

# Types of Computer Networks and their Topologies

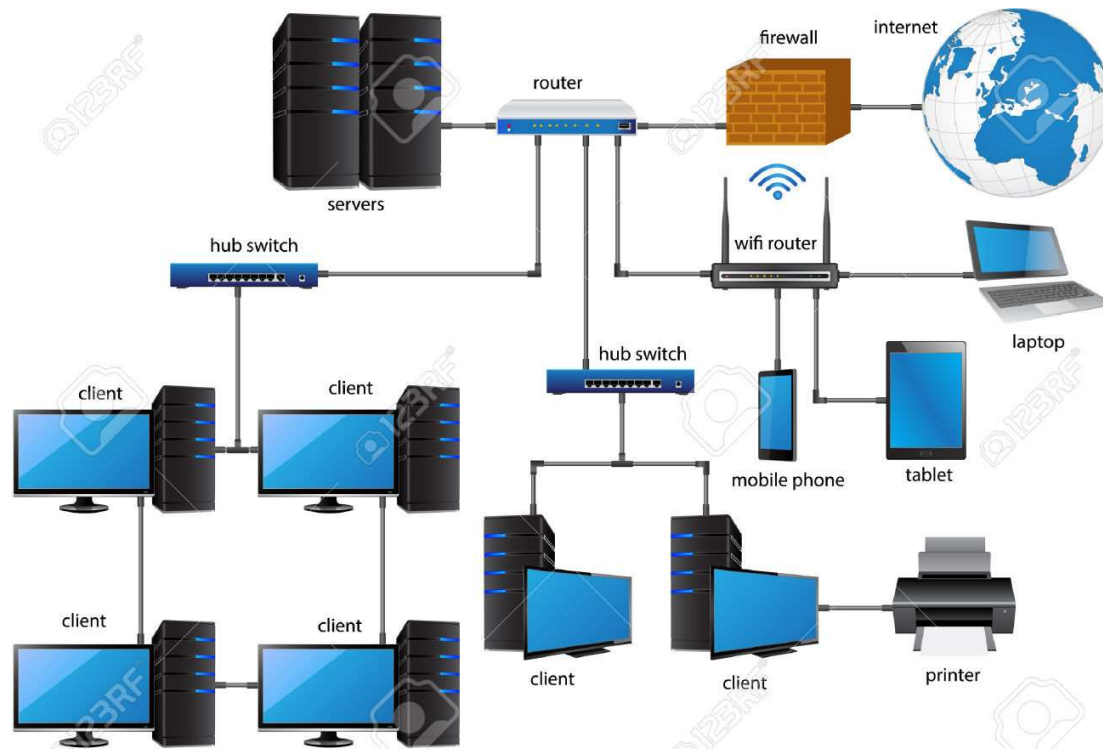
Four important groups of computer networks: PAN, LAN, MAN, WAN

## PAN (Personal Area Networks)

- A network infrastructure that provides access communication between computer devices within close proximity of a user
- laptops, tablet PCs, and smartphones can communicate with each other by using a variety of wireless technologies.
- The most common technologies:
  - Bluetooth and infrared.

## LAN (Local Area Networks)

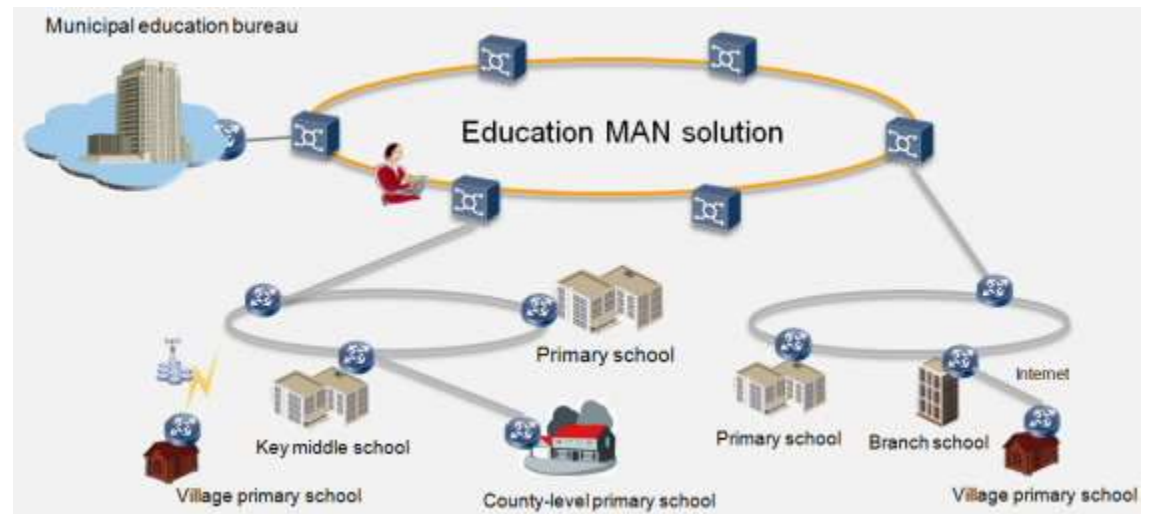
- A network infrastructure that provides access in a small geographical area:
  - enterprise, home, or small business network
  - owned and managed by an individual or IT department.
- Generally broadcast
  - Ethernet
  - Token Ring



LAN Network Diagram

## MAN (Metropolitan Area Networks)

- network infrastructure that spans a physical area larger than a LAN but smaller than a WAN (e.g., a city).
- Interconnecting LANs
- MANs are typically operated by a single entity such as a large organization.
  - Different ownership, rental, sharing agreements
- e.g. FDDI, CDDI
- Own broadband infrastructure
  - transport and switching
  - Often public, 3<sup>rd</sup> party infrastructure



## WAN (Wide Area Networks)

- Generally cover a large geographical area (country, continent, global)
- Interconnecting hosts, LANs, MANs
- Typically owned and managed by a telecommunications service provider
  
- Consists of a number of interconnected switching node
- Rely at least in part on circuits provided by one or more *common carriers*—  
companies that offer communication services to the general public
  
- Fixed, satellite, mobile narrowband, broadband
- Wide range of physical infrastructure

# Problems to be discussed when presenting a network:

Sample network: a Wired LAN

Application domain

Standards bodies and their issues

Topologies

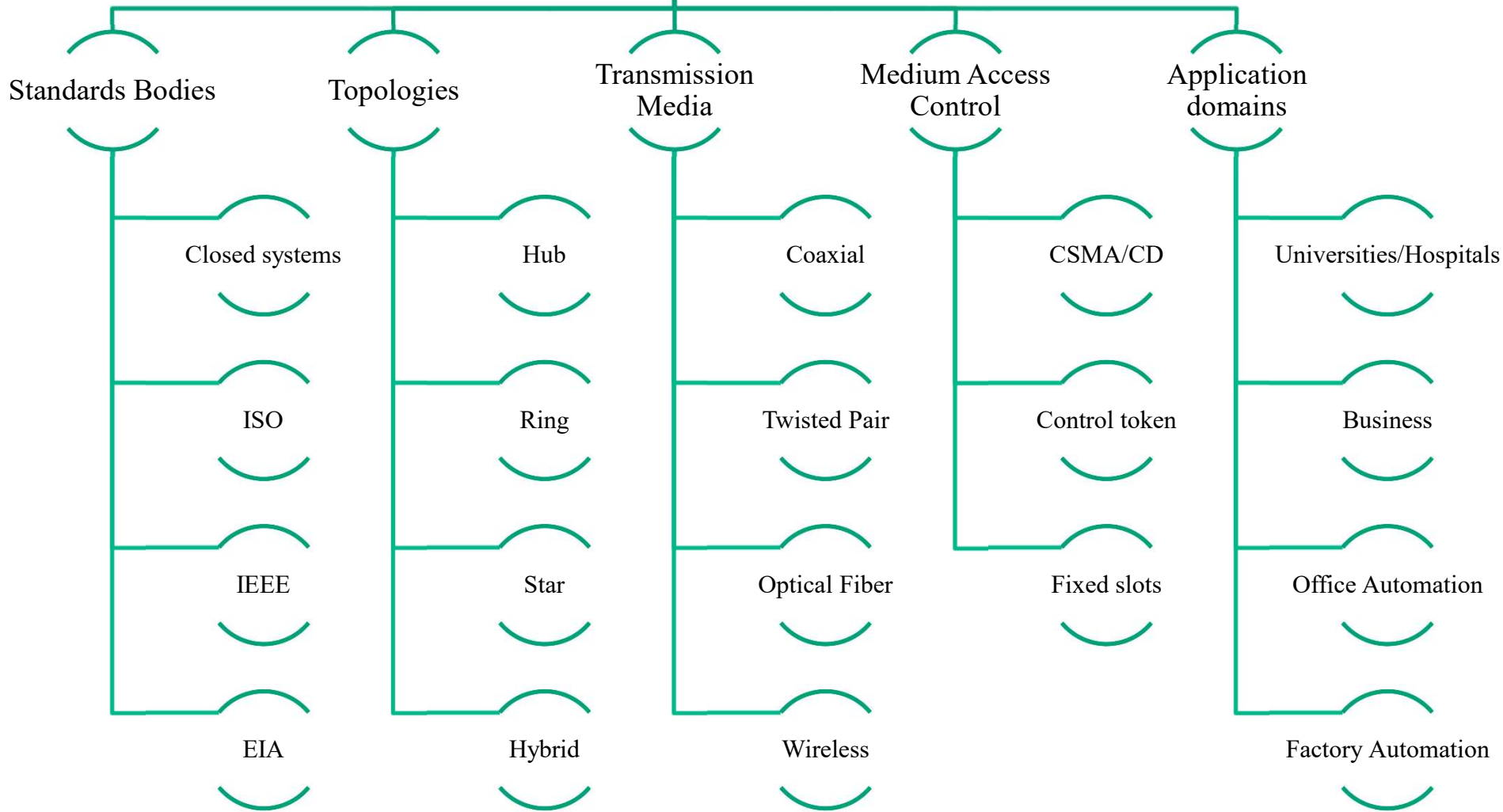
Internetworking Protocols

Medium Access Control

Transmission Media

See next slide as example:

# Wired LAN



# Network Topologies

## Network Topology – Definition:

The specific physical, *i.e.*, real, or logical, *i.e.*, virtual, arrangement of the elements of a network.

Two networks **have the same topology** if the connection configuration is the same, although the networks *may differ* in physical interconnections, distances between nodes, transmission rates, and/or signal types.

## Vertical Topology

Hierarchical

Mesh

## Horizontal Topology

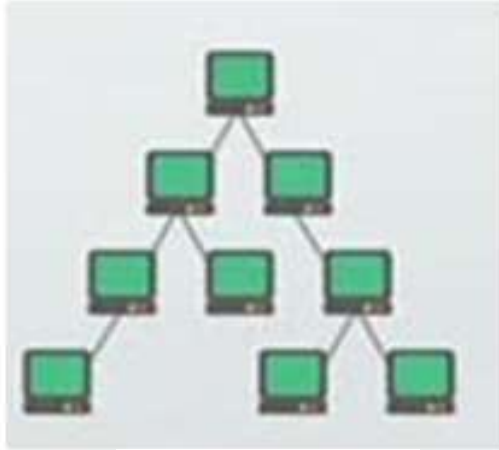
Star

Bus

Tree

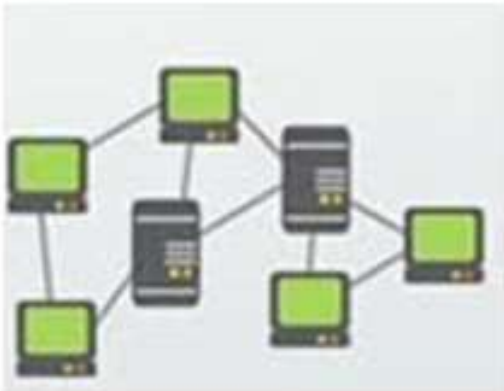
Ring

## Vertical Topology



Hierarchical

**Hierarchical** (tree) topology: existence of a **central node** (root) and of various sets of level organized nodes (intermediary nodes); the leaves of the tree are the workstations. The data flow between any two nodes goes up-down using the upper levels nodes.

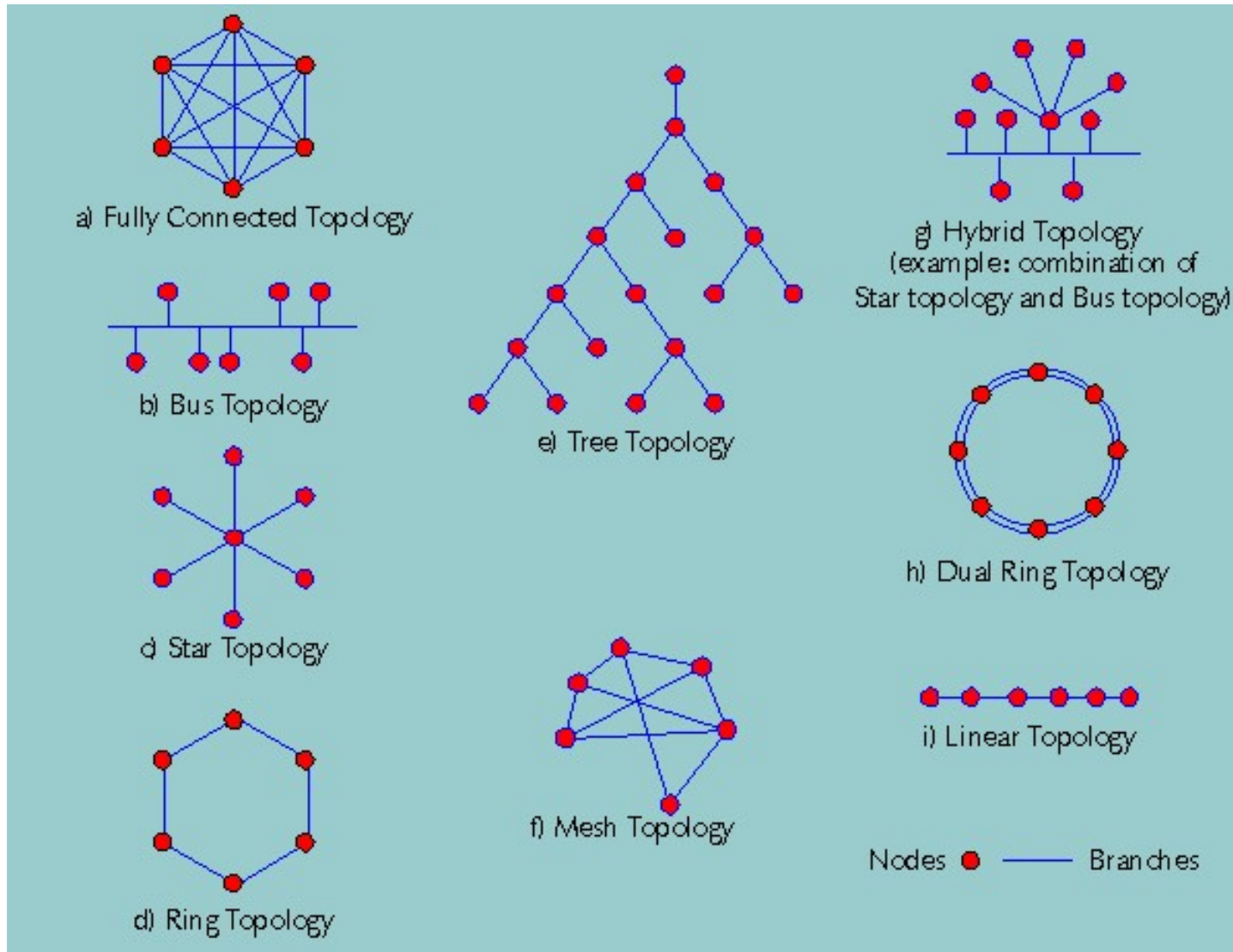


Mesh

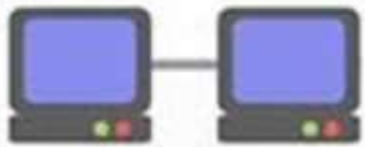
**Mesh** topology: there are at least two nodes with two or more paths between them.



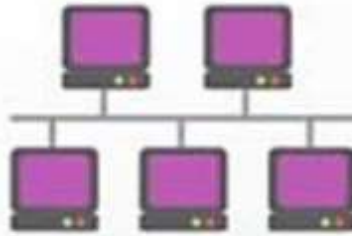
# Various Topologies



## Various Topologies



***point-to-point***



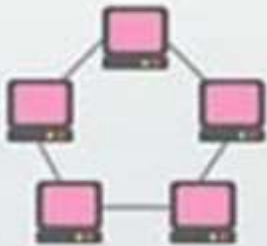
***bus***



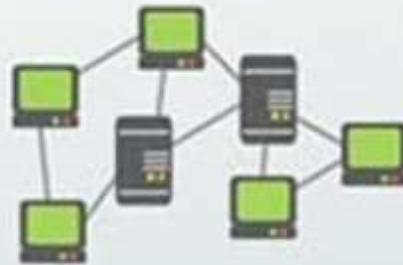
***hybrid***



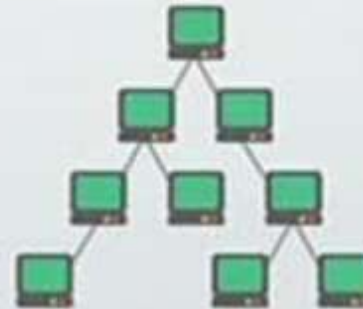
***star***



***ring***



***mesh***



***tree***

# 'Main' Horizontal Topologies

**Bus** topology: all nodes, *i.e.*, stations, are connected together by a single bus (the main trunk). Stations are connected using interfaces, named transceivers or attachment units (AUI).

Ex: pure Ethernet LAN, Token Bus.

Multipoint medium

Transmission propagates throughout medium

Heard by all stations

- Need to identify target station

- Each station has unique address

Full duplex connection between station and AUI

- Allows for transmission and reception

Need to regulate transmission

- To avoid collisions and hogging

- Data in small blocks - frames

Terminator absorbs frames at end of medium

**Ring** topology: every node has exactly two branches connected to it (a succession of point-to-point links). Stations are connected using interfaces (repeaters).

Ex: Token Ring LAN.

Repeaters joined by point to point links in closed loop

Receive data on one link and retransmit on another

Links unidirectional

Data in frames

Circulate past all stations

Destination recognizes address and copies frame

Frame circulates back to source where it is removed

Media access control determines when station can insert frame

**Dual Ring** – allows for a second (reserve) ring; data flow has here an opposite direction; not all stations linked to both rings

**Star** topology: there is a central node (switch) and peripheral nodes. The peripheral nodes are connected to the central node, which rebroadcasts all transmissions received from any peripheral nodes to all peripheral nodes on the network, including the originating node. Ex: switched Ethernet LAN.

**Extended star**: links individual stars together, by linking the centers (hubs/switches); also known as snowflake topology.

Need for more distance between computers => Layer 1 device **repeater**

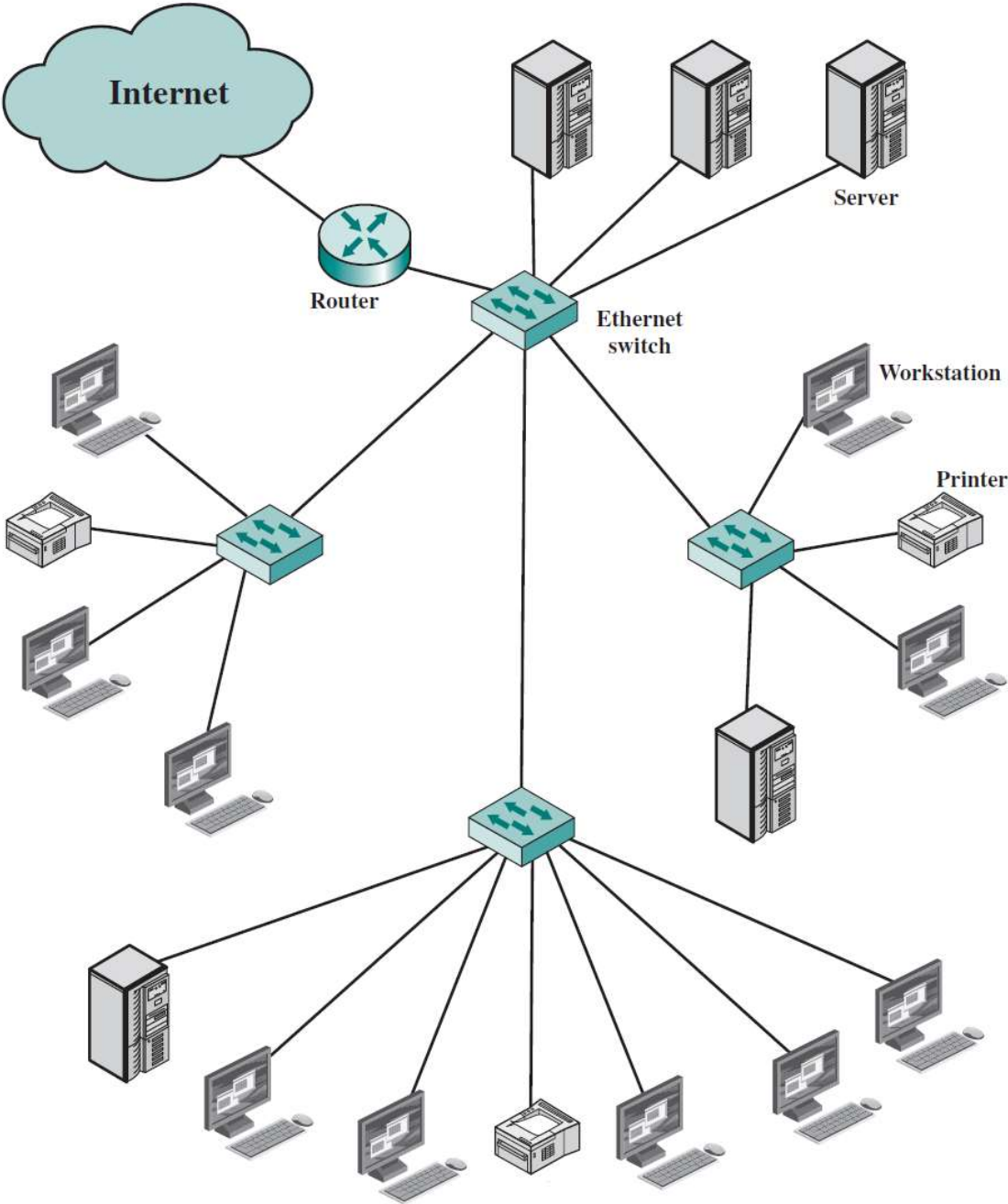
Need for more workgroup connectivity => **multiport repeater**, or **hub**.

Need for traffic filter => **bridge** as a way to filter network traffic into local and non-local traffic (Layer 2 device, based on physical address)

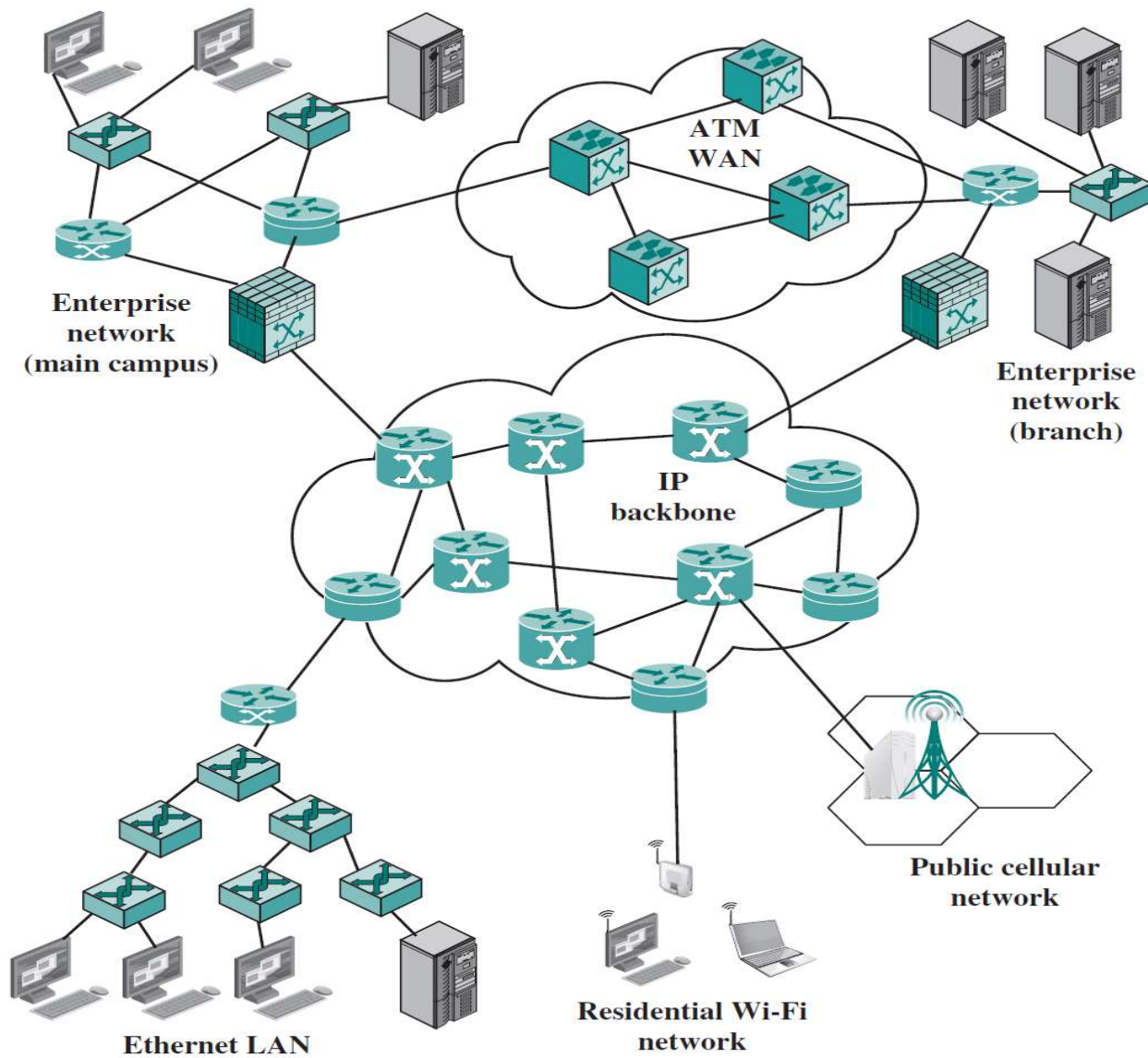
Need for Layer 2 connectivity (port-density) => a **multiport bridge**, or **switch**

As networks grew, the diversity of platforms, protocols, and media, the geographic distance between computers, the number of computers wishing to communicate, and the dynamism inherent in large networks, all necessitated the development of the **router**. Layer 3 device which makes best path and switching decisions based on network addresses.

# Example of an hierarchical, complex network

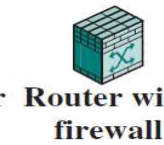


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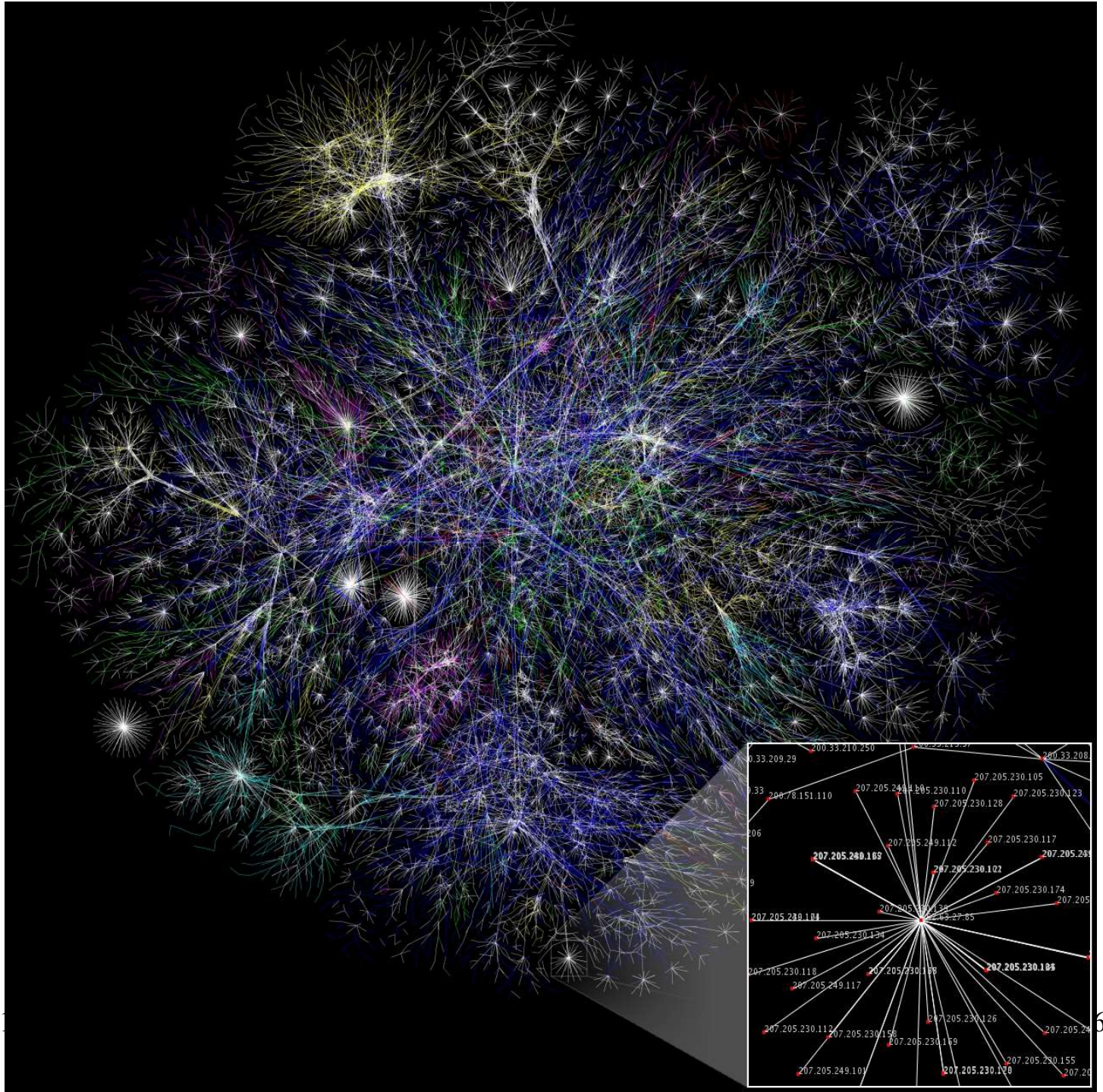
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Networking icons:





<http://www.opte.org/maps/>



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