

Data and Computer Communications

Chapter 1 – Data Communications, Data Networks, and the Internet



Data Communications, Data Networks, and the Internet

“The fundamental problem of communication is that of reproducing at one point either exactly or approximately a message selected at another point”

- *The Mathematical Theory of Communication,*

Claude Shannon



Technological Advancement Driving Forces

**Traffic
growth at
a high &
steady
rate**

- **Development of new services**
- **Advances in technology**

Changes in Networking Technology

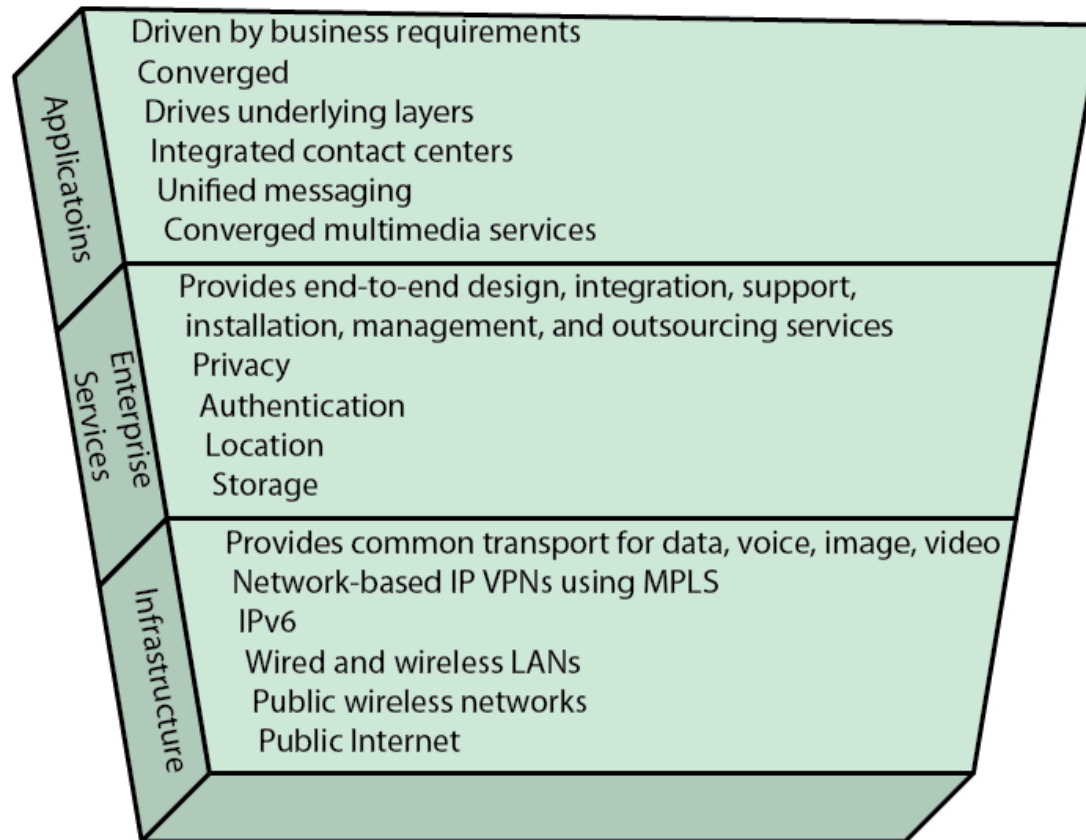
- * Emergence of high-speed LANs
- * Corporate WAN needs
- * Digital electronics



Convergence

- The merger of previously distinct telephony and information technologies and markets
- Layers:
 - applications
 - these are seen by the end users
 - enterprise services
 - services the information network supplies to support applications
 - infrastructure
 - communication links available to the enterprise

Convergence Layers



Benefits

Convergence benefits include:

Efficiency

- better use of existing resources, and implementation of centralized capacity planning, asset and policy management

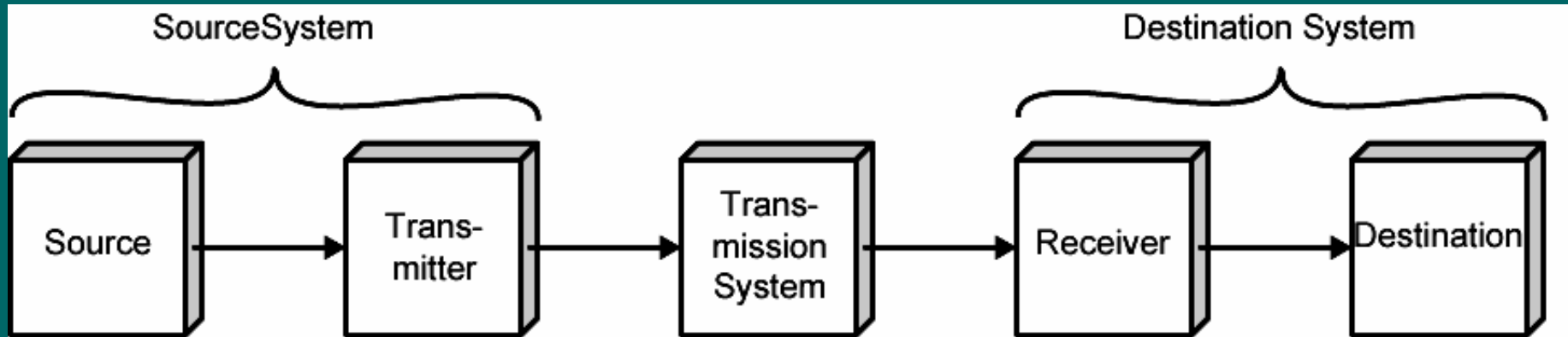
Effectiveness

- the converged environment provides users with flexibility, rapid standardized service deployment and enhanced remote connectivity and mobility

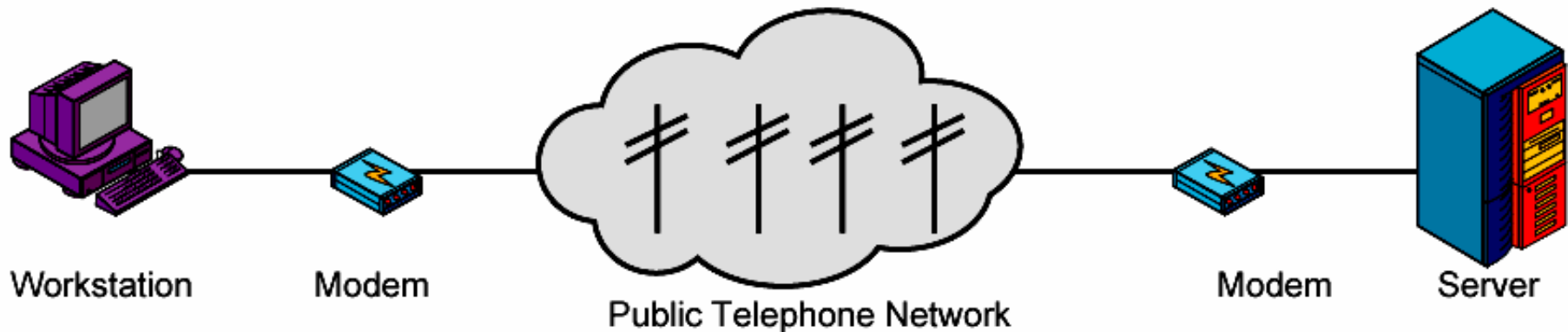
Transformation

- enables the enterprise-wide adoption of global standards and associated service levels

Communications Model



(a) General block diagram

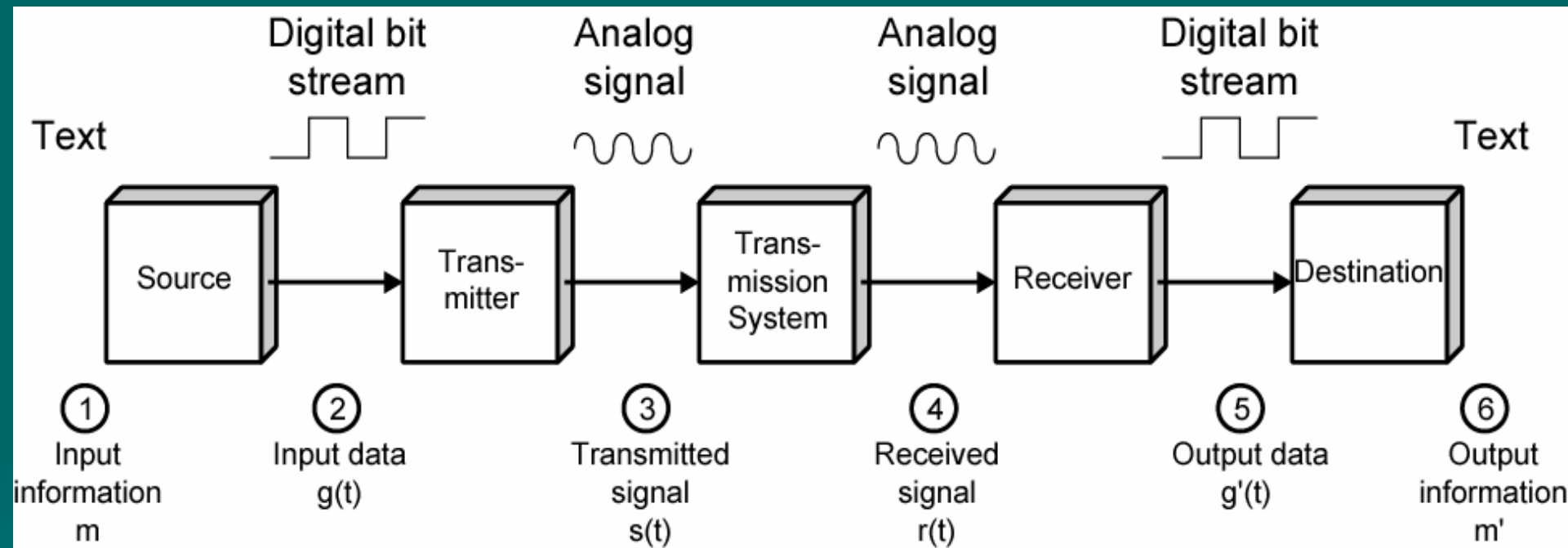


(b) Example

Communications Tasks

Transmission system utilization	Addressing
Interfacing	Routing
Signal generation	Recovery
Synchronization	Message formatting
Exchange management	Security
Error detection and correction	Network management
Flow control	

Data Communications Model



Transmission Lines

The basic building block of any communications facility is the transmission line.

The business manager is concerned with a facility providing the required capacity, with acceptable reliability, at minimum cost.

Capacity


Reliability

Cost

**Transmission
Line**

Transmission Mediums

Two mediums currently driving the evolution of data communications transmission are:

Fiptic transmissions

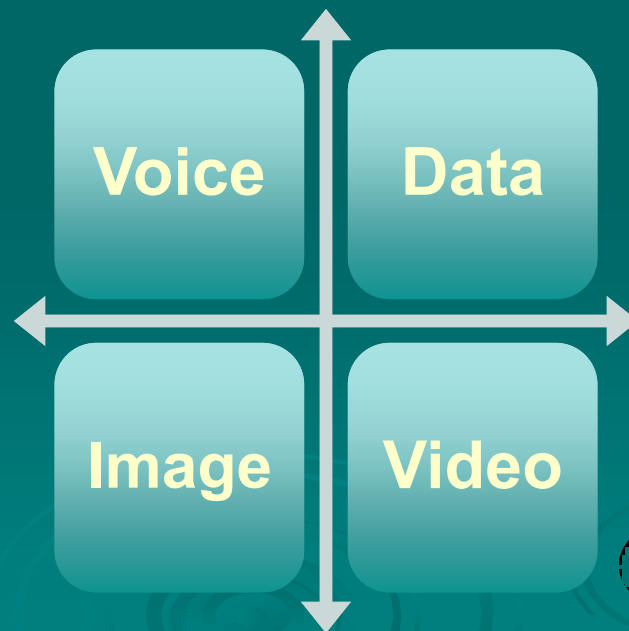
and

Wireless transmissions



Networking

Advances in technology have led to greatly increased capacity and the concept of integration, allowing equipment and networks to work simultaneously.



LANs and WANs

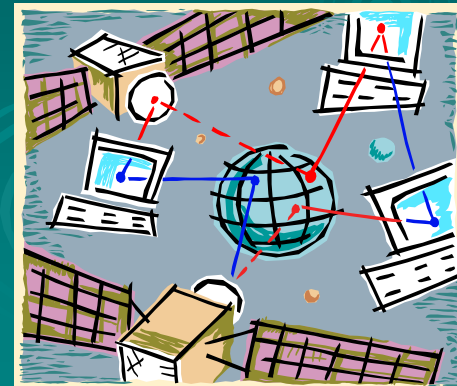
There are two broad categories of networks:

Local Area Networks (LAN)

Wide Area Networks (WAN)

Wide Area Networks (WANs)

- Span a large geographical area
- Require the crossing of public right-of-ways
- Rely in part on common carrier circuits
- Typically consist of a number of interconnected switching nodes





Wide Area Networks

Alternative technologies used include:

- Circuit switching
- Packet switching
- Frame relay
- Asynchronous Transfer Mode (ATM)

Circuit Switching

- Uses a dedicated communications path
- Connected sequence of physical links between nodes
- Logical channel dedicated on each link
- Rapid transmission
- The most common example of circuit switching is the telephone network

Packet Switching

- Data are sent out in a sequence of small chunks called packets
- Packets are passed from node to node along a path leading from source to destination
- Packet-switching networks are commonly used for terminal-to-terminal computer and computer-to-computer communications

Frame Relay

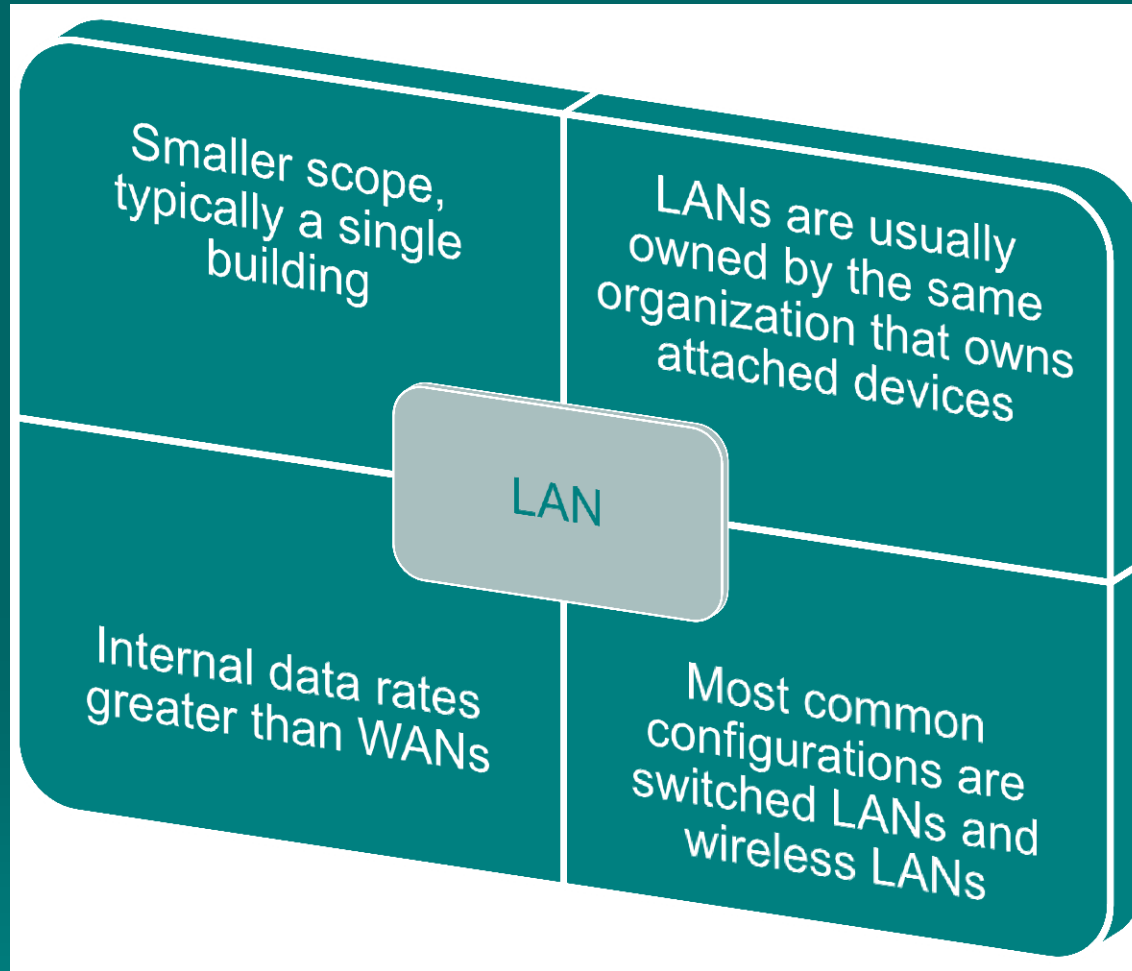
- Developed to take advantage of high data rates and low error rates
- Operates at data rates of up to 2 Mbps
- Rate of errors dramatically lowered thus reducing overhead of packet-switching



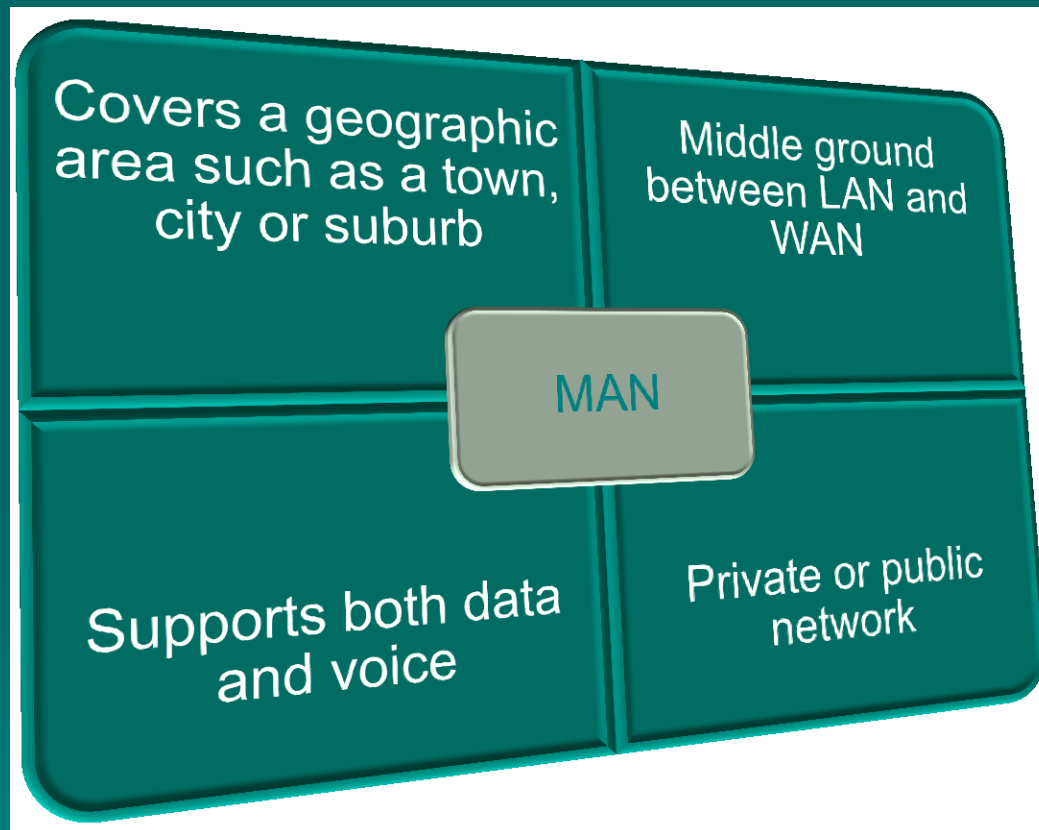
Asynchronous Transfer Mode (ATM)

- Referred to as cell relay
- Culmination of circuit switching and packet switching
- Uses fixed-length packets called cells
- Works in range of 10's and 100's of Mbps and in the Gbps range
- Data rate on each channel dynamically set on demand

Local Area Networks (LAN)



Metropolitan Area Networks (MAN)

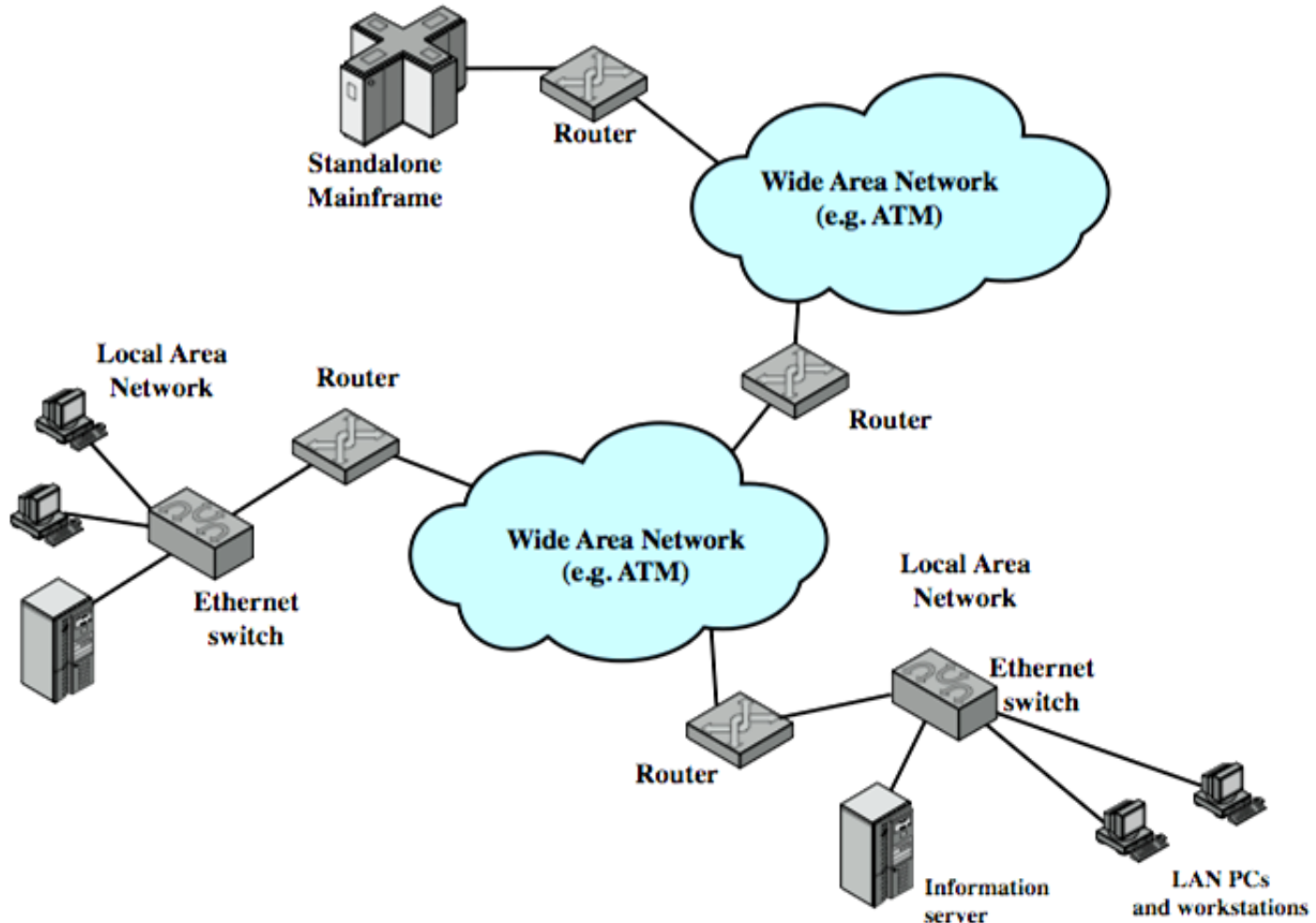


The Internet

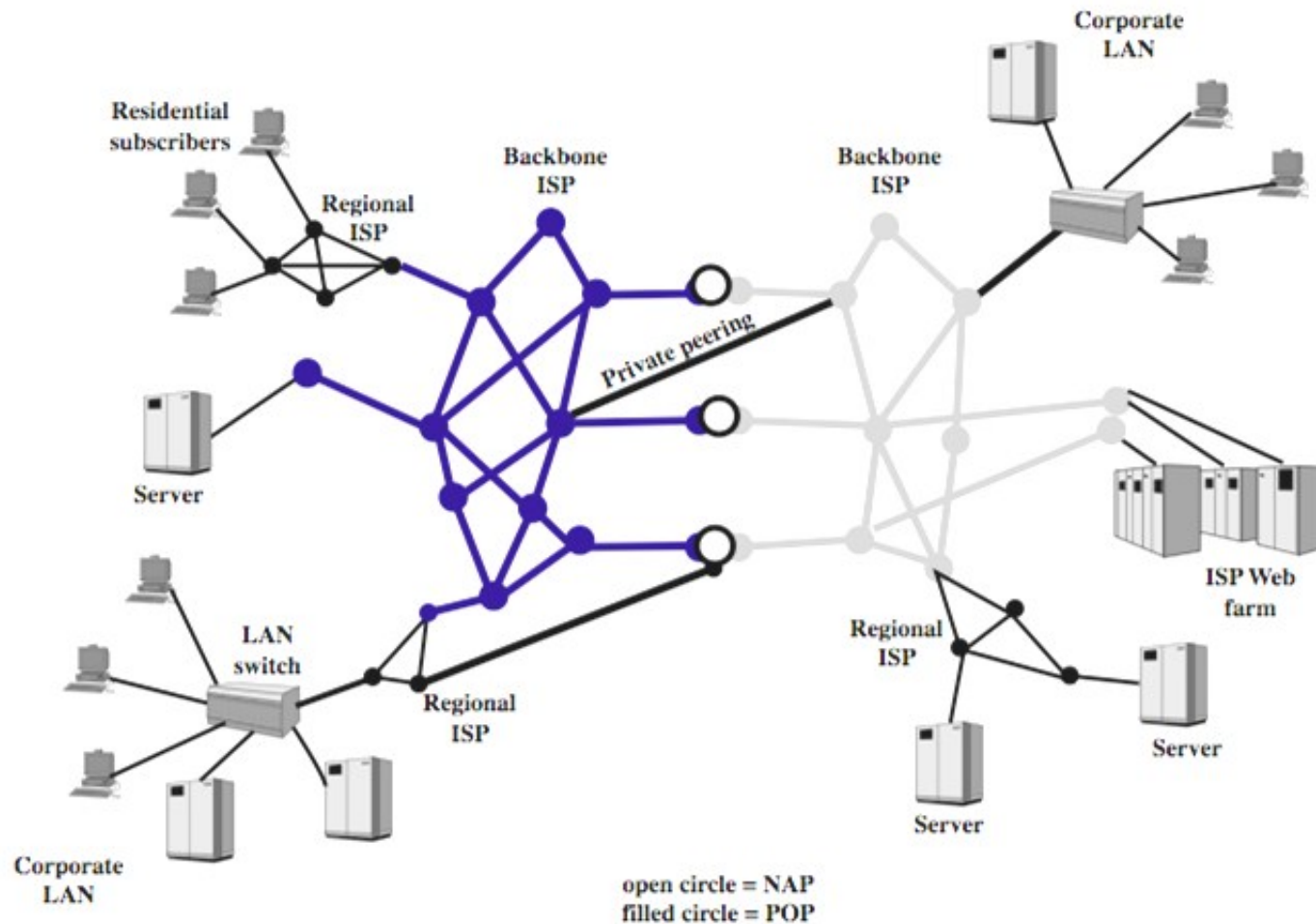
- Internet evolved from ARPANET
- Developed to solve the dilemma of communicating across arbitrary, multiple, packet-switched network
- TCP/IP provides the foundation



Internet Key Elements



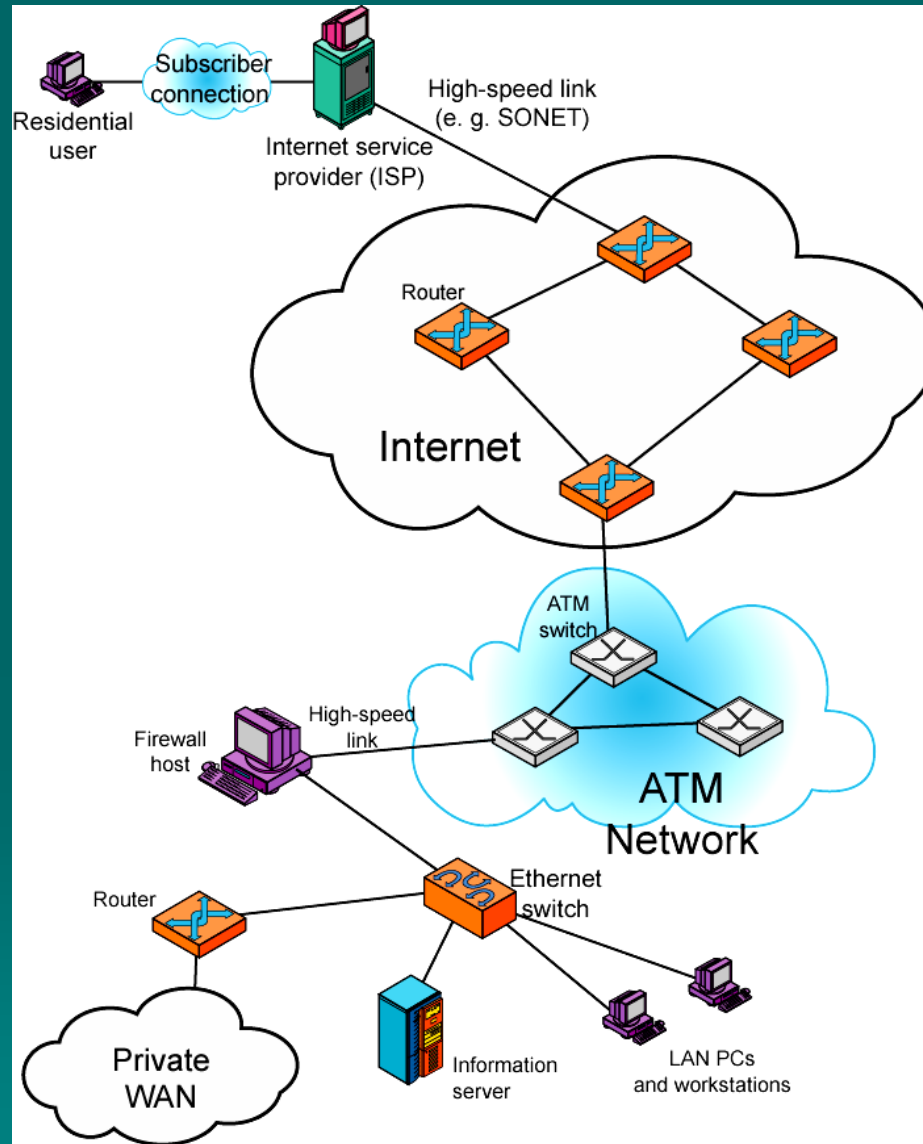
Internet Architecture



Internet Terminology



A Networking Configuration



Summary

- Trends challenging data communications:
 - traffic growth
 - development of new services
 - advances in technology
- Transmission mediums
 - fiber optic
 - wireless
- Network categories:
 - WAN
 - LAN
- Internet
 - evolved from the ARPANET
 - TCP/IP foundation

