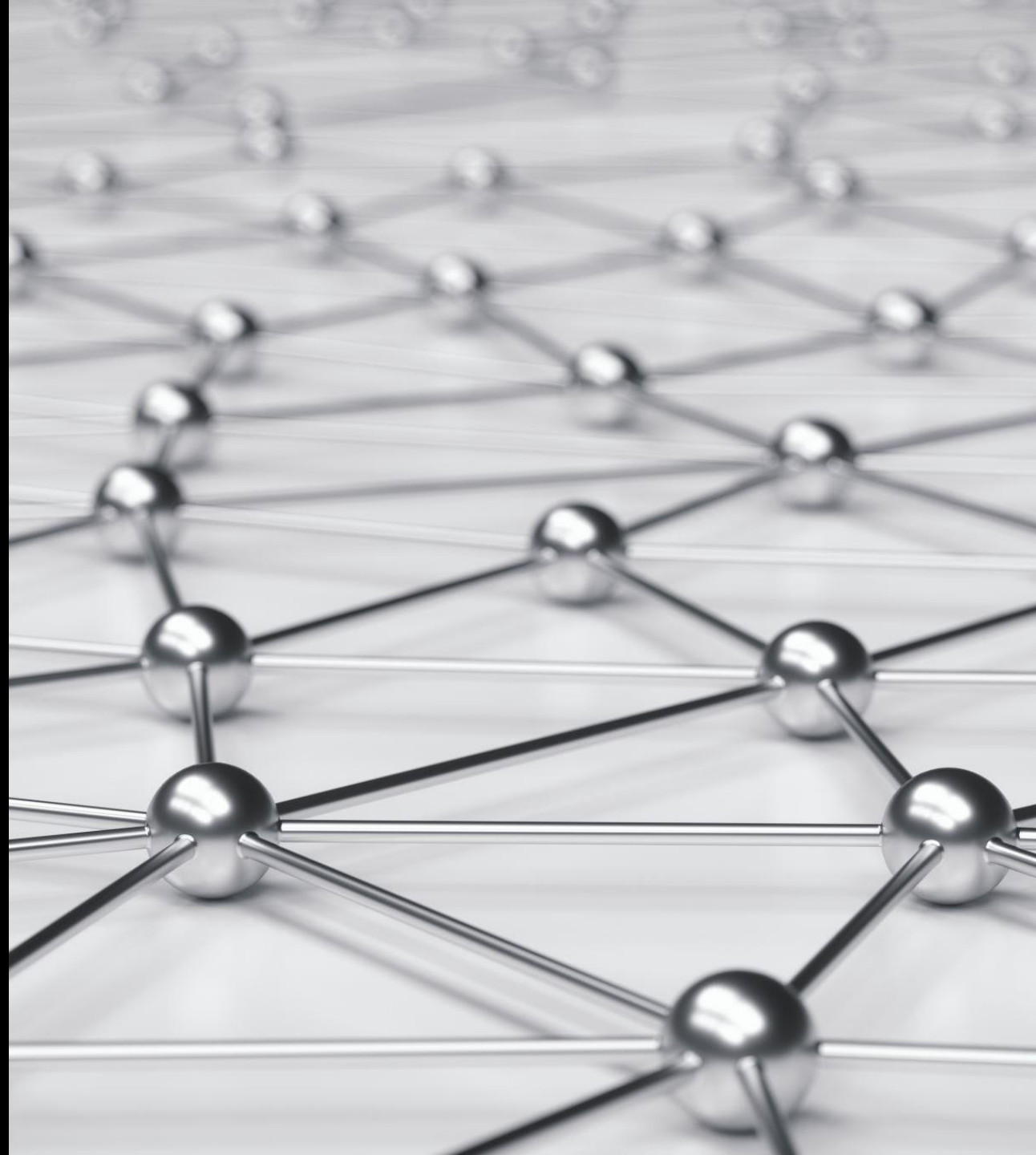
A perspective view of a server room aisle. The racks on both sides are filled with server hardware, and numerous small lights are visible, creating a grid-like pattern of light points. The floor is a light-colored, perforated metal grating. The overall lighting is a cool, blueish-white, typical of a data center environment.

COMPUTER NETWORKS

Emtinan Tobuli

THE DEFINITION OF NETWORKS:

is a group of two or more computer systems linked together to exchange data and share resources, including expensive peripherals such as laser printers



THE ADVANTAGES OF NETWORKS:

- **Reduced hardware costs:** reduce costs because users can share expensive equipment.
- **Application sharing:** able users to share software.
- **Sharing info resources:** Organizations can use networks to create common pools of data that employees can access.
- **Centralized data management:** Data stored on a network can be accessed by multiple users.
- **Connecting people:** networks create powerful new ways for people to work.

THE DISADVANTAGES OF NETWORKS:

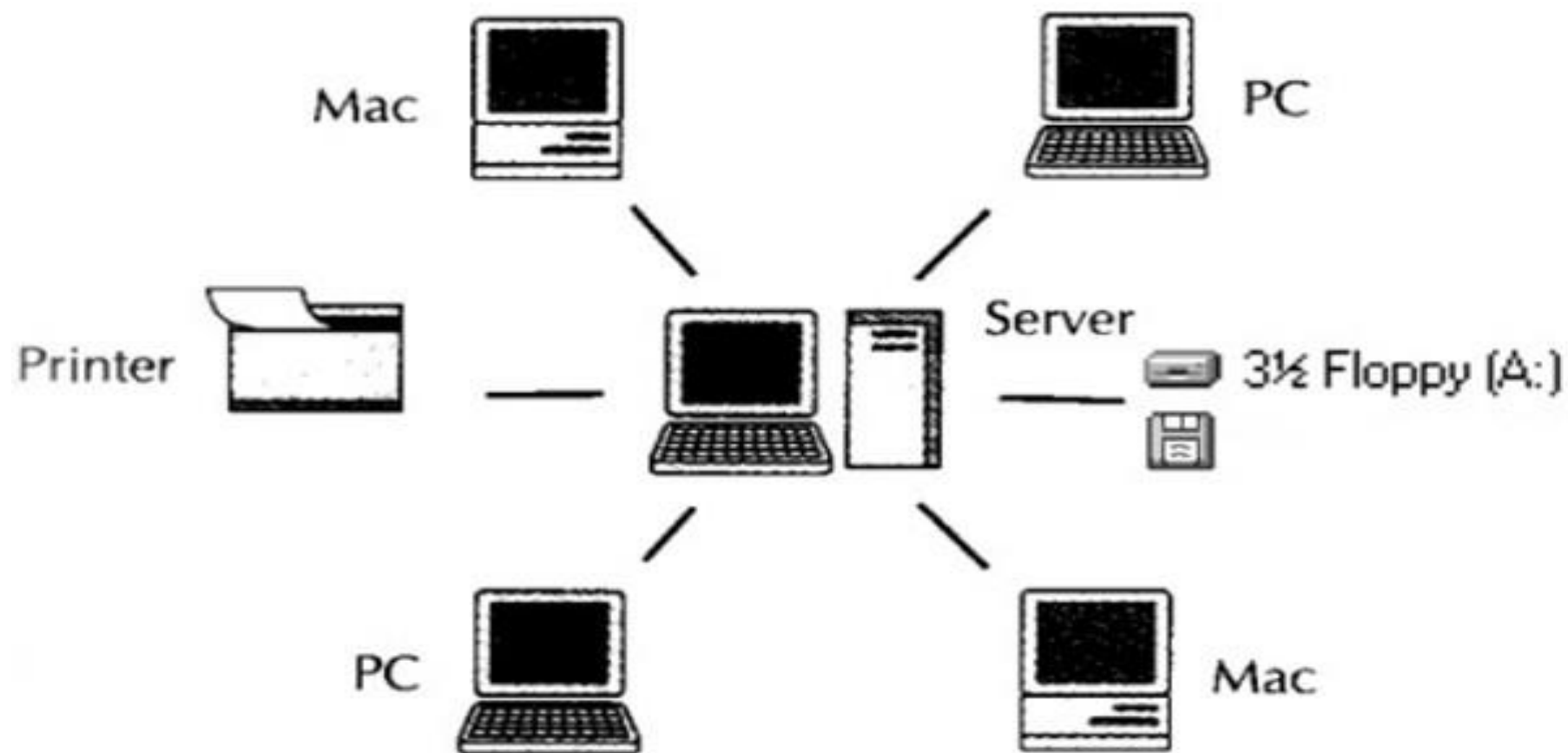
- **Loss of autonomy:** being a part of a network is being a part of a community . Sometimes you have to give up personal freedoms for the good of the group.
- **Lack of privacy:** Network membership can threaten your privacy.
- **Security threats:** it is possible that others may gain unauthorized access to files, user names, and even passwords.
- **Loss of productivity:** networks are powerful but access to resources is sometimes restricted or unavailable because of viruses, hacking, sabotage, or a simple breakdown.

THE DIFFERENT TYPES OF NETWORKS

A local area network (LAN) uses cables, radio waves, or infrared signals to link computers or peripherals, such as printers

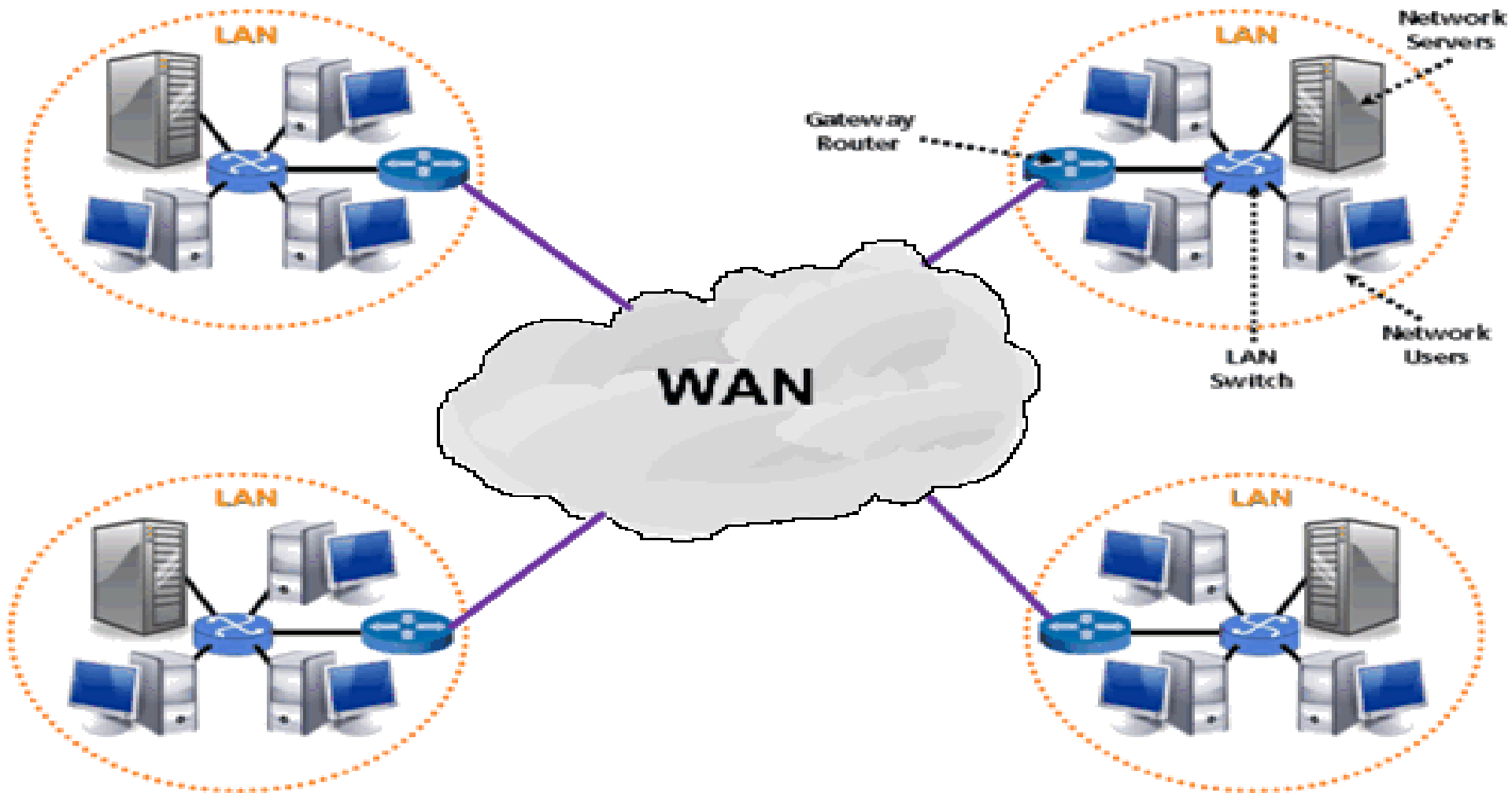
- **within a small geographic area (building or a group of buildings).**
- **typically owned and managed by a single person or organization.**

Local Area Network (LAN)

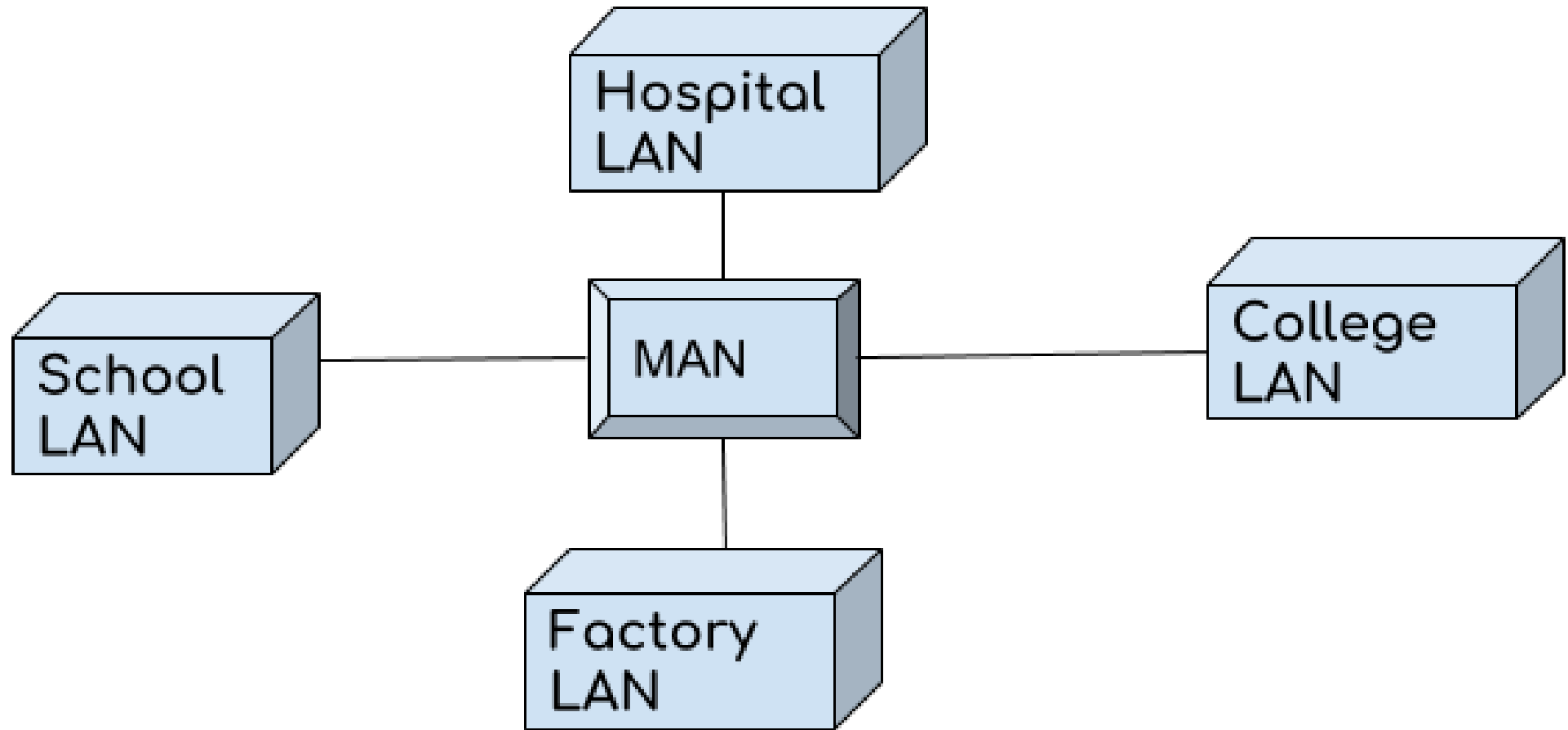


A wide area network (WAN) : uses long-distance transmission media to link computers separated by a few miles or even thousands of miles.

- **geographically dispersed collection of LANs.**
- **The Internet is the largest WAN.**
- **WAN is not owned by a single organization. it has a collective ownership like the Internet.**



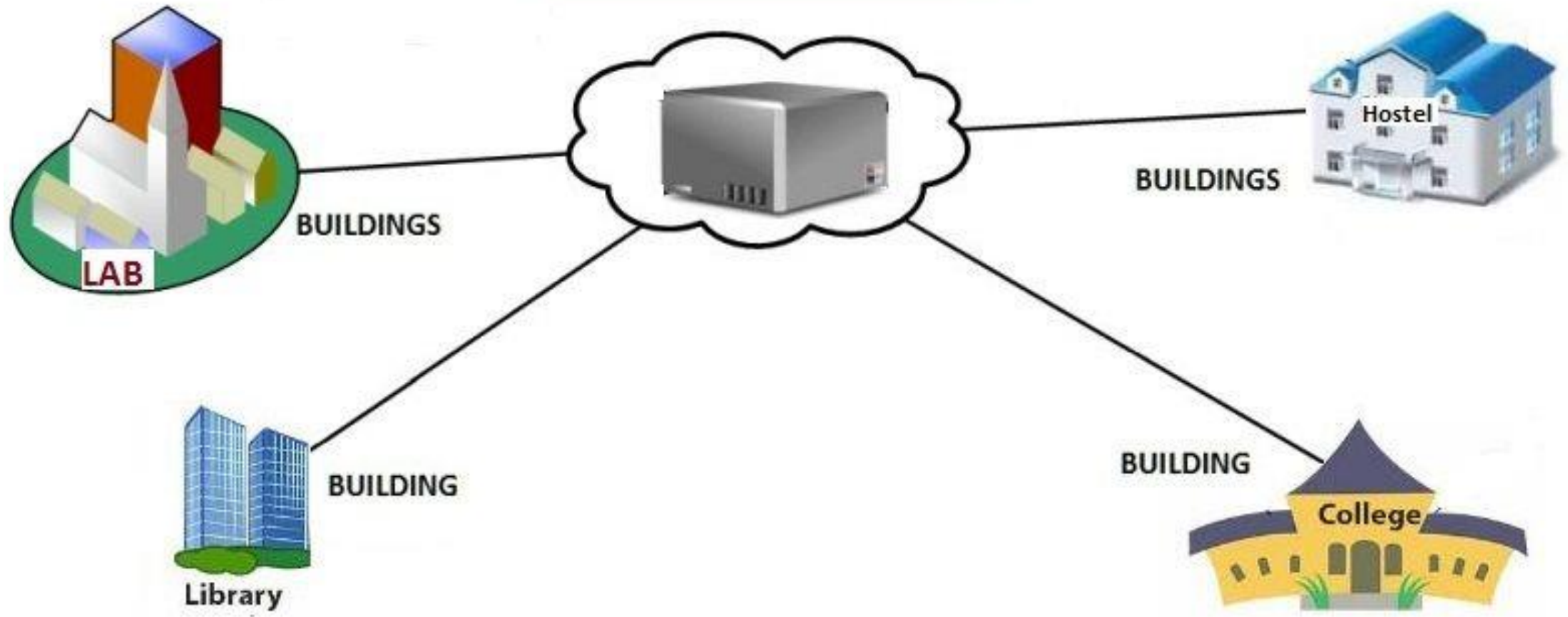
- **metropolitan area network (MAN)** is a network designed for a city or town.
- usually larger than a LAN but smaller than a WAN.
- Typically, a MAN is owned by a single government or organization.
- essential examples of a MAN include a network used to connect firehouses across a region or county.



campus area network (CAN):

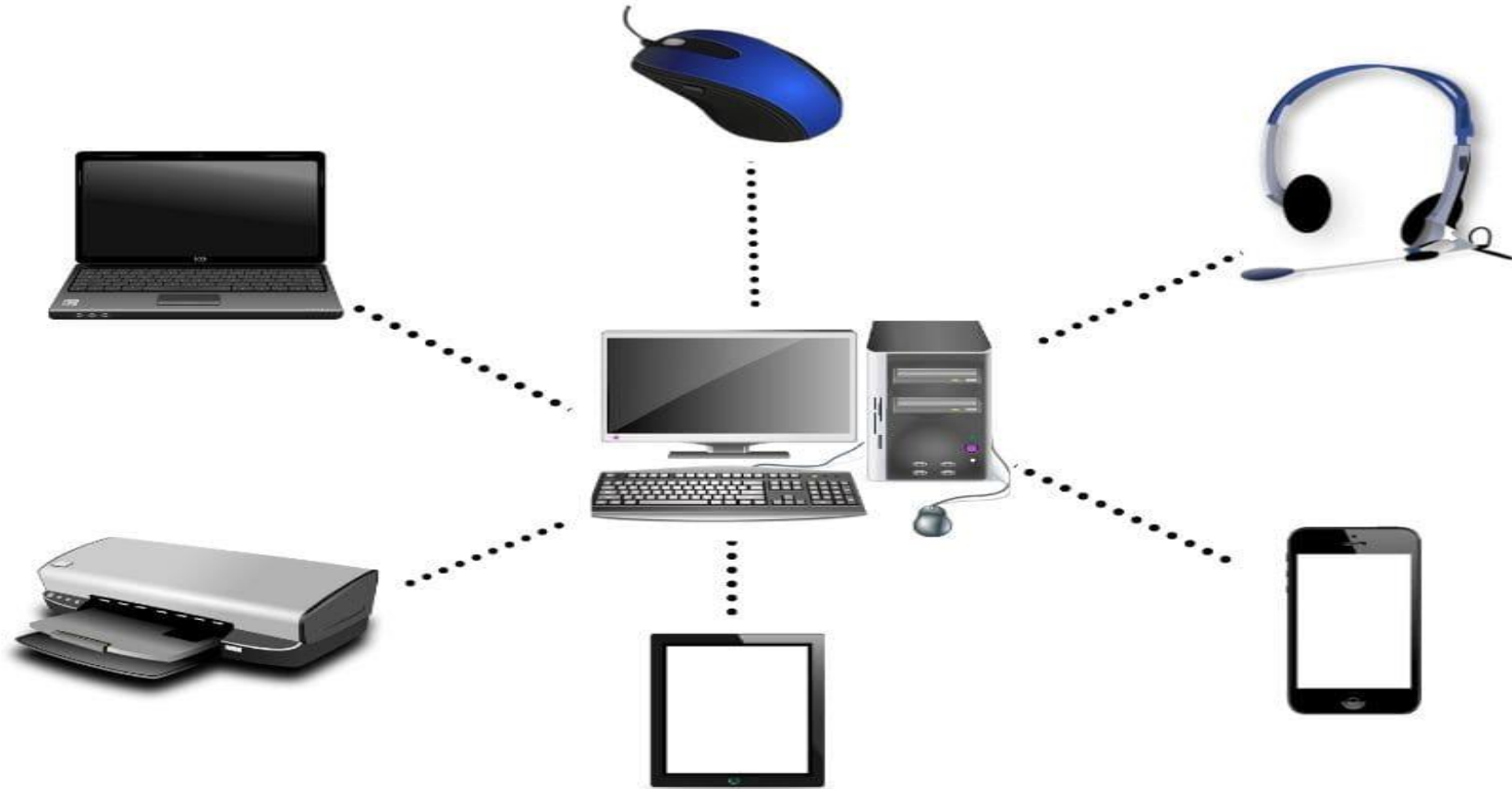
- includes several LANs that are housed in various locations on a college or business campus.
- Usually smaller than a WAN.
- CANs use devices such as switches, hubs, and routers to interconnect.

CAMPUS AREA NETWORK



personal area network (PAN):

- **network created among an individual's own personal devices.**
- **usually within a range of 32 feet.**
- **involve wireless technology .**



PAN (Personal Area Network)

- **home area network or HAN:** is a personal and specific use of network technology that provides connectivity between users and devices located in or near one residence.
- It enables users to quickly and conveniently share files and resources by using network connections between computers and peripheral devices.
- Home networks can accommodate both wired and wireless communications.

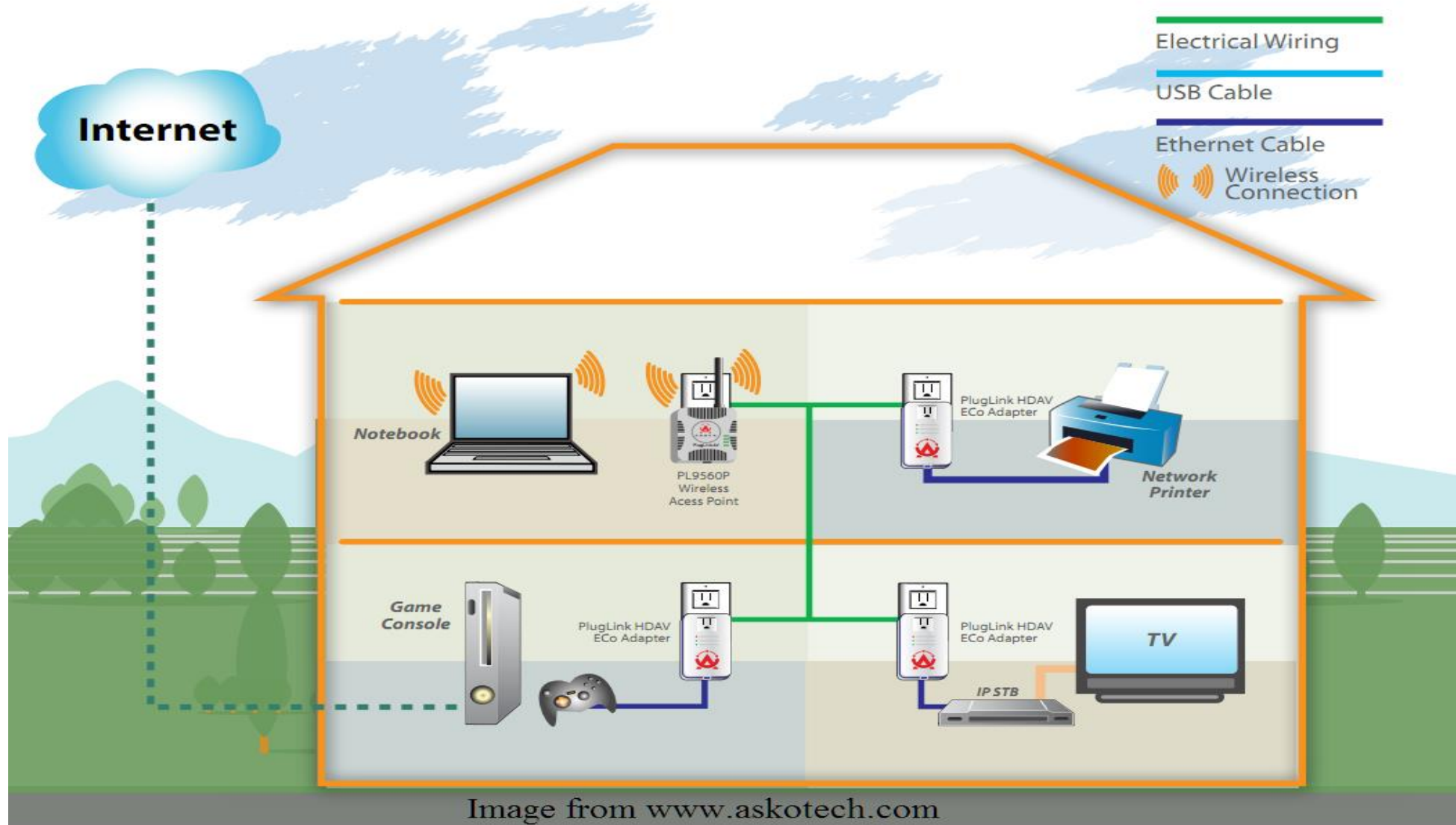


Image from www.askotech.com

PEER TO PEER NETWORKS:

peer-to-peer (P2P) network, :all of the computers on the network are equals, or peers . there's no file server, each computer user decides which files will be accessible to other users on the network.

- easy to set up generally to share an expensive peripherals or to provide Internet access on the LAN.
- often used for home networks or small businesses.
- do not require a NOS (network operating system).
- security is not strong due to the lack of hierarchy among the participants.

CLIENT \ SERVER NETWORK:

includes one or more servers as well as clients .

common servers provide e-mail, file storage, and database storage, and facilitate communication with other networks, including the Internet. A client can be any type of computer connected to a network and contains the software that enables it to send requests to a server.

It can connect via modem, dedicated physical connection, or wireless connection.

The client/server model works with any size or physical layout of LAN and doesn't tend to slow down with heavy use.

VIRTUAL PRIVATE NETWORK (VPN):

virtual private network (VPN). a password-protected network controlled by the company and accessed only by employees A VPN operates as a private network over a public network, making data accessible to authorized users in remote locations through the use of secure, encrypted connections and special software.

THE 3 LAN TOPOLOGIES:

The physical layout of a LAN is called its network topology

-Bus topology: every node(any device connected to a network), is attached to a common cable or pathway referred to as the bus

- special connectors called terminators **AT THE END OF THE BUS** signify the end of the circuit.
- only one node can transmit at a time.
- Other limitations of a bus topology include length restrictions because of the loss of signal strength and practical limits .
- bus networks are simple, reliable, and easy to expand.
- practical in a relatively small environment such as a home or small office

A star topology: solves the expansion problems of the bus topology with a central wiring device, which can be a hub, switch, or computer . Adding users is simple; you just run a cable to the hub or switch and plug the new node into a vacant connector.

- use contention management to deal with collisions.**
- ideal for office buildings, computer labs, and WANs.**
- the loss of the hub, switch, or central computer, caused by a power outage or virus invasion, can bring down the entire network**

ring topology, all of the nodes are attached in a circular wiring arrangement.

not in common use today, provides a unique way to prevent collisions .

- A special unit of data called a token travels around the ring. A node can transmit only when it possesses the token.**
- well suited for use within a division of a company or on one floor of a multi-floor office building**

LAN COMPONENTS:

- **network interface card (NIC)** is an expansion board that provides the electronic components to make the connection between a computer and a network
- **A hub** is a simple device that joins multiple computers together in a single network without managing the traffic between the connections.
- **Switches** are more intelligent than hubs. contains software that inspects the source and target of a data package and attempts to deliver it to that destination. with better performance than a hub. Switches and hubs only move data between nodes within a single network.

- **router** is a more complex device, that is used to connect two or more networks. it also inspect the source and target of a data package and locate alternative pathways so that the data reaches its destination.
- **A wireless access point**, also known as an AP or WAP, is a node on a network act as a joint or bridge connecting wireless nodes to a wired network
- **servers**, a computer or device with software that manages network resource
- the most comon is server is file server, a high-capacity \ speed computer with a large hard disk. dedicated to make program and data files available.
- It contains the network operating system (NOS):designed to enable data transfer and application usage among computers and other devices connected to a local area network.

WAN COMPONENTS:

- . **A point of presence (POP):** is a wired or wireless WAN connection point that enables users to access the WAN, provide availability to it users, WANs have a POP in as many towns and cities as needed.
- **Backbones:** are the high-capacity transmission lines that carry WAN traffic.
- A variety of physical media are used for backbone services, including microwave relays, satellites, and dedicated telephone lines. Some backbones are regional, connecting towns and cities.

THE DIFFERENCE BETWEEN CIRCUIT\ PACKET SWITCHING AND

WAN protocols are based on either circuit- or packet-switching network technology

circuit switching:

- used in the public switched telephone system, with a direct connection between the communicating devices.
- Data is sent over a physical end-to-end circuit between the sending and receiving computers.
- Usefull when avoiding delivery delays is essential.
- In a circuitswitching network, high-speed electronic switches handle the job of establishing and maintaining the connection.

packet switching:

- used for computer communication, with no need to create a single direct connection .
- The sending computer's outgoing message is divided into packets. Each packet is numbered and addressed to the destination computer.
- The packets then travel to a router, which examines each packet it detects.
- After reading the packet's address, the router consults possible pathways that the packet can take to get to its destination.
- If more than one path exists, it sends the packet along the path with the least congestion. The packets may not all take the same path or arrive in the order they were sent,
- but On the receiving computer, protocols put the packets in the correct order and decode the message they contain. If any packets are missing, the receiving computer sends a message requesting retransmission of the missing packet.

Packet switching is more efficient and less expensive than circuit switching.

packet-switching networks are more reliable. And can function even if portions of the network aren't working.

If network experiences congestion (overloading), some of the packets may be further delayed, and the message can't be decoded until all of its packets are received. For these reasons, packet switching is not well suited to the delivery of real-time voice and video.

NETWORK PROTOCOLS:

network also uses protocols (standards or rules) that enable network-connected devices to communicate with each other. Protocols could be implemented by hardware, software, or a combination of both.

All of the communications devices in a network conform to different protocols for example modems must conform to standards called **modulation protocols**.

- Each protocol specifies the important details of communication, including: data transfer rate, standards for data compression and error checking
- A single network may use dozens of protocols. The complete package of protocols that specify the network's functions is called the **network's protocol suite**. also called network architecture

NETWORK LAYERS

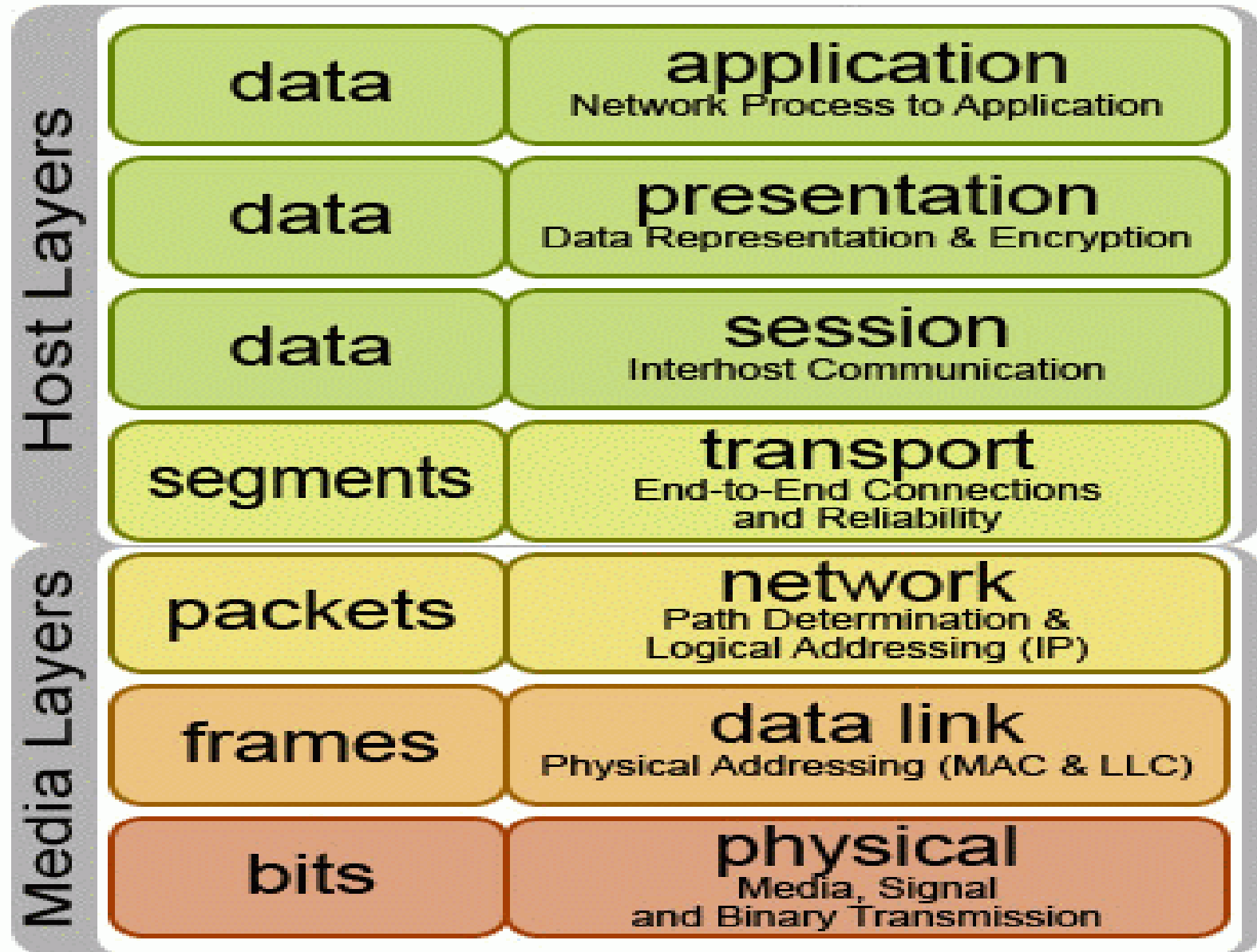
Network Layers: networks use a network architecture that is divided into separate network layers. Each network layer has a functions and protocol precisely defines how each layer passes data to another and can be isolated and treated separately from other layers.

the layers are called a **protocol stack**. On the receiving end, the process is reversed: The received message goes up the protocol stack. First, the network's data envelope is opened, and the data is translated until it can be used by the receiving application.

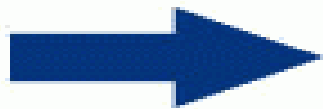
OSI Model

data unit

layers



3



2



LAN WIRED\WIRELESS PROTOCOLS

LAN protocol for wired networks is Ethernet which is The most widely used (Twisted-pair cable) uses a protocol called carrier sense multiple access/collision detection, or CSMA/CD place a data units of a fixed size, called a packets, onto the network and then sends it on its way .

versions include Ethernet (10Base-t), Fast Ethernet (100Base-T), Gigabyte Ethernet, and 10 Gigabyte Ethernet. The most commonly used wireless protocol is 802.11g. Additional wireless protocols are 802.11n, 80211r, 802.15, 802.16, and the new 802.20

WAN PROTOCOLS

WAN protocols are based on either circuit- or packet-switching network technology

Example of WAN protocols:

The Internet Protocols: called TCP/IP,

IP: defines the Internet's addressing scheme, which enables any Internet-connected computer to be uniquely identified.

Transmission Control Protocol (TCP) defines how one Internet-connected computer can contact another to exchange control and confirmation messages.