Computer Networks

What is a Computer Network?

A computer network is a system that connects two or more computing devices to share resources and information.

• Networks can be established using either wired (cables) or wireless (Wi-Fi, Bluetooth, etc.) connections.
• Both hardware (routers, switches, cables) and software (network protocols, security applications) play essential roles in connecting devices.
• The first functional network, ARPANET, was created in the late 1960s with funding from the U.S. Department of Defense.

Examples of Computer Networks

1. Traffic Monitoring Systems:

Used in cities to track traffic flow and incidents.
Alerts officials and emergency responders in real-time.

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3. Alerts officials and emergency responders in real-time.
4. Remote Collaboration (e.g., Google Drive, Video Calls):

Enables document sharing, video conferencing, and messaging.
Whenever you stream movies, share files, chat online, or browse the internet, a computer network is in action.

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Uses of Computer Networks

' Communication (email, video calls, instant messaging, etc.)
' Sharing hardware (printers, scanners, storage devices)
' File sharing across multiple systems
' Running software on remote machines
' Easy access to and management of information

Key Components of a Network

Ø=ÜÌ Network Devices: Computers, mobile phones, routers, serv

Ø=ÜÌ Transmission Media (Links):

• Wired: Coaxial cables, twisted-pair cables, optical fiber, phone lines.
• Wireless: Wi-Fi, cellular networks, satellites.

Ø=ÜÌ Communication Protocols:

• Define rules for data transmission.
• Common protocols include TCP/IP (Internet Protocol Suite), IEEE 802, Ethernet, Wi-Fi, and cellular standards.

Ø=ÜÌ Network Security:

• Ensuring data security is crucial in modern networks.
• Common security measures include: Ø=Ý9 Firewalls Ø=Ý9 Intru Systems (IDS/IPS) Ø=Ý9 Network Access Control (NAC) Ø=Ý9 Co servers Ø=Ý9 Anti-DDoS protection Ø=Ý9 Load balancers

Types of Computer Networks

There are five main types of computer networks:

1. Personal Area Network (PAN)
2. Local Area Network (LAN)
3. Campus Area Network (CAN)
4. Metropolitan Area Network (MAN)
5. Wide Area Network (WAN)

1. Personal Area Network (PAN)

Ø=Ý9 Definition: The smallest network type, designed to connec
short range (1–100 meters).

Ø=Ý9 Example:

• Connecting a smartphone to a Bluetooth headset.
• Syncing a smartwatch with a mobile phone.

Ø=Ý9 Technologies Used: Bluetooth, Infrared (IrDA), Zigbee, US

' Advantages of PAN:

'þ Easy to set up with minimal cost
'þ Portable and flexible
'þ Requires little technical knowledge

'L Disadvantages of PAN:

'L Limited coverage area
'L Low data transfer rates
'L Wireless communication security risks

Ø=ÜÌ Applications:

• Home and office automation
• Wearable technology (fitness trackers, smartwatches)
• Healthcare and medical devices
• Military communication

2. Local Area Network (LAN)

Ø=Ý9 Definition: A network that connects multiple computers and
(e.g., home, school, office).

Ø=Ý9 Example:

• Wi-Fi in a coffee shop
• School computer labs
• Office workstations

Ø=Ý9 Technologies Used: Ethernet (wired), Wi-Fi (wireless).

Ø=Ý9 Range: Up to 2 km

' Advantages of LAN:

'þ High speed (up to 100 Gbps)
'þ Private and more secure than larger networks
'þ Low maintenance cost

'L Disadvantages of LAN:

'L High initial setup cost (requires cables, routers, switches)
'L Limited coverage area
'L Privacy concerns (administrators can monitor user activity)

3. Campus Area Network (CAN)

Ø=Ý9 Definition: A network covering multiple buildings within a
as a school, university, or corporate campus.

Ø=Ý9 Example:

• College Wi-Fi covering multiple buildings
• A corporate office network spanning multiple locations

Ø=Ý9 Technology Used: Ethernet, fiber optic cables, Wi-Fi

Ø=Ý9 Range: 1 km to 5 km

' Advantages of CAN:

'þ Faster speeds than MAN or WAN
'þ Centralized control ensures security
'þ Cost-effective for universities and corporations

'L Disadvantages of CAN:

'L Limited to a specific area
'L Requires dedicated network administrators

4. Metropolitan Area Network (MAN)

Ø=Ý9 Definition: A network that covers a large city or town. Lar
WAN.

Ø=Ý9 Example:

• City-wide broadband internet
• Public Wi-Fi networks in a metropolitan area

Ø=Ý9 Technology Used: Fiber Distributed Data Interface (FDDI),

Ø=Ý9 Range: 5 km to 50 km

' Advantages of MAN:

'þ High-speed internet (10–100 Mbps)
'þ Secure and centralized management
'þ Supports multiple users with stable performance

'L Disadvantages of MAN:

'L Complex network design
'L Expensive setup (fiber optic cables, network infrastructure)
'L Lower data transfer rates than LAN

5. Wide Area Network (WAN)

Ø=Ý9 Definition: A large-scale network connecting devices acros
even worldwide.

Ø=Ý9 Example:

• The Internet
• Corporate branches connected via VPN

Ø=Ý9 Technology Used: Leased lines, satellites, cellular networ

Ø=Ý9 Range: Above 50 km (can be global)

' Advantages of WAN:

'þ Covers vast distances (ideal for businesses with multiple lo
'þ Scalable to accommodate growth
'þ Facilitates global communication and data exchange

'L Disadvantages of WAN:

'L Very high setup and maintenance costs
'L Requires skilled network administrators
'L Higher risk of security breaches

Comparison: LAN vs. WAN vs. MAN vs. PAN

Feature	LAN (Local Area Network)	WAN (Wide Area Network)	MAN (Metropolitan Area Network)	PAN (Personal Area Network)
Coverage	Small area (home, office)	Global (cities, countries)	Medium (city-wide)	Personal devices (short range)
Ownership	Private (company, school)	Public/Private (telecom providers)	Government/private	Individual
Speed	High (up to 100 Gbps)	Slower than LAN (Mbps to Gbps)	Medium (10-100 Mbps)	Low (Kbps to Mbps)
Cost	Low to moderate	Very high	Moderate to high	Very low

Security
High
Lower (due to global exposure)
Higher than WAN
Moderate (wireless risks)

Example
Home Wi-Fi, school network
The Internet, VPN
City-wide Wi-Fi
Bluetooth headset, smartwatch