial organizations. In the research paper different computer networking systems types are outlined and some examples are provided as well. In addition, technology options related to the network connections like packet and circuit switching are examined.

Personal Area Network (PAN) is the simplest form of the networking type of connection as it is organized around one individual PC user. It is used to provide connection and communication between a PC and other electronic devices including cell phones, telephones and other gadgets aimed for personal use. Personal Area Networks is mainly used for transferring different files such as email, pictures, text documents, music, video etc. PAN can operate within the distance of about 10 meters (30 feet). Gadgets in the PAN can be connected with a help of cables such as USB or FireWire or they

can cooperate wirelessly for example via Bluetooth (sometimes known as Piconet), ZigBee, IrDA or Z-wave (Mitchel). Wireless PAN can be used for the interconnection of all personal portable devices that a majority of people commonly use on a regular basis. Besides using such type of networking systems for common purposes, PAN may also be used during the surgical operations to enhance communication between a doctor and other team members (Shivers, 1993).

Another type of networking system Local Area Network (LAN) includes a group of interconnected computers that operates within a single geographical location such as an office building or a school. It provides higher rates of data transfer and does not require usage of the leased telecommunication lines (Joe, 2007). A LAN is used to share resources and applications. In order to establish a LAN and support the controlled access to it, some special operating system software such as Internet Connection Sharing (ICS) should be used (Mitchell). It is also possible to set up a temporary LAN when, for example, participants of one multiplayer gaming event are connecting their computers to build up a so-called LAN party.

Wired LAN is preferable to the wireless LAN as it is less expensive to establish and maintain by using inexpensive hardware like network adapters, hubs, and Ethernet cables. Token Ring, ARCNET, Ethernet, and Wi-Fi are the most commonly used LAN technologies. ARCNET represents one of the first LAN forms, which has been used in the automated industries until now.

Another form of LAN technology called Token Ring uses ring or star network topology connection of computers. Usage of the token- or bit-passing schemes prevents the system of any probable errors or collisions in case

when two computers are transmitting some files at the same time. Wi-Fi and Ethernet are two LAN technologies that are usually used nowadays. The last one may require usage of a coaxial cable or special twisted pair wires to perform as a shared medium, but also can be used in wireless LANs. For example, the most widely used type of Ethernet called 10BASE-T maintains the speed of data transfer that equals up to 10 Mbps. Appliances are connected with a cable and get an access by using a Carrier Sense Multiple Access with Collision Detection protocol (CSMA/CD) (Whatis. com, 2009). Wi-Fi technology is based on the IEEE 802. 11 standards and allows Wi-Fi enabled gadgets such as cell phone, personal computer, electronic books or iPods to get a wireless access to Internet via wireless network access points called hotspots. It can be aimed for limited use at home or in the offices as well as to provide free-of-charge or prepaid public access in such places as airport or cafe.

Campus Area Network (CAN) is a computer network system that unites several local networking systems within one corporate or university campus. In this case, all campus departments and structures including academic building, administrative offices, library, student and technology centers, conference hall and students' residence halls are using identical hardware and sharing one networking system and technologies. All hardware equipment like routers, switches, and cabling along with wireless network points are a property of the organization. Corporate Area Networks such as Googleplex and Microsoft's Campus like the university network are used to form a connection among structures of one corporation or organization (Javvin).

Metropolitan Area Network (MAN) is larger than LAN. It uses the same technology that LAN does and is basically a larger prototype of LAN. MAN may be private or public network that covers a unit of neighboring corporate offices or a city. Its design is simplified as MAN uses only a few cables and does not require switching elements (Tanenbaum). Usage of the fiber optical cables or other digital media helps to reach high speed of a connection in a MAN. MAN supply metropolitan LANs with Internet connectivity, and may also be used in cable television. MAN is based on the IEEE 802. 6 standard, also known as DQDB (Distributed Queue Dual Bus). DQDB is built up with two cables called unidirectional buses to which all the computers are connected. Each of such cables has a head-end, a device that is responsible for transferring the information. DQDB technology allows providing connectivity at the distance up to 20 miles away from the network access and a speed up to 155 Mbit/s.

Wide Area Network (WAN) covers larger geographical area than a metropolitan network. WAN may connect different smaller networks like LANs or MAN, allowing in such a way users and computers from different locations to communicate with each other. For instance, some drugstores use WANs to deliver a more efficient service to their customers. For example, every customer use a common customer database even being away in other state. Commercial organizations may use WAN to share and transmit information concerning sales, development and production, marketing and accounting to other authorized locations. The concept of Wide Area Network also creates new possibilities for business world and human resources management. A unified computer network system established for a

particular company allows its employees not to be tied to their workplace at office, but to be more flexible and work from different locations. If under some circumstances a network is inaccessible, workers may simply move to another to another hotspot and continue working (Tatum, 2010). WAN may be constructed with a help of leased line, packet or circuit switching or cell relay. The first technology option when two computers or LANs are using point-to-point connection technology is called leased line. It turned to be the most secured, but also the most expensive technology. PPL, SDLC, HNAS, and PPL are sample protocols that are used in leased line. Circuit switching is set up by establishing a circuit path that is created with two network nodes. Dialup connection can be set as an example. PPP, IDSN or other protocols can be used in circuit switching. Package switching transfer packets of divided data through a point-to-point or point-to-multipoint link via the carrier internet network. It can be done by setting up Switched Virtual Circuits or Permanent Virtual Circuits. Similarly to circuit switching, it is not expensive, but it uses shared across link. X. 25 Frame-Relay is one of the protocols that may be used. Cell relay technology has a principle of operation that is close to packet switching technology, but it uses fixed length packets. Data is firstly portioned out to fixed-length packets and after that transferred via virtual channels. It is the most comfortable way to transmit both voice files and data at the same time, but overhead in such case is possible. ATM is a sample protocol commonly used in cell relay connection. In general, telephone lines, satellite channels, and microwave links are typically used telecommunication networks in WANs. Still, Internet is the most frequently used WAN technology. Some components of Internet such as VPN-based extranets are also WANs (Mitchell).

Global Area Network (GAN) is the largest type of computer network system, which includes different computer networks that are interconnected and covers the furthest possible geographical area. Broadband Global Area is the best-known GAN example.

BGAN is a global satellite internet network that provides Internet connection in the remotest parts of a planet with a help of portable terminals, which are normally connected to a laptop. BGAN terminals are very flexible and comfortable in use as they are small in size and do not require installation of the enormous satellite dishes to provide connectivity. The capability to provide connectivity in the areas where other cellular or wireless network systems are unavailable is a crucial feature of BGAN technology.

Home Area Network (HAN), Virtual Private Network (VPN), and Internetwork are other computer networking technologies that are used nowadays for common purposes. Home Area Network includes a limited number of computers and electronic devices that are connected in home environment. In the Virtual Private Network a host computer transfers data via shared or public networks, but maintain the properties of the private network. The links between nodes are formed by using open point-to-point connections or virtual circuit in another larger network instead of physical wires. Best-effort performance may occur in such type of connection, unless a service level agreement (SLA) exists between the VPN service provider and the VPN customer (Warehand, 2009). An Internetwork, which is commonly called Internet, is a practice of connecting two distant computer networks via using a common routing technology.

To conclude, all the mentioned computer network systems are used to provide an effective communication and data transferring between computers and other electronic devices. As long as technologies became an inevitable part of our modern life, it is useful to understand the basics of their topology, way of operation and practical application. In spite of the fact that all the network systems have their specific physical and logical network topology, they can be combined in order to provide a more effective service and communication between personal computers and other networks.