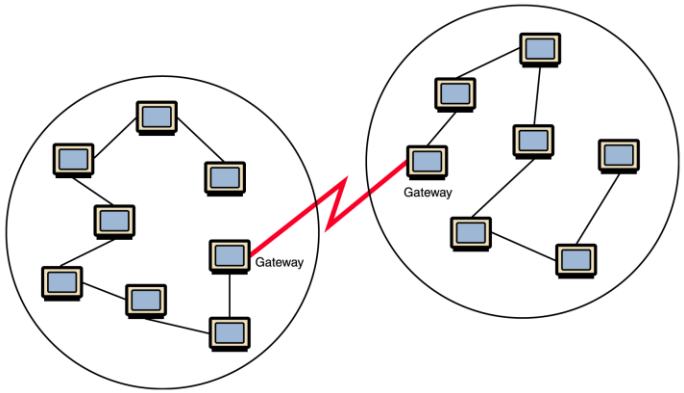
Networking

A collection of computing devices connected in order to communicate and share resources

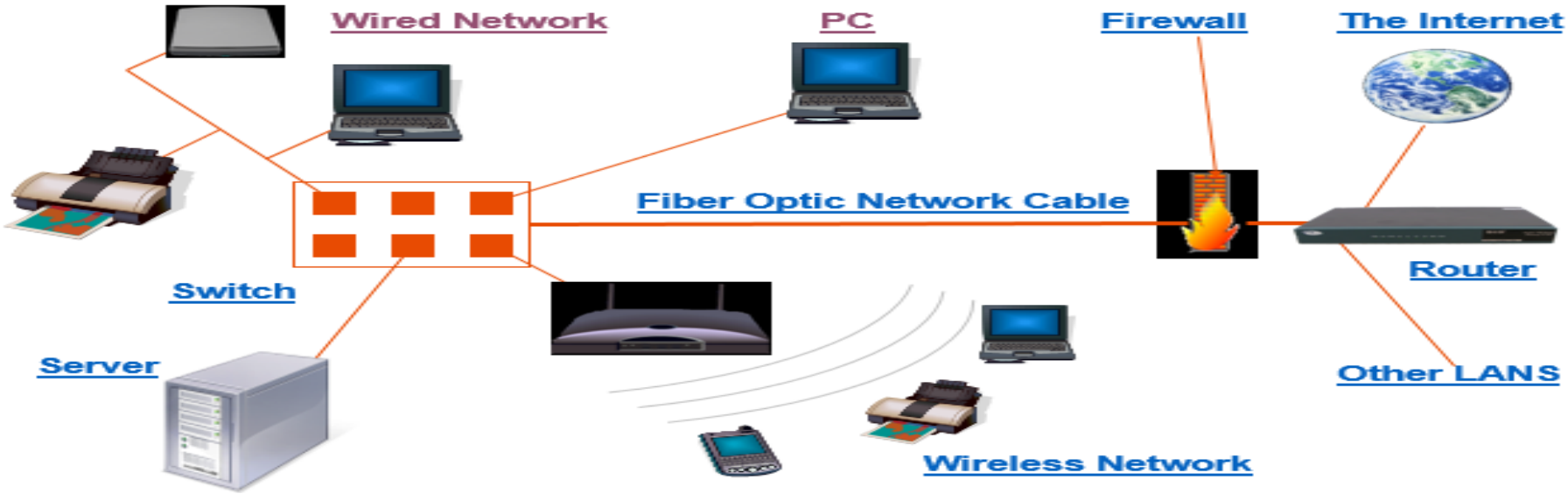
Connections between computing devices can be physical using wires or cables or wireless using radio waves or infrared signals



What is a Computer Network?

A system containing any combination of computers, computer terminals, printers, audio or visual display devices, or telephones interconnected by telecommunication equipment or cables: used to transmit or receive information.

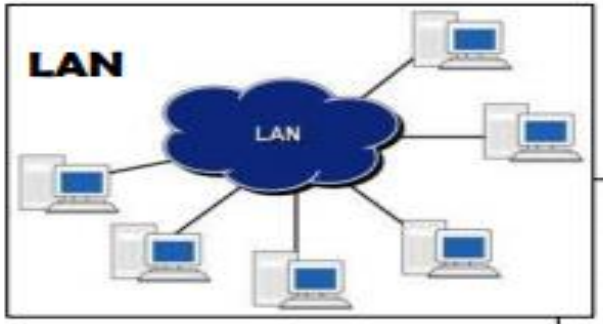
The Network Diagram



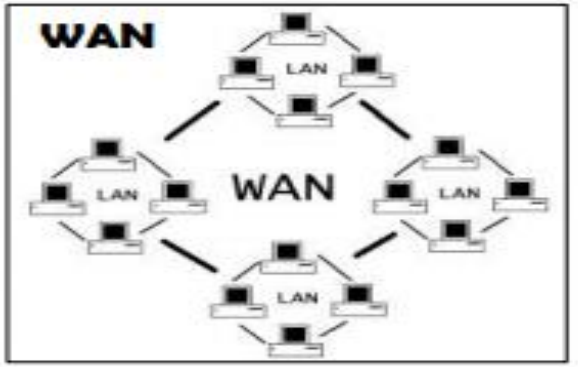
Types of Network

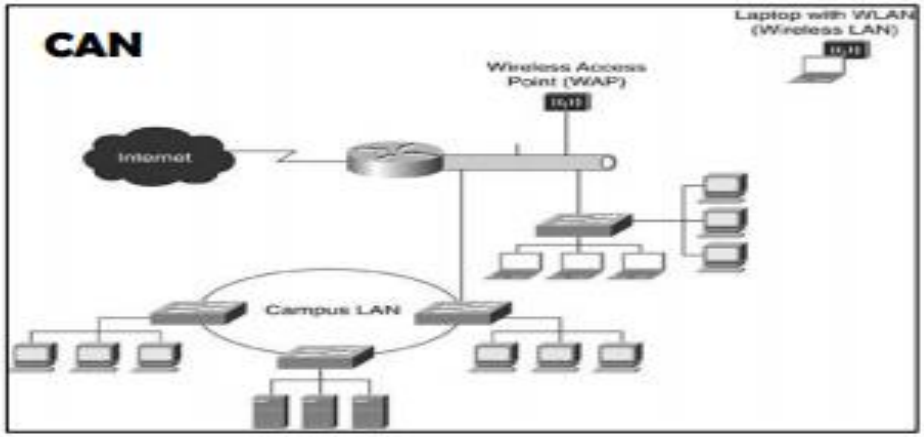
There are many types of computer networking which are used world wide these days. There are some types of network that are using Worldwide:

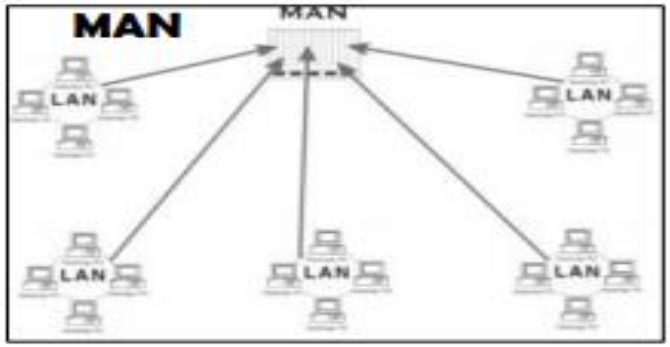
- LAN - Local Area Network
- WAN - Wide Area Network
- WLAN - Wireless Local Area Network
- PAN - Personal Area Network
- SAN - Storage Area Network
- GAN - Global Area Network
- MAN - Metropolitan Area Network
- CAN - Controller Area Network
- DAN - Desk Area Network
- VPN - Virtual Private Network


LAN
LAN

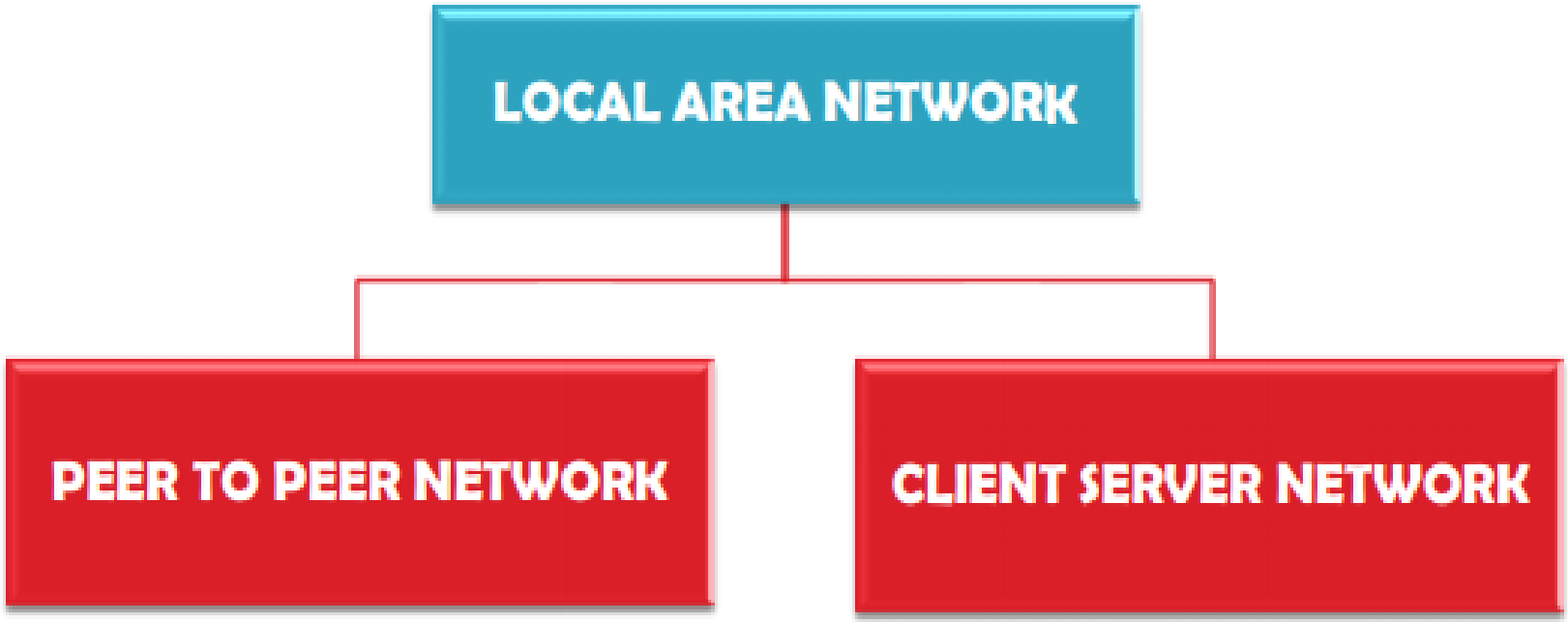

PAN

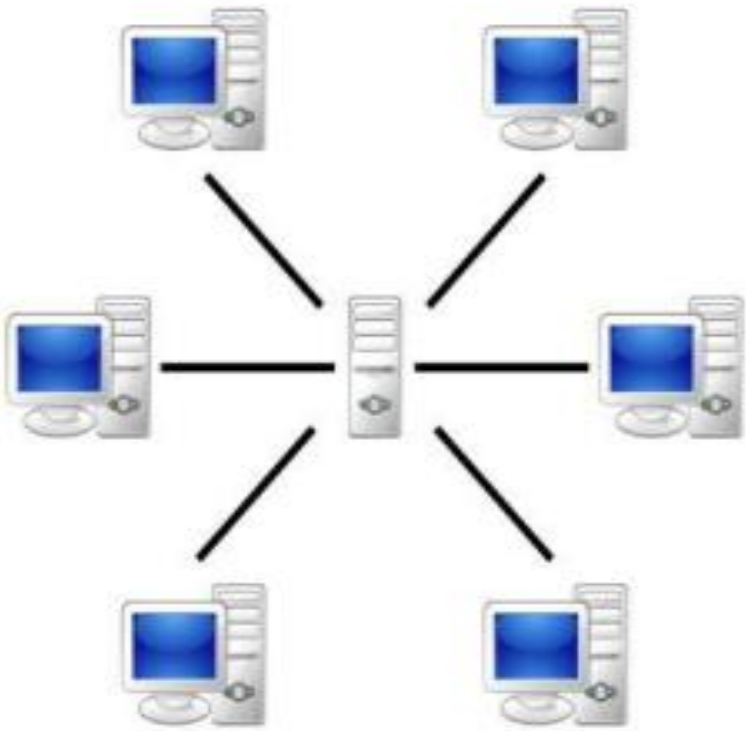

WAN
LAN
LAN
WAN
LAN
LAN


CAN
Laptop with WLAN
(Wireless LAN)
Wireless Access
Point (WAP)
Internet
Campus LAN

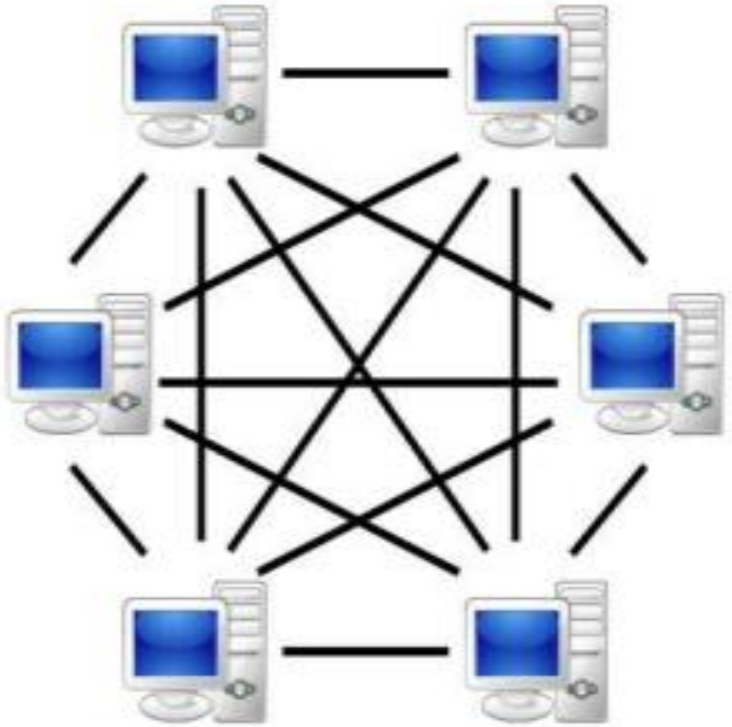

MAN
MAN
LAN
LAN
LAN
LAN
LAN

Network Classification By Their Component Role





Server-based



P2P-network

Peer To Peer Network

- In peer to peer network each computer is responsible for making its own resources available to other computers on the network.
- Each computer is responsible for setting up and maintaining its own security for these resources.
- Also each computer is responsible for accessing the required network resources from peer to peer relationships.
- Peer to peer network is useful for a small network containing less than 10 computers on a single LAN .
- In peer to peer network each computer can function as both client and server.
- Peer to peer networks do not have a central control system. There are no servers in peer networks.

Client/Server Network

- In client-server network relationships, certain computers act as server and other act as clients. A server is simply a computer, that available the network resources and provides service to other computers when they request it. A client is the computer running a program that requests the service from a server.
- Local area network(LAN) is based on client server network relationship.
- A client-server network is one on which all available network resources such as files, directories, applications and shared devices, are centrally managed and hosted and then are accessed by client.
- Client serve network are defined by the presence of servers on a network that provide security and administration of the network.

Components of Computer Network

- Two or more computers
- Cables as links between the computers
- A network interfacing card(NIC) on each computer
- Switches
- Software called operating system(OS)

The Networking Devices

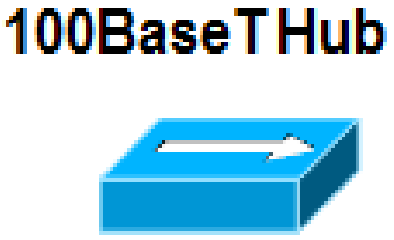
1. NIC Card
2. Hub
3. Switch
4. Bridge
5. Router
6. Gateway
7. Firewall

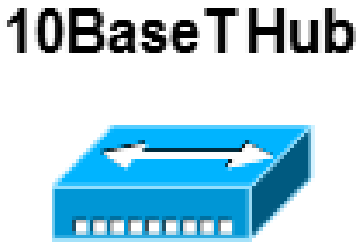
1. Network Interface Card

- NIC is used to physically connect host devices to the network media.
- A NIC is a printed circuit board that fits into the expansion slot of a bus on a computer motherboard.
- It can also be a peripheral device. NICs are sometimes called network adapters.
- Each NIC is identified by a unique code called a Media Access Control (MAC) address.
- This address is used to control data communication for the host on the network.

3. Hubs

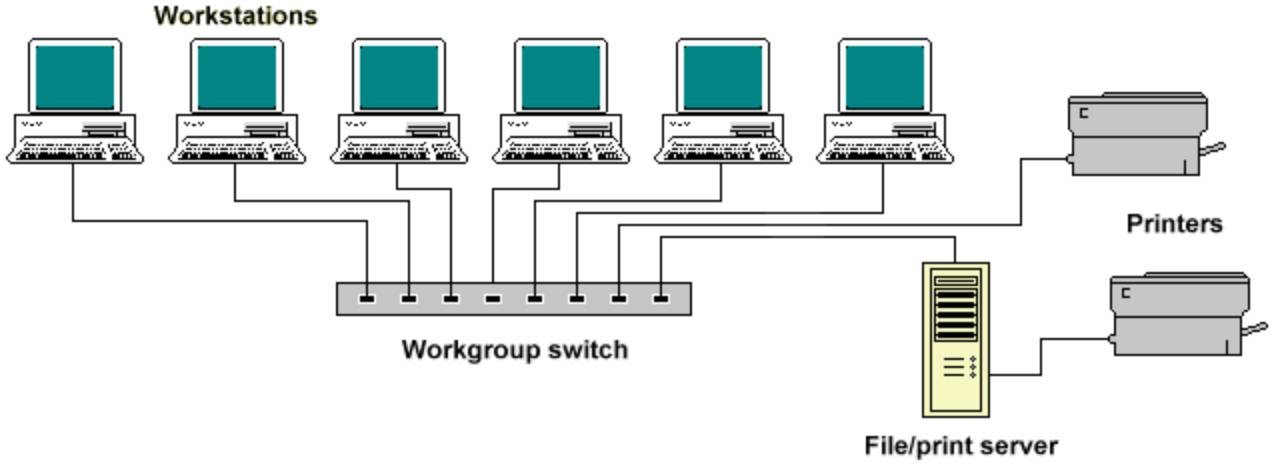
- Hubs concentrate on connections.
- In other words, they take a group of hosts and allow the network to see them as a single unit. This is done passively, without any other effect on the data transmission.
- Active hubs concentrate hosts and also regenerate signals.





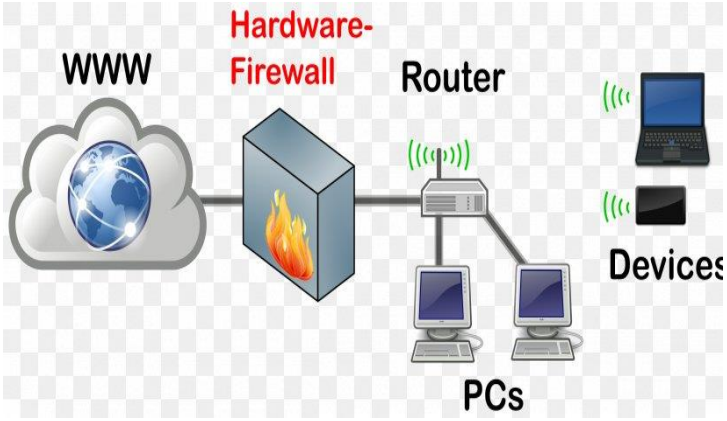
5. Switches

- **Switches add more intelligence to data transfer management.**
- **They can determine if data should remain on a LAN and transfer data only to the connection that needs it.**
- **Another difference between a bridge and switch is that a switch does not convert data transmission formats**



8. Firewall

- A firewall is a network device or software for controlling network security and access rules.
- Firewalls are inserted in connections between secure internal networks and potentially insecure external networks such as the Internet.
- Firewalls are typically configured to reject access requests from unrecognized sources while allowing actions from recognized ones.
- The vital role firewalls play in network security grows in parallel with the constant increase in cyber attacks.



Networking key terms

Node (host)

Any device on a network

Data transfer rate (bandwidth)

The speed with which data is moved from one place to another on a network

Protocol

A set of rules that defines how data is formatted and processed on a network; i.e., rules that allow client/server interaction

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Network topology

Local-area network (LAN)

A network that connects a relatively small number of machines in a relatively close geographical area

Ring topology connects all nodes in a closed loop on which messages travel in one direction

Star topology centers around one node to which all others are connected and through which all messages are sent

Bus topology nodes are connected to a single communication line that carries messages in both directions

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Types of Networks

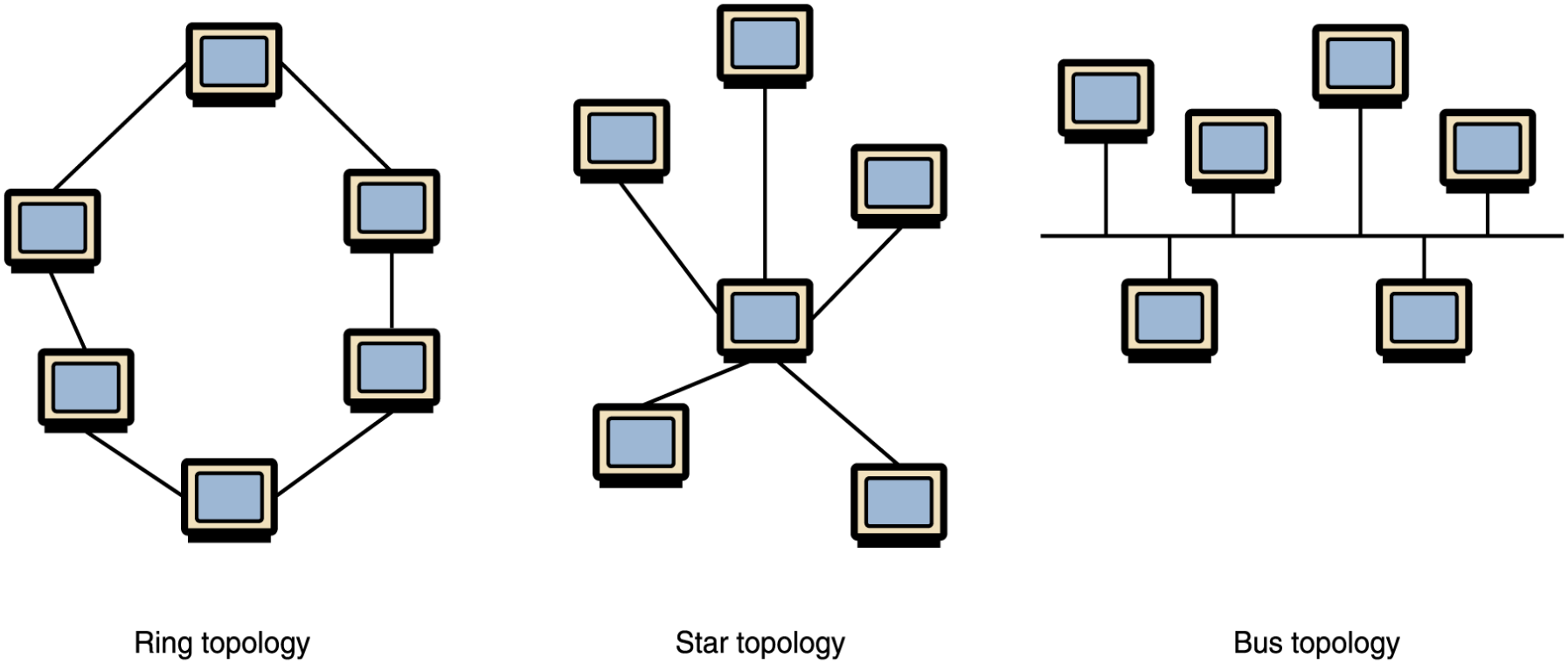

Figure 15.2 **Various network topologies**

Ethernet

The industry standard bus technology for local-area networks

Issue 1: Topology

- If every pair of computers on a network had a dedicated communication link, passing messages would be direct and straightforward.
- Unfortunately, with hundreds, thousands or millions of computers on a network, they cannot all have direct links to each other.

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Issue 2: Addressing

If a device wants to send a message to another, how does it specify precisely which device?

To what *address*?

Network Addresses

IP address

An address made up of four one-byte numeric values separated by dots that uniquely identifies a computer on the Internet

Example: 192.0.0.1

DNS

Domain Name System (DNS) is used for IP address translation services.

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IP Addresses

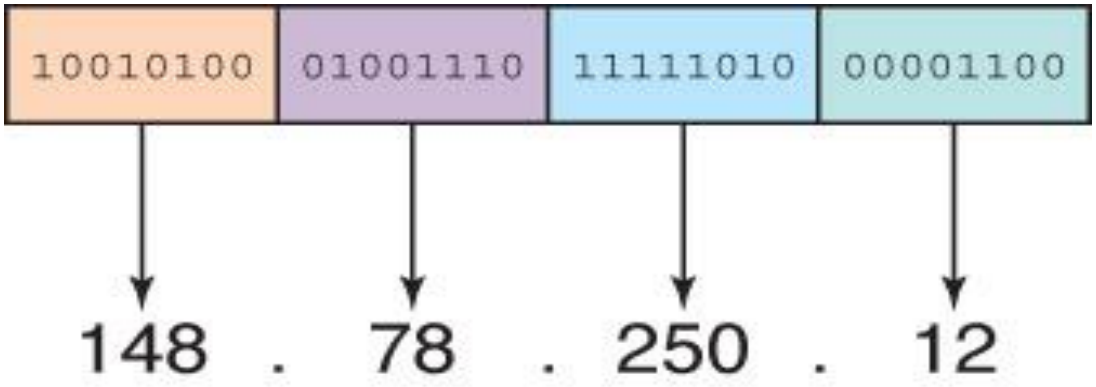
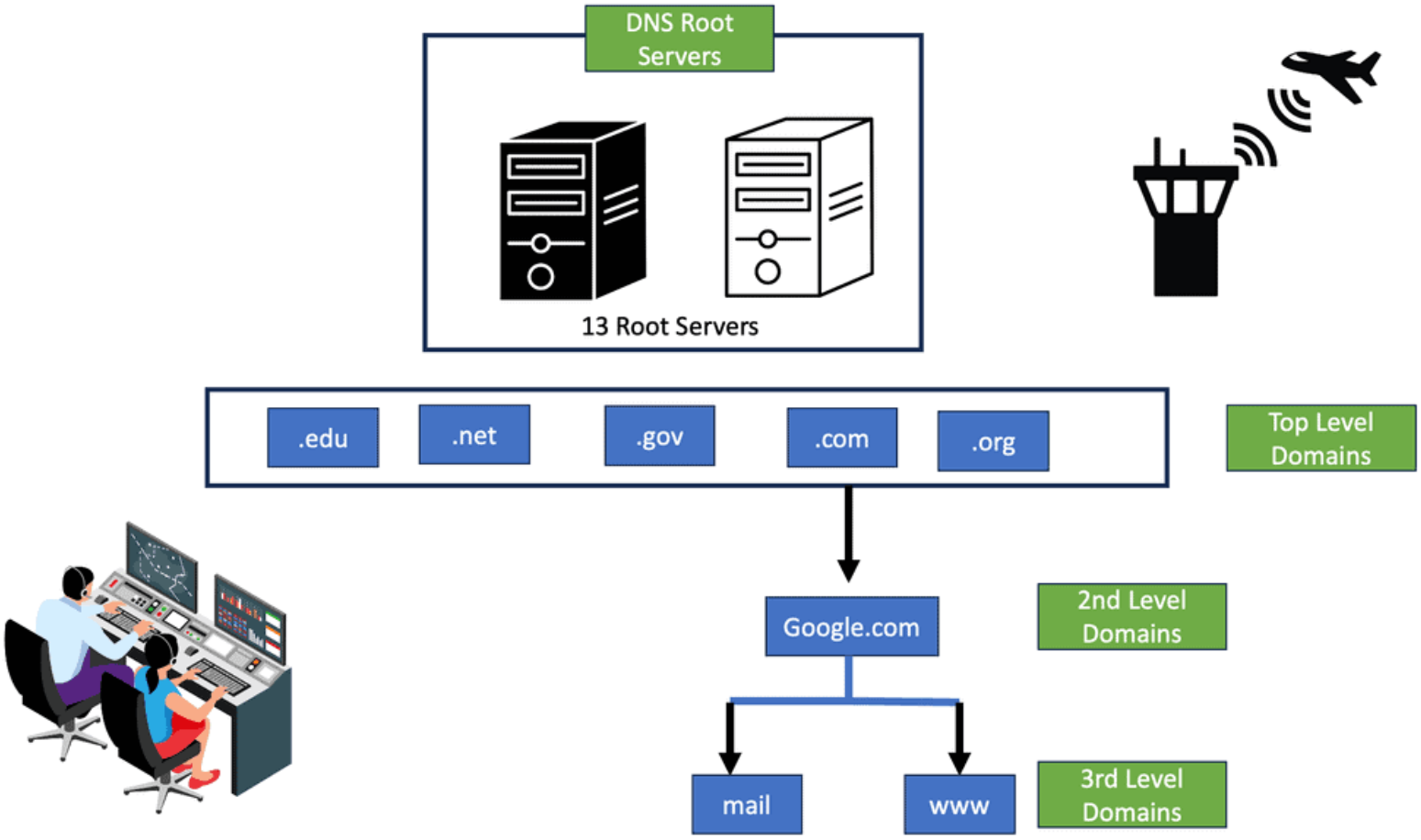


Figure 15.9
An IP address is stored in four bytes

- An **IP address** can be split into
  - **network address**, which specifies a specific network
  - **host number**, which specifies a particular machine in that network

Domain Name System



Domain Name System

Top-Level Domain	General Purpose
.aero	Aerospace industry
.biz	Business
.com*	U.S. Commercial (unrestricted)
.coop	Cooperative
.edu*	U.S. Educational
.gov*	U.S. Government
.info	Information (unrestricted)
.int*	International organizations
.jobs	Employment
.mil*	U.S. Military
.museum	Museums
.name	Individuals and families
.net*	Network (unrestricted)
.org*	Nonprofit organization (unrestricted)
.pro	Certain professions

Figure 15.10 **Top-level domains, including some relatively new ones**

Domain Name System

Organizations based in countries other than the United States use a top-level domain that corresponds to their two-letter country codes

Country Code TLD	Country
.au	Australia
.br	Brazil
.ca	Canada
.gr	Greece
.in	India
.ru	Russian Federation
.uk	United Kingdom

Figure 15.11
Some of the top-level domain names based on country codes