



Intro to LAN/WAN

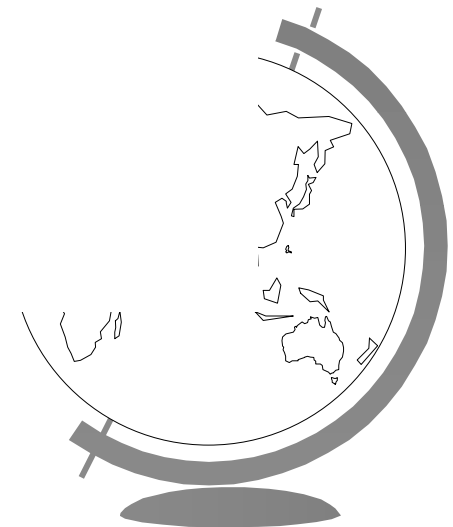
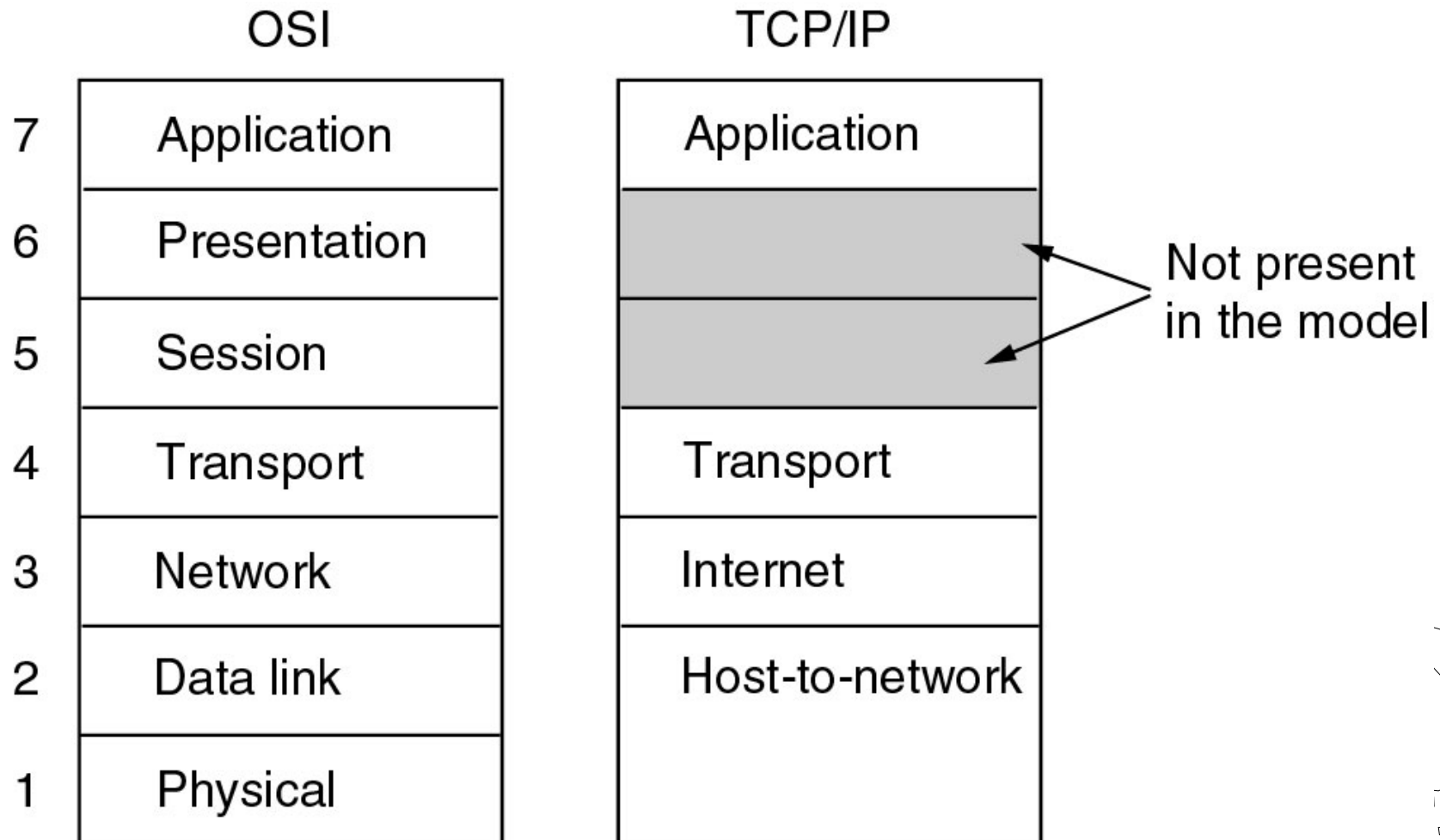
Introduction (contd)

ARPANET

- Military funded, predecessor to the Internet
- Phone lines first, satellite and radio later
 - req: connect multiple networks seamlessly
- DoD worry about routers going down
 - req: survive loss of subnet hardware without losing connections
- Applications with diverse requirements
 - req: flexible architecture
- Used TCP/IP protocols
 - **then** came their reference model



TCP/IP Reference Model



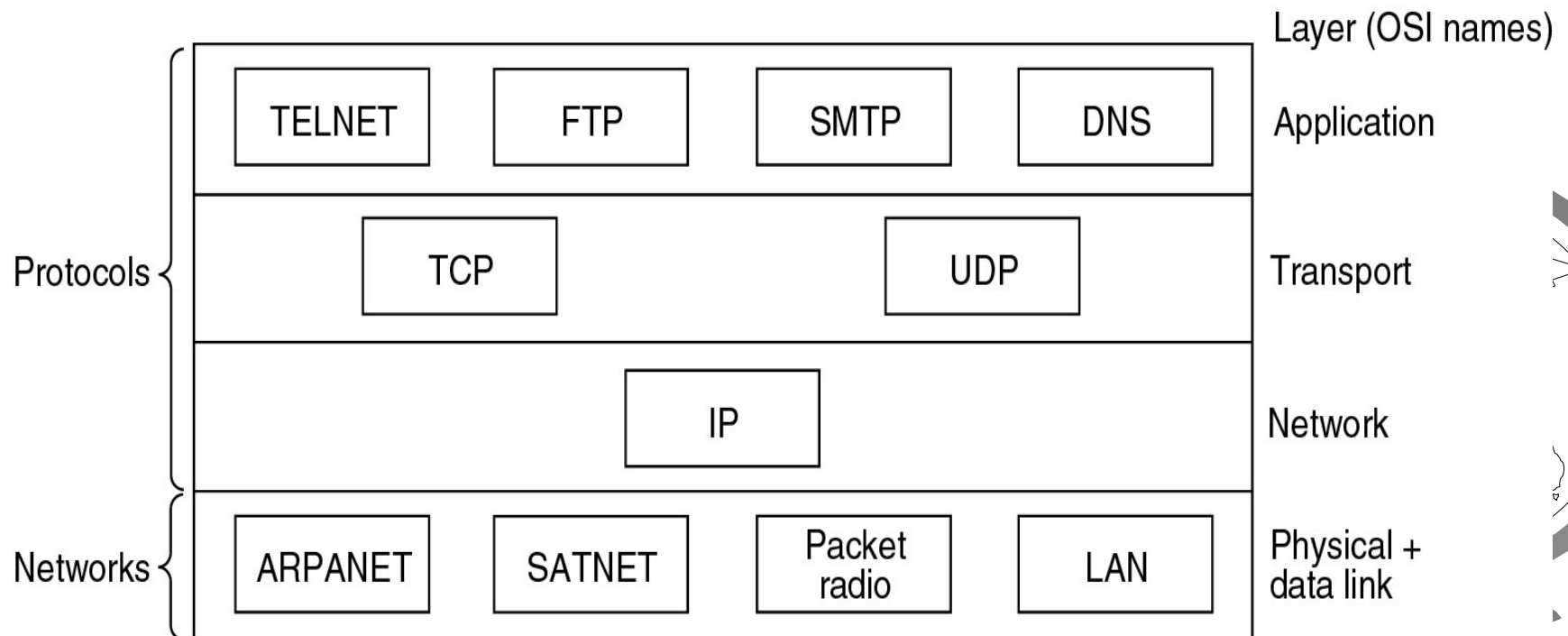
Internet Layer

- ☞ Packet switched
- ☞ Connectionless
- ☞ Packets can be:
 - travel different routes
 - lost
 - out of order
- ☞ Called *IP (Internet Protocol)*



Transport Layer

- Similar to OSI Transport Layer
 - end-to-end, “conversation”
- Two protocols
 - TCP: reliable, stream, flow control, connection
 - UDP: unreliable, no flow control, connectionless
- Protocols and networks in TCP/IP model initially:



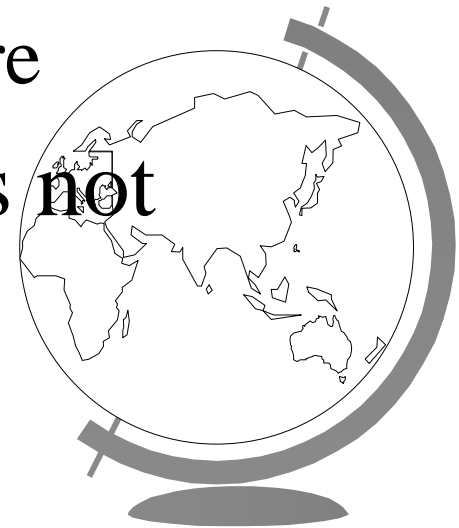
Application Layer

- No session/presentation layers -- no need
- High-level protocols:
 - original: telnet, ftp, smtp, dns
 - new: http, nntp



Critique of TCP/IP Model

- Not clean in describing service, interface and protocol
 - not a good guide for new technologies
- Not general, tied to protocols
 - hard to describe other networks
- No physical and data link layers
 - hard to abstract from physical hardware
- IP, TCP well-thought out, but others **not**
 - TELNET: 10 cps, no GUI, no mouse



Model Differences: OSI and TCP/IP

☞ OSI concepts:

- services: what layer does
- interface: how processes above access it
- protocols: how it works, private to layer

☞ Not so clean in TCP/IP

- harder to replace as technology changes



Differences: OSI and TCP/IP

- OSI model before protocols
- TCP/IP protocols before model
 - model does not fit other protocols
 - not useful for non TCP/IP networks
- OSI transport
 - connection oriented only
- TCP/IP transport
 - connection + connectionless



Hybrid Model

- ➔ OSI useful for discussing networks
- ➔ TCP/IP provides better protocols for using them
- ➔ Hybrid model used in textbook:

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



Example Networks

- Read 1.5 and 1.6 of text yourself
- Internet
- Asynchronous Transfer Mode (ATM)
- Ethernet
- Wireless LANs



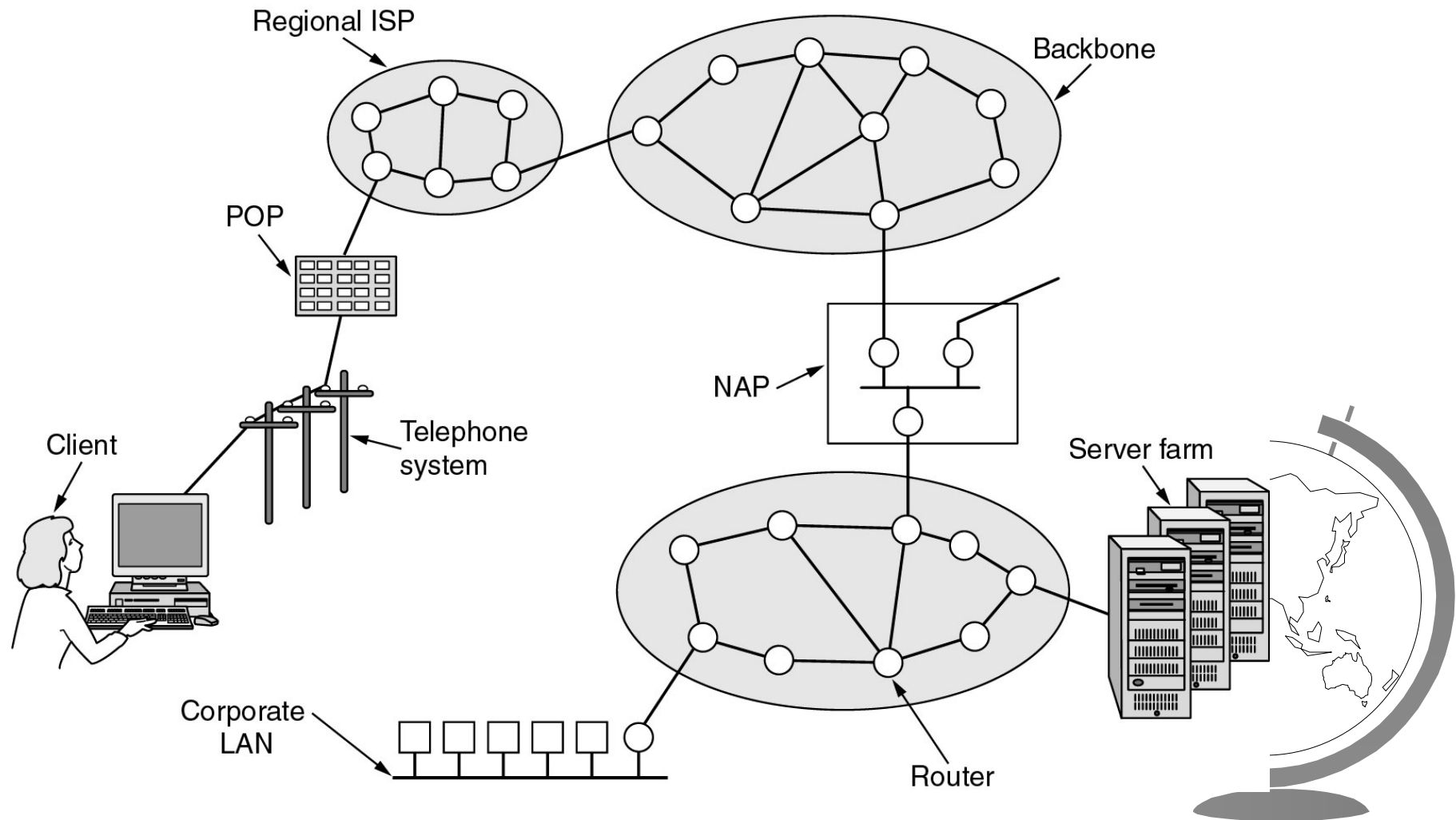
Internet Usage

- ☞ Traditional applications (1970 – 1990)
- ☞ E-mail
- ☞ News
- ☞ Remote login
- ☞ File transfer



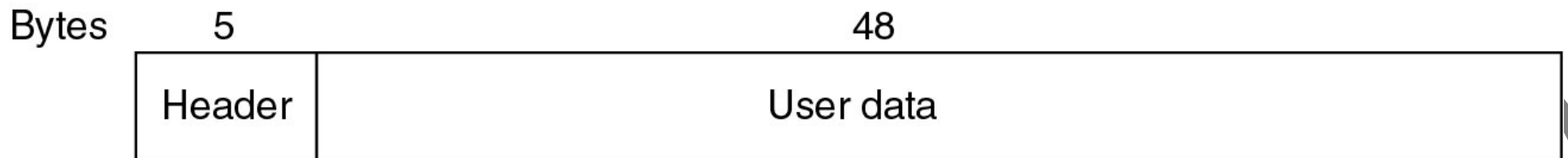
Architecture of the Internet

➔ Overview of the Internet.



ATM Basics

- ☞ Telephone companies coordinate multiple networks
 - ex: POTS circuit-switched, other packet-switched
- ☞ Invent network of future to manage all
- ☞ Transmit data of fixed sized *cells*
 - Flexible (audio, video, text)
 - Fast (155 Mbps and 622 Mbps)

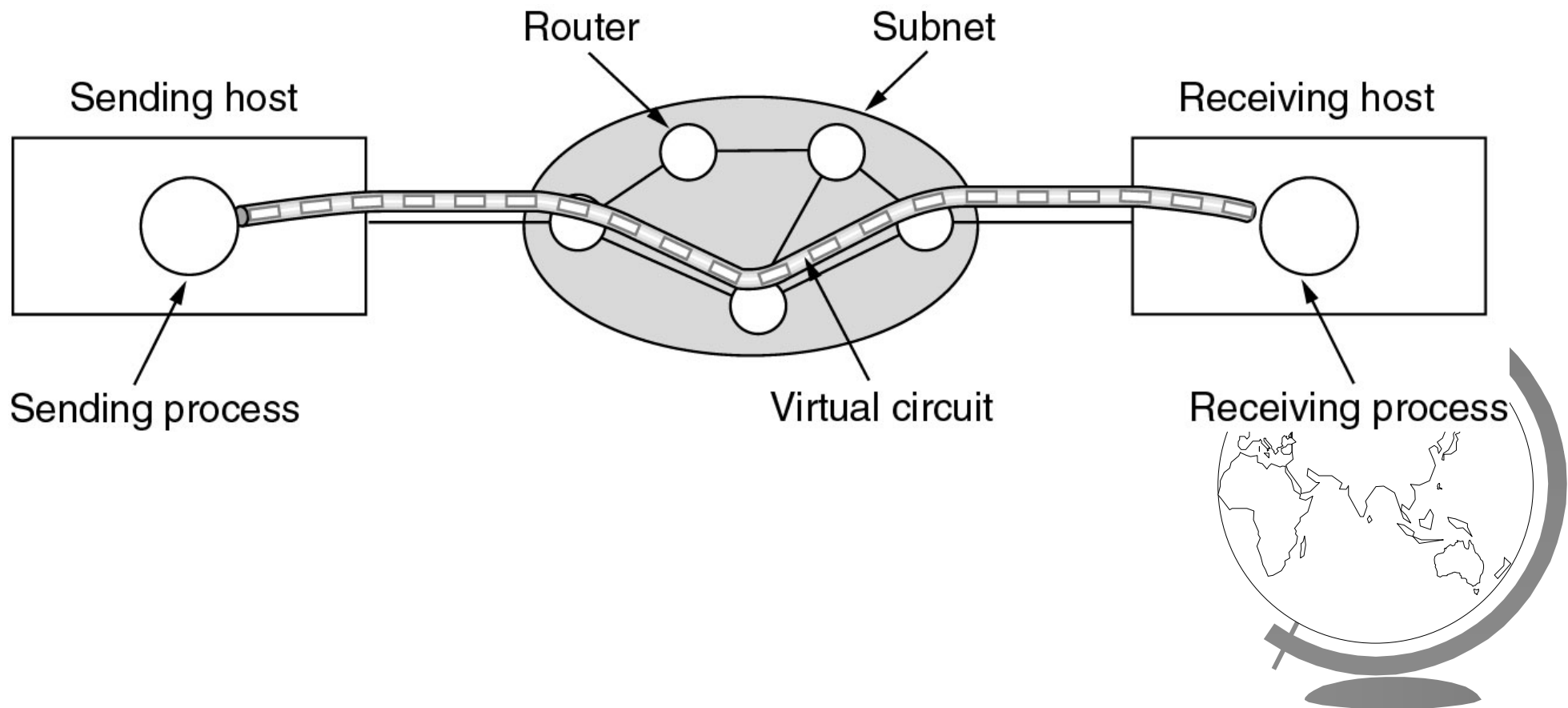


- ☞ Figure: An ATM cell
- ☞ Connection oriented
- ☞ Niche, for now, is connecting LAN's



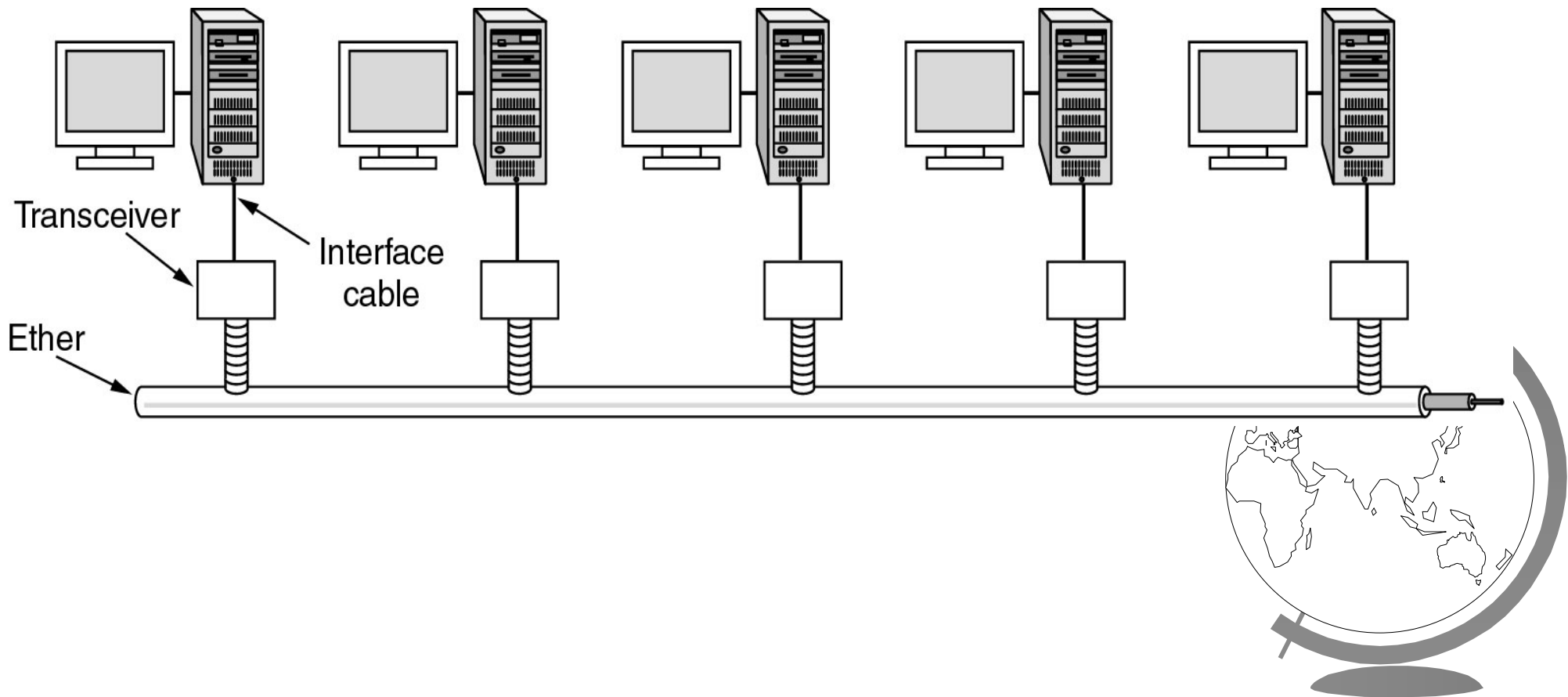
ATM Virtual Circuits

➔ A virtual circuit.

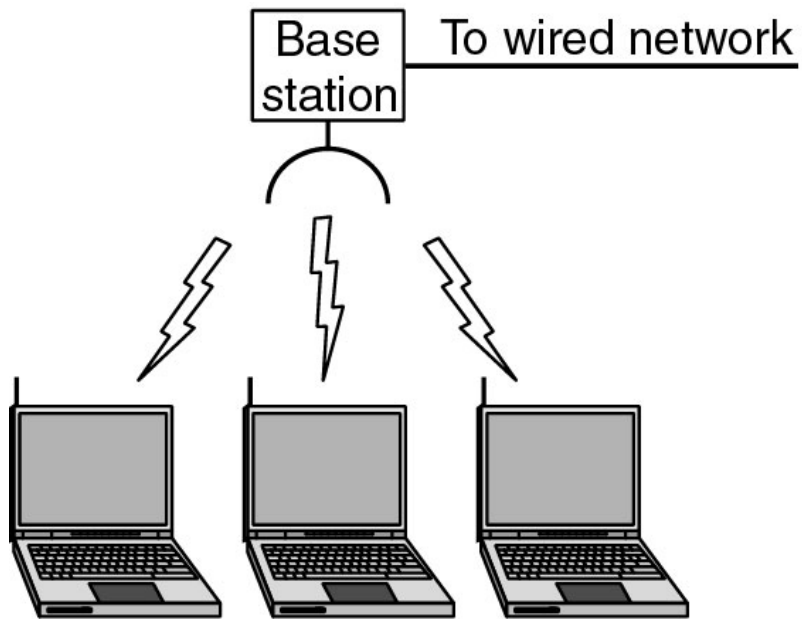


Ethernet

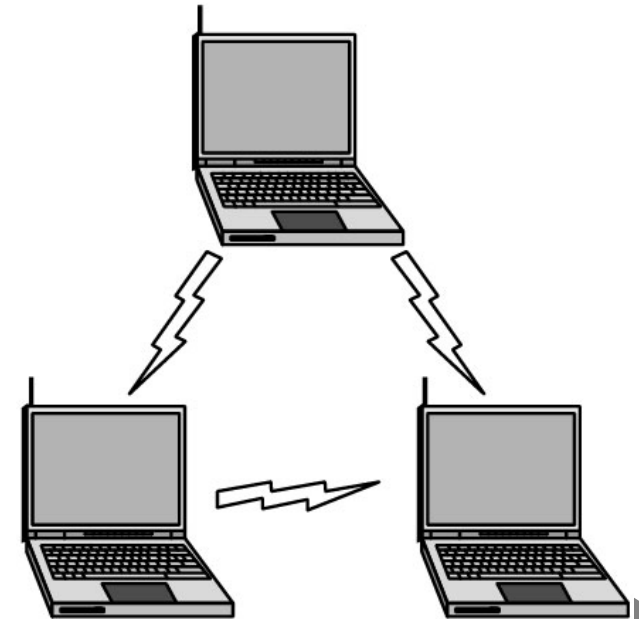
➔ Architecture of the original Ethernet.



Wireless LANs

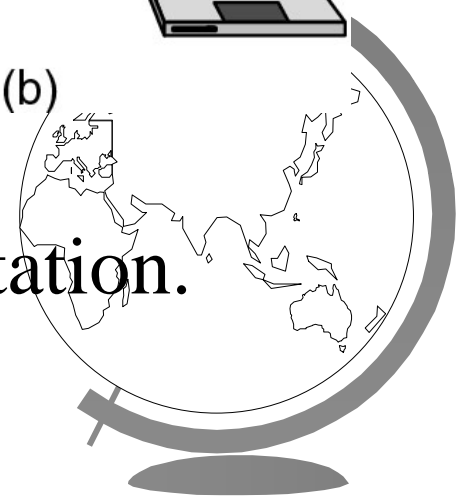


(a)



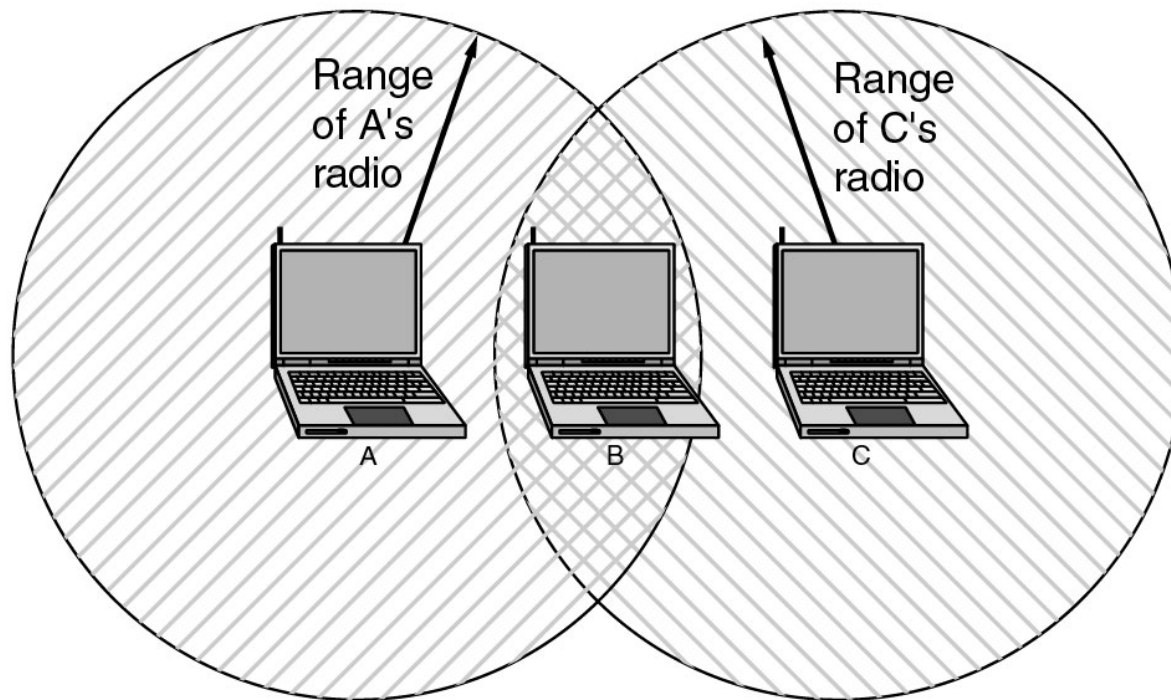
(b)

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



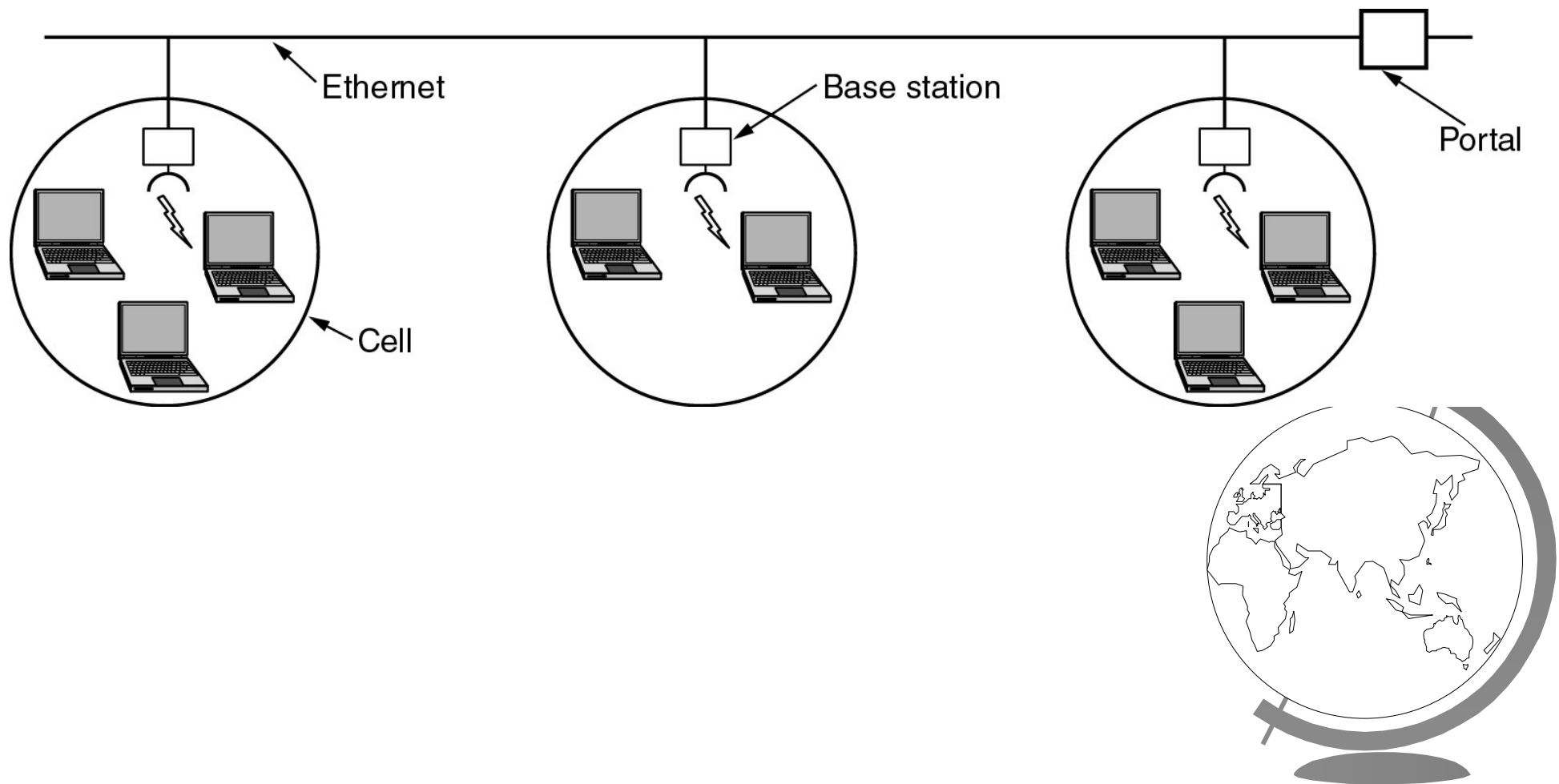
Wireless LANs (2)

- *Ad hoc network*: Range of a single radio may not cover the entire system.



Wireless LANs (3)

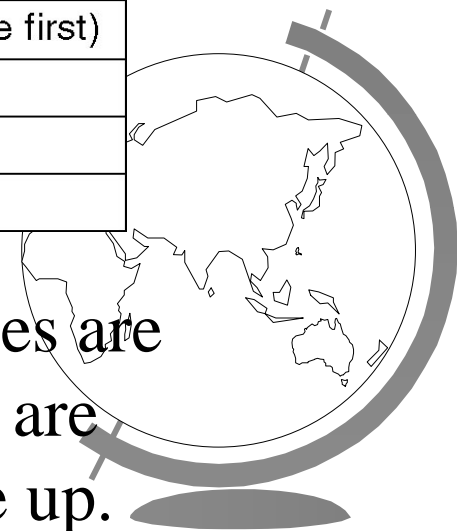
☞ *Infrastructure*: A multicell 802.11 network.



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.



Outline for Rest of Course

- ☞ Intro, reference models, ch 1 (1 day)
- ☞ Physical layer, ch 2 (1 day)
- ☞ Data link layer, ch 3 (2 days)
- ☞ Medium access sublayer, ch 4 (1 day)
- ☞ Network layer, ch 5 (2 days)
 - midterm exam
- ☞ Transport layer, ch 6 (2 days)
 - UDP/TCP/IP, ch 6.4 (1 – 1.5 days)
- ☞ Upper layers, misc, chap 7
 - final exam

