Reti di Calcolatori

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Struttura del Corso

Didattica

❑ Lezioni frontali
❑ Laboratorio
  – Programmazione di rete su sistemi UNIX/LINUX
  – Applicazioni multimediali (VoIP), sicurezza (OpenSSL)
❑ Valutazione
  – Esame scritto
  – Discussione progetto
❑ Materiale Didattico
  – Slides del corso
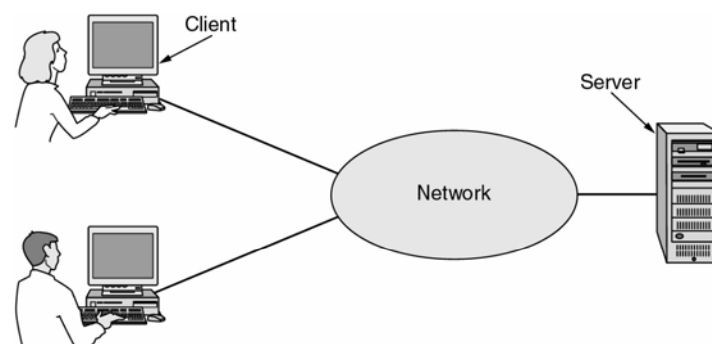 – Libri di testo (Tanenbaum, Reti di Calcolatori)

Introduction

Uses of Computer Networks

- Business Applications
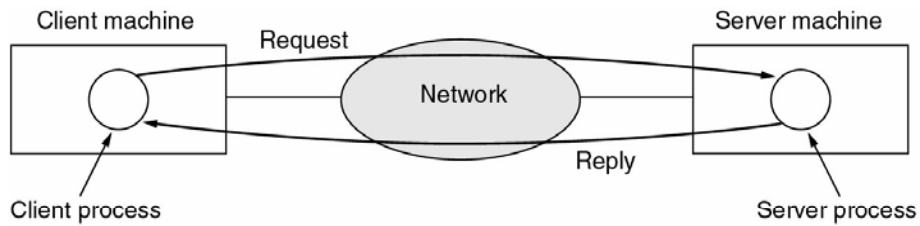- Home Applications
- Mobile Users
- Social Issues

Business Applications of Networks

❑ A network with two clients and one server.

Business Applications of Networks (2)

❑ The client-server model involves requests and replies.

Client machine — Request — Network — Server machine
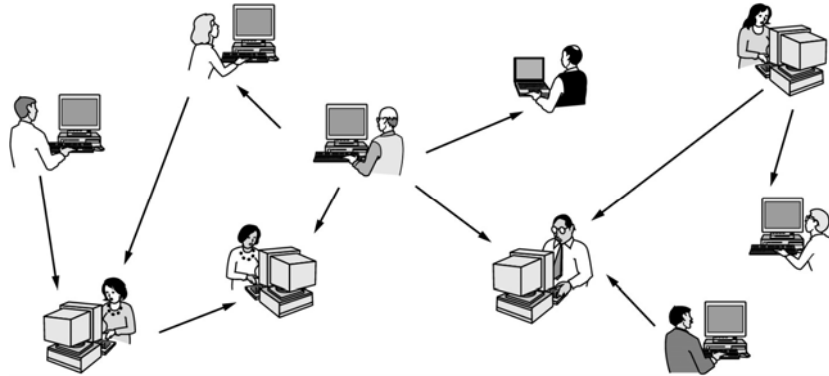Client process — Reply — Server process

Home Network Applications

- Access to remote information
- Person-to-person communication
- Interactive entertainment
- Electronic commerce

Home Network Applications (2)

❑ In peer-to-peer system there are no fixed clients and servers.

Home Network Applications (3)

❑ Some forms of e-commerce.

Tag	Full name	Example
B2C	Business-to-consumer	Ordering books on-line
B2B	Business-to-business	Car manufacturer ordering tires from supplier
G2C	Government-to-consumer	Government distributing tax forms electronically
C2C	Consumer-to-consumer	Auctioning second-hand products on-line
P2P	Peer-to-peer	File sharing

Mobile Network Users

❑ Combinations of wireless networks and mobile computing.

Wireless	Mobile	Applications
No	No	Desktop computers in offices
No	Yes	A notebook computer used in a hotel room
Yes	No	Networks in older, unwired buildings
Yes	Yes	Portable office; PDA for store inventory

Network Hardware

- Local Area Networks
- Metropolitan Area Networks
- Wide Area Networks
- Wireless Networks
- Home Networks
- Internetworks

Broadcast Networks

❑ Types of transmission
technology
- Broadcast links
- Point-to-point links

Broadcast Networks (2)

❑ Classification of interconnected processors
by scale.

| Interprocessor distance	Processors located in same	Example
1 m	Square meter	Personal area network
10 m	Room	Local area network
100 m	Building	Local area network
1 km	Campus	Local area network
10 km	City	Metropolitan area network
100 km	Country	Wide area network
1000 km	Continent	Wide area network
10,000 km	Planet	The Internet

Local Area Networks
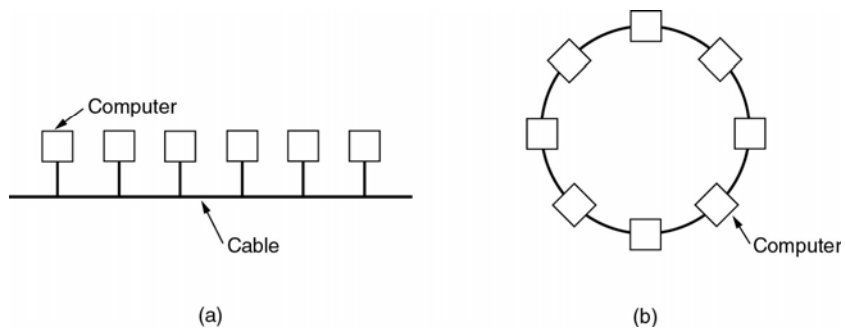
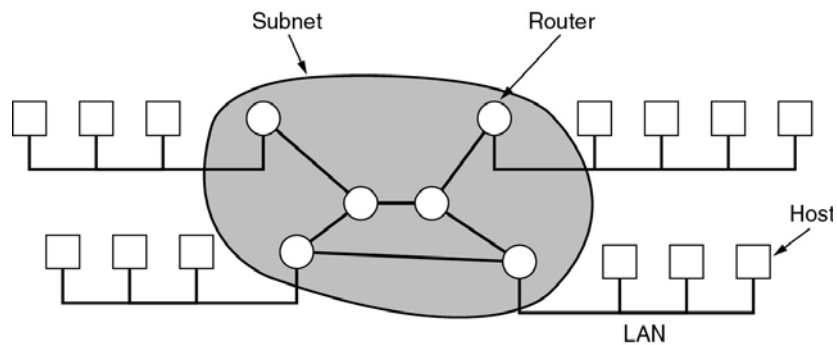
❑ Two broadcast networks
❑ (a) Bus
❑ (b) Ring

Metropolitan Area Networks
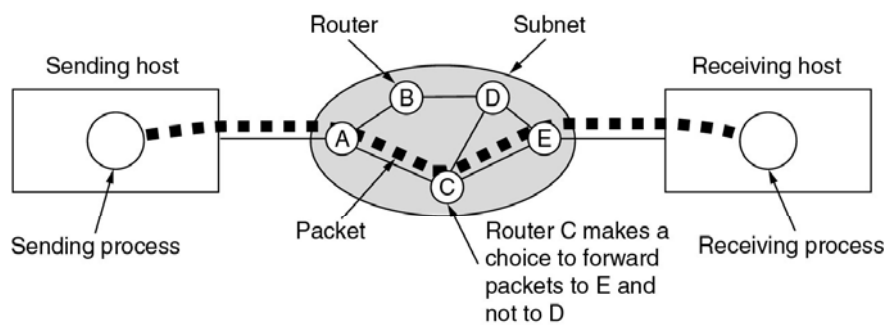
❑ A metropolitan area network based on cable TV.
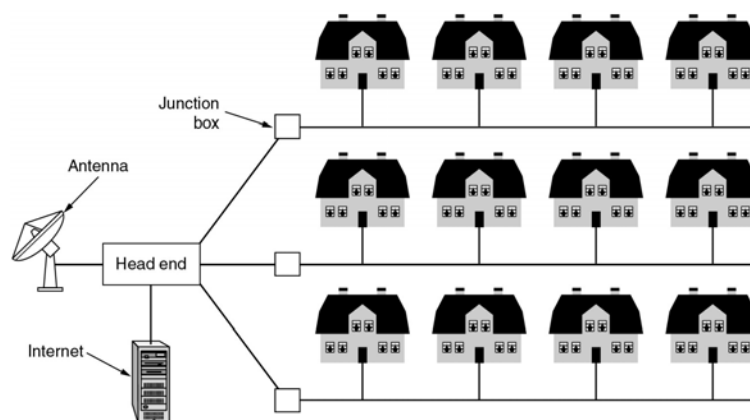
Wide Area Networks

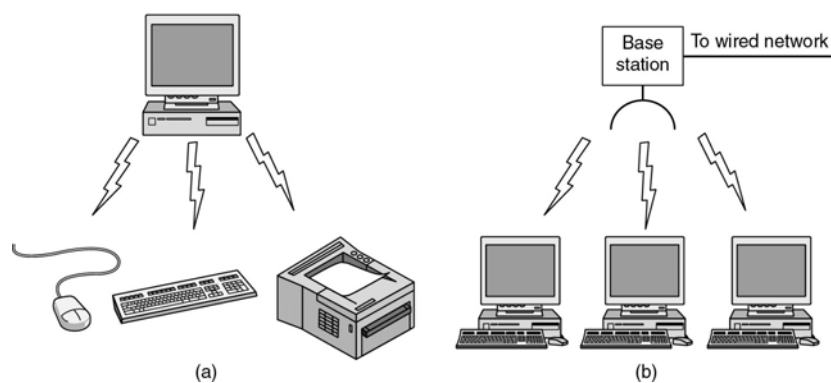❑ Relation between hosts on LANs and the subnet.

Wide Area Networks (2)

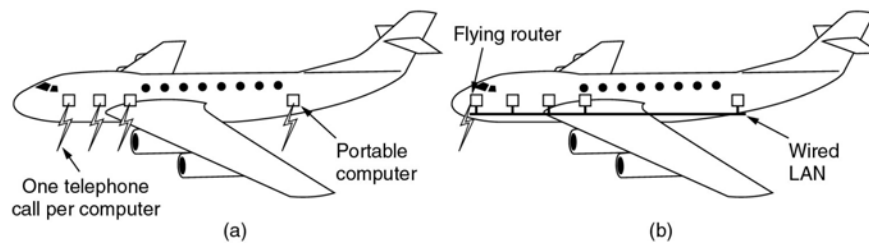❑ A stream of packets from sender to receiver.

Wireless Networks

❑ Categories of wireless networks:
- System interconnection
- Wireless LANs
- Wireless WANs

Wireless Networks (2)

❑ (a) Bluetooth configuration
❑ (b) Wireless LAN

Wireless Networks (3)

One telephone call per computer Portable computer (a)

Flying router Wired LAN (b)

- ❑ (a) Individual mobile computers
- ❑ (b) A flying LAN

Home Network Categories

- Computers (desktop PC, PDA, shared peripherals
- Entertainment (TV, DVD, VCR, camera, stereo, MP3)
- Telecomm (telephone, cell phone, intercom, fax)
- Appliances (microwave, fridge, clock, furnace, airco)
- Telemetry (utility meter, burglar alarm, babycam).

Network Software

- Protocol Hierarchies
- Design Issues for the Layers
- Connection-Oriented and Connectionless Services
- Service Primitives
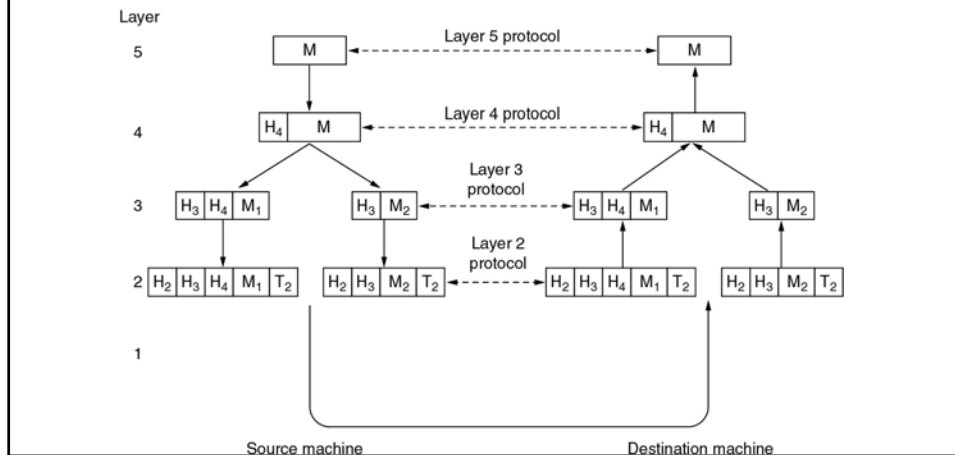- The Relationship of Services to Protocols

Network Software
Protocol Hierarchies
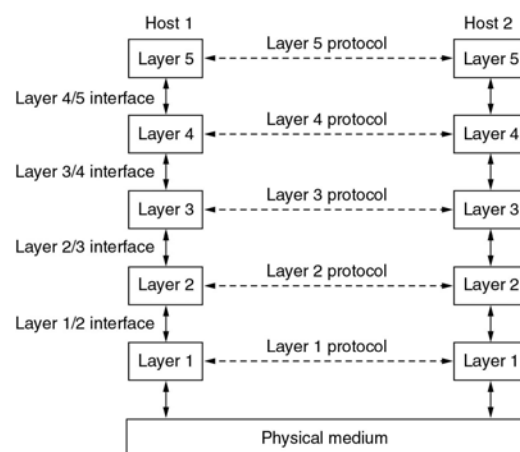
❑ Layers, protocols, and interfaces.

Protocol Hierarchies (3)

❑ Example information flow supporting
   virtual communication in layer 5.

Design Issues for the Layers

- Addressing
- Error Control
- Flow Control
- Multiplexing
- Routing

Connection-Oriented and Connectionless Services

❑ Six different types of service.

	Service	Example
Connection-oriented	Reliable message stream	Sequence of pages
	Reliable byte stream	Remote login
	Unreliable connection	Digitized voice
Connection-less	Unreliable datagram	Electronic junk mail
	Acknowledged datagram	Registered mail
	Request-reply	Database query

Service Primitives

Primitive	Meaning
LISTEN	Block waiting for an incoming connection
CONNECT	Establish a connection with a waiting peer
RECEIVE	Block waiting for an incoming message
SEND	Send a message to the peer
DISCONNECT	Terminate a connection

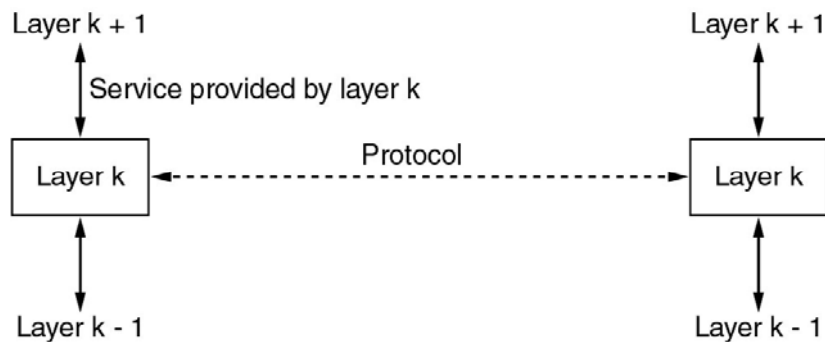❑ Five service primitives for implementing a simple connection-oriented service.

Service Primitives (2)
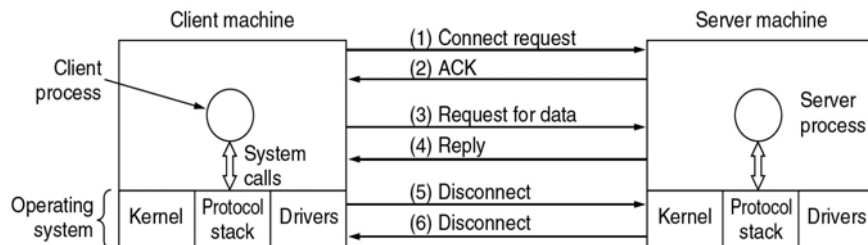
❑ Packets sent in a simple client-server interaction on a connection-oriented network.

Services to Protocols Relationship

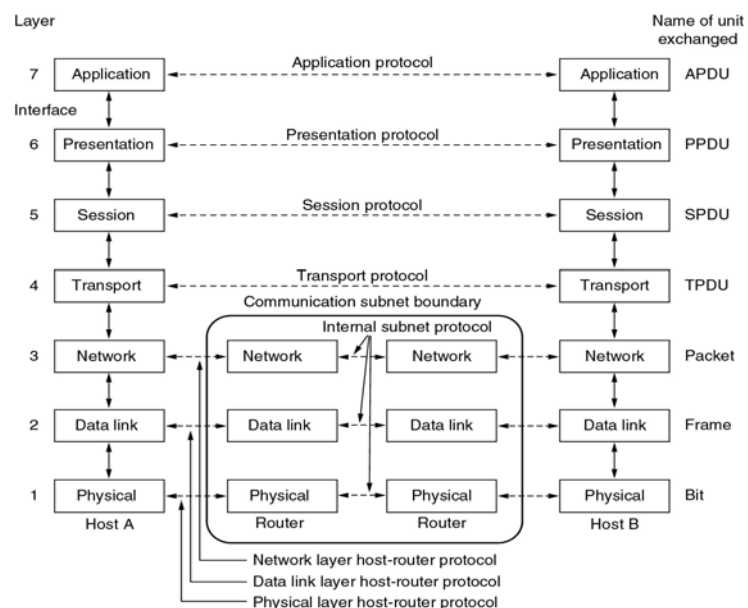❑ The relationship between a service and a protocol.

Reference Models

- The OSI Reference Model
- The TCP/IP Reference Model
- A Comparison of OSI and TCP/IP
- A Critique of the OSI Model and Protocols
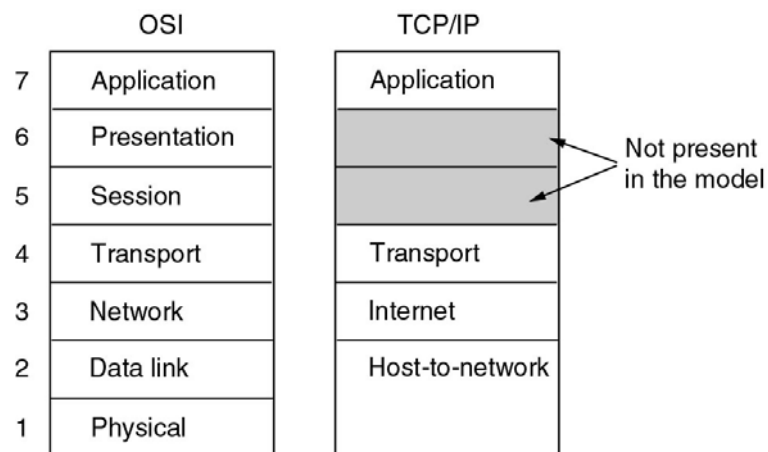- A Critique of the TCP/IP Reference Model

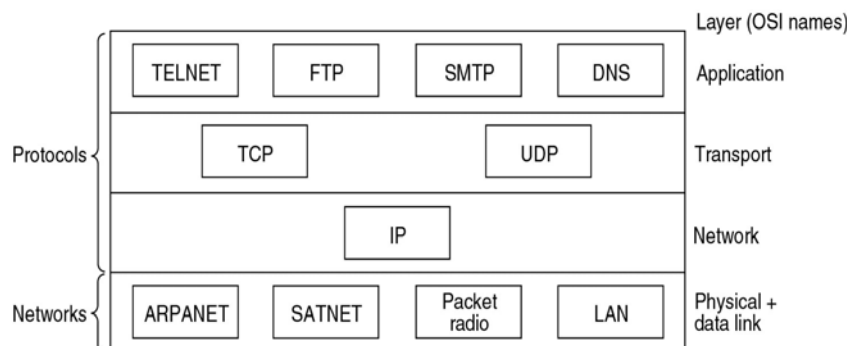# Reference Models

The OSI reference model.

Reference Models (2)

❑ The TCP/IP reference model.

Reference Models (3)

❑ Protocols and networks in the TCP/IP model initially.

Comparing OSI and TCP/IP Models

❑ Concepts central to the OSI model
- Services
- Interfaces
- Protocols

A Critique of the TCP/IP Reference Model

❑ Problems:
- Service, interface, and protocol not distinguished
- Not a general model
- Host-to-network "layer" not really a layer
- No mention of physical and data link layers
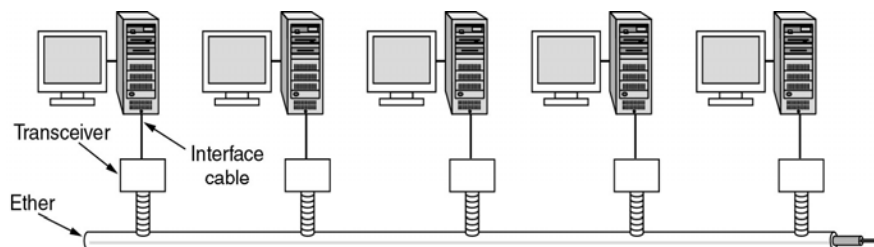- Minor protocols deeply entrenched, hard to replace

Hybrid Model

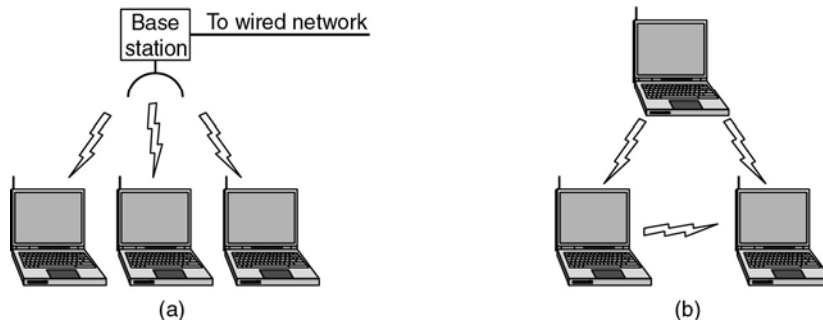❑ The hybrid reference model to be used in this book.

5	Application layer
4	Transport layer
3	Network layer
2	Data link layer
1	Physical layer

Ethernet

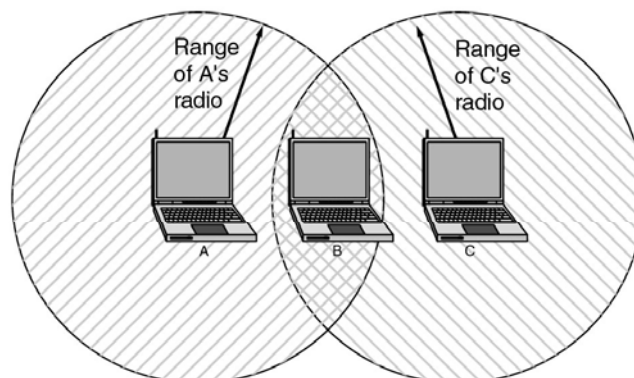❑ Architecture of the original Ethernet.

Wireless LANs

- ❑ (a) Wireless networking with a base station.
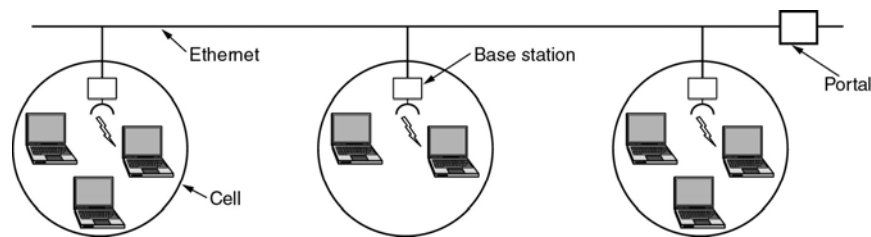- ❑ (b) Ad hoc networking.

Wireless LANs (2)

- ❑ The range of a single radio may not cover the entire system.

Wireless LANs (3)

❑ A multicell 802.11 network.

IEEE 802 Standards

Number	Topic
802.1	Overview and architecture of LANs
802.2 ↓	Logical link control
802.3 *	Ethernet
802.4 ↓	Token bus (was briefly used in manufacturing plants)
802.5	Token ring (IBM's entry into the LAN world)
802.6 ↓	Dual queue dual bus (early metropolitan area network)
802.7 ↓	Technical advisory group on broadband technologies
802.8 †	Technical advisory group on fiber optic technologies
802.9 ↓	Isochronous LANs (for real-time applications)
802.10 ↓	Virtual LANs and security
802.11 *	Wireless LANs
802.12 ↓	Demand priority (Hewlett-Packard's AnyLAN)
802.13	Unlucky number. Nobody wanted it
802.14 ↓	Cable modems (defunct: an industry consortium got there first)
802.15 *	Personal area networks (Bluetooth)
802.16 *	Broadband wireless
802.17	Resilient packet ring

The 802 working groups. The important ones are
marked with *. The ones marked with ↓ are
hibernating. The one marked with † gave up.