Introduction

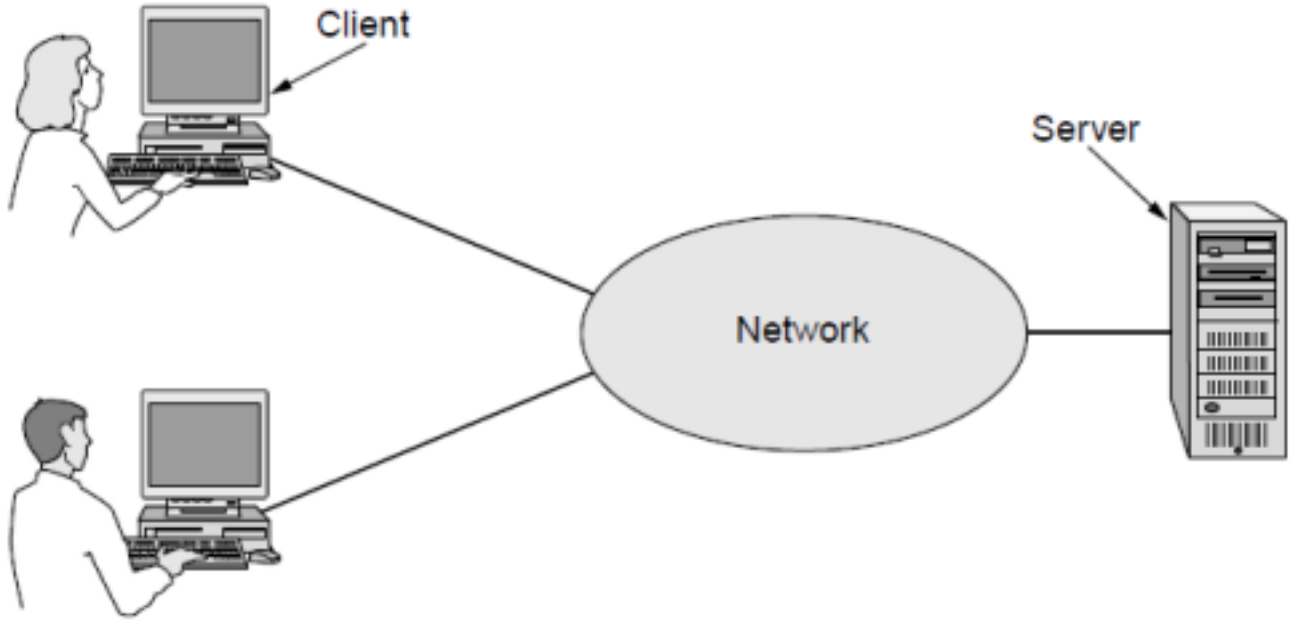
Chapter 1

Uses of Computer Networks

- Business Applications
- Home Applications

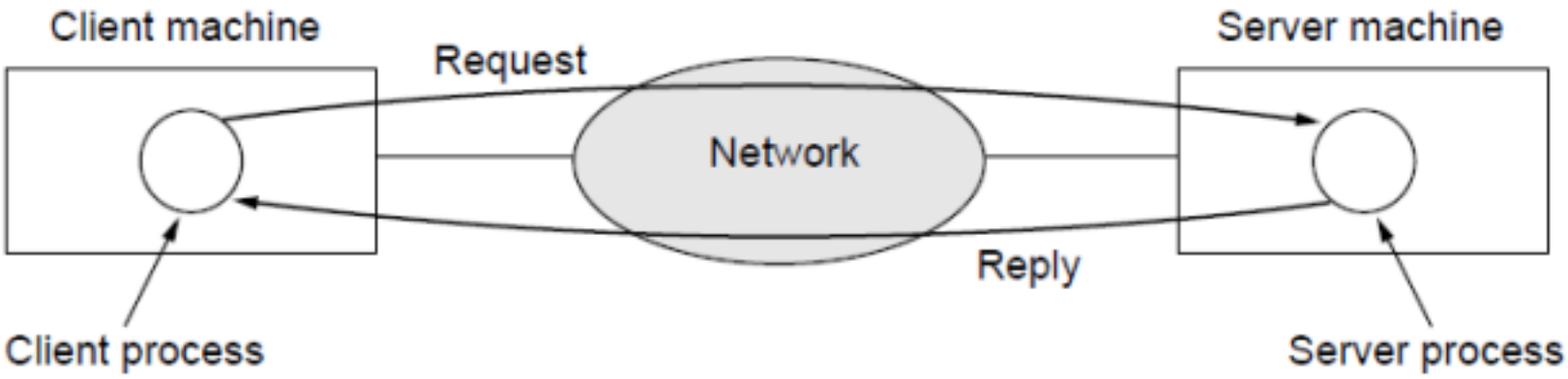
- Mobile Users
- Social Issues

Business Applications (1)



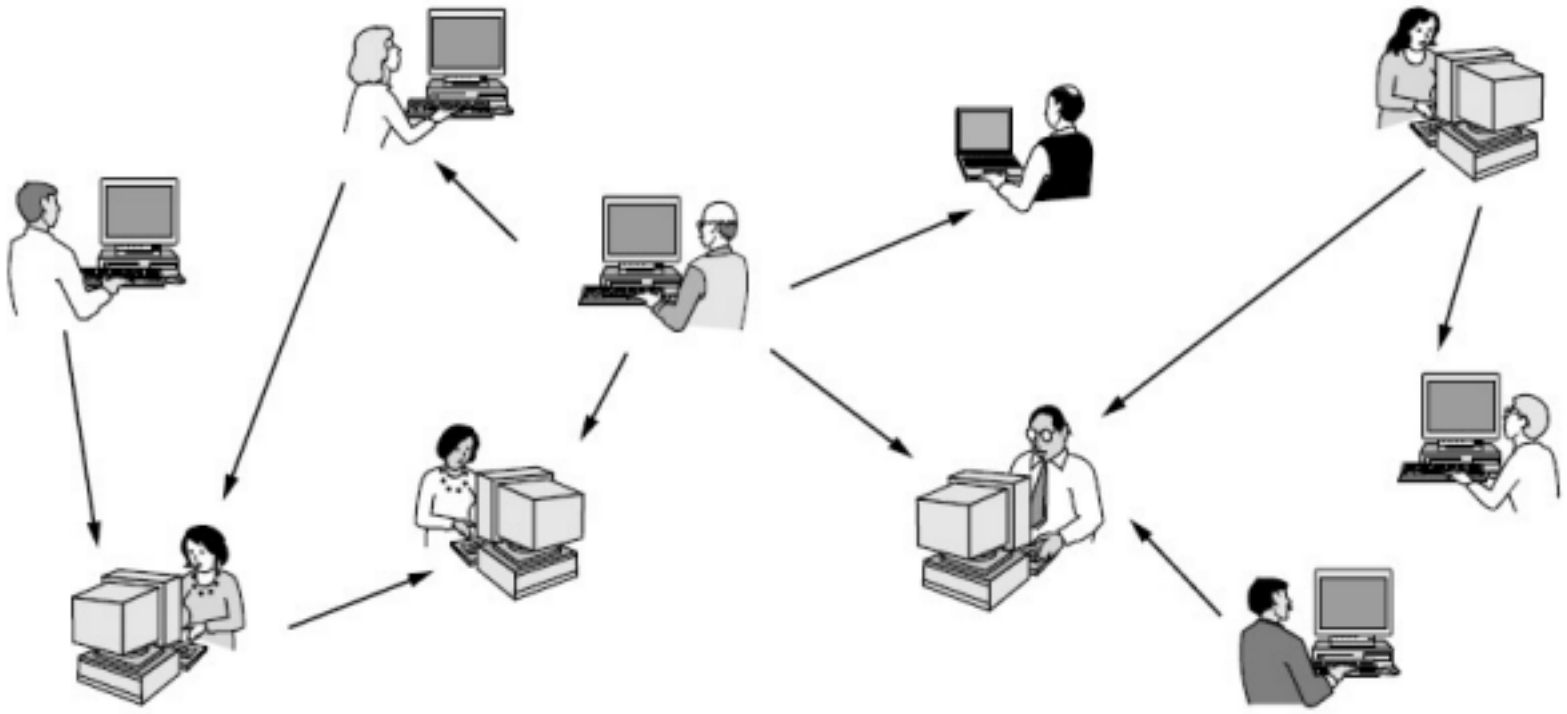
A network with two clients and one server *Computer Networks*, Fifth Edition by Andrew Tanenbaum and David Wetherall, © Pearson Education-Prentice Hall, 2011

Business Applications (2)



The client-server model involves requests and replies

Home Applications (1)



In a peer-to-peer system there are no fixed clients and servers. *Computer Networks*, Fifth Edition by Andrew Tanenbaum and David Wetherall, © Pearson Education-Prentice Hall, 2011

Home Applications (2)

Tag	Full name	Example
B2C	Business-to-consumer	Ordering books online
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 online
P2P	Peer-to-peer	Music sharing

Some forms of e-commerce

Mobile Users

Wireless	Mobile	Typical applications
No	No	Desktop computers in offices
No	Yes	A notebook computer used in a hotel room
Yes	No	Networks in unwired buildings
Yes	Yes	Store inventory with a handheld computer

Combinations of wireless networks and mobile computing

Social Issues

- Network neutrality
- Digital Millennium Copyright Act •

Profiling users

- Phishing

Network Hardware (1)

- Personal area networks
- Local area networks
- Metropolitan area networks
- Wide are networks

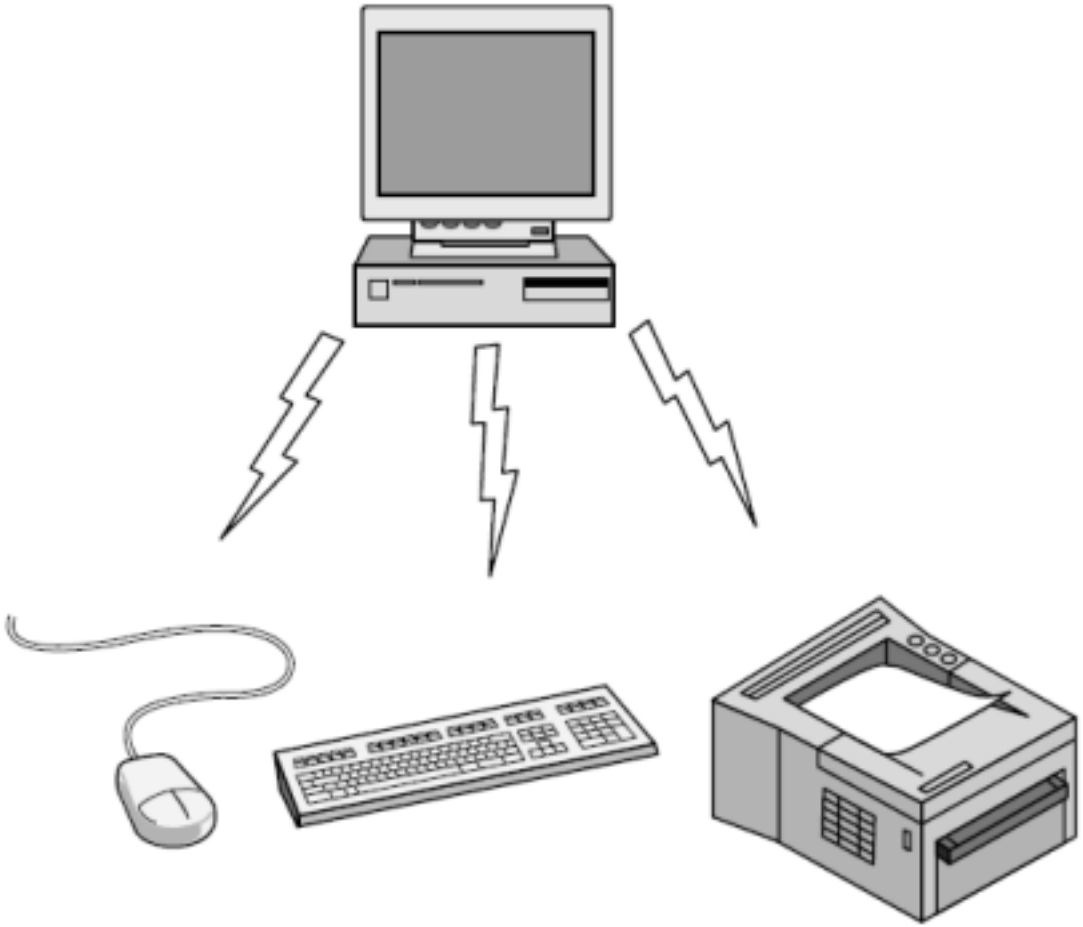
- The internet

Network Hardware (2)

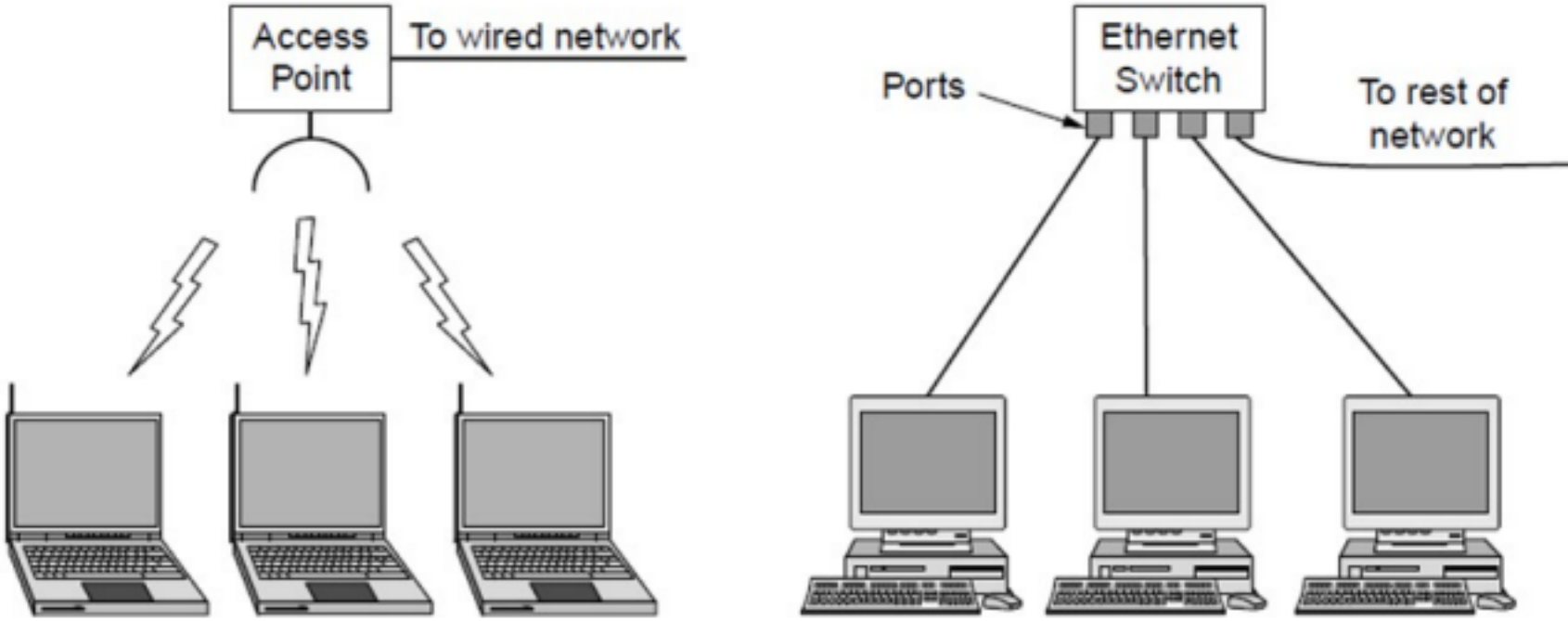
Interprocessor distance	Processors located in same	Example
1 m	Square meter	Personal area network
10 m	Room	Local area network
100 m	Building	
1 km	Campus	
10 km	City	Metropolitan area network
100 km	Country	Wide area network
1000 km	Continent	
10,000 km	Planet	The Internet

Classification of interconnected processors by scale.

Personal Area Network

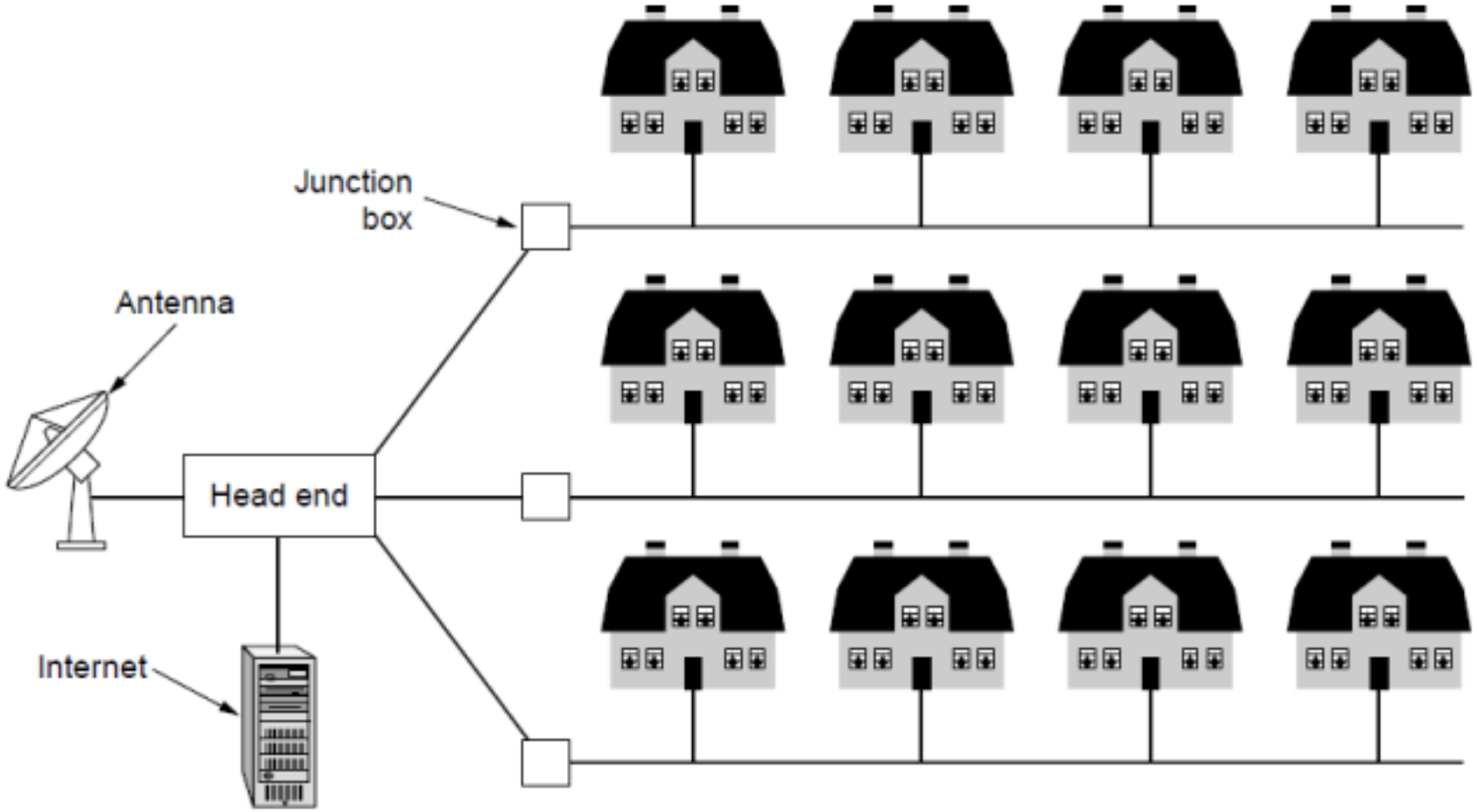


Bluetooth PAN configuration



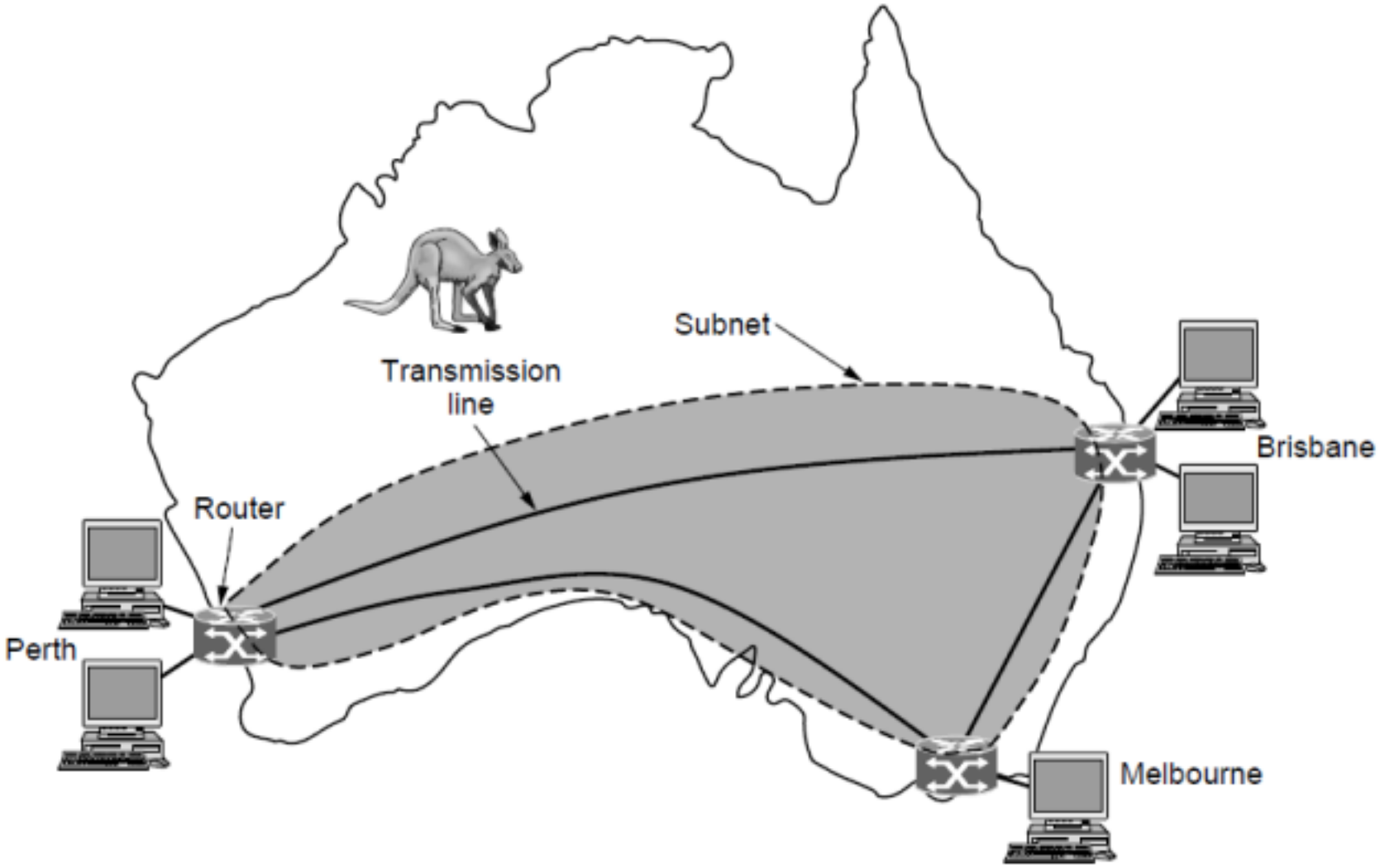
Wireless and wired LANs. (a) 802.11. (b) Switched Ethernet. *Computer Networks*, Fifth Edition by Andrew Tanenbaum and David Wetherall, © Pearson Education-Prentice Hall, 2011

Metropolitan Area Networks



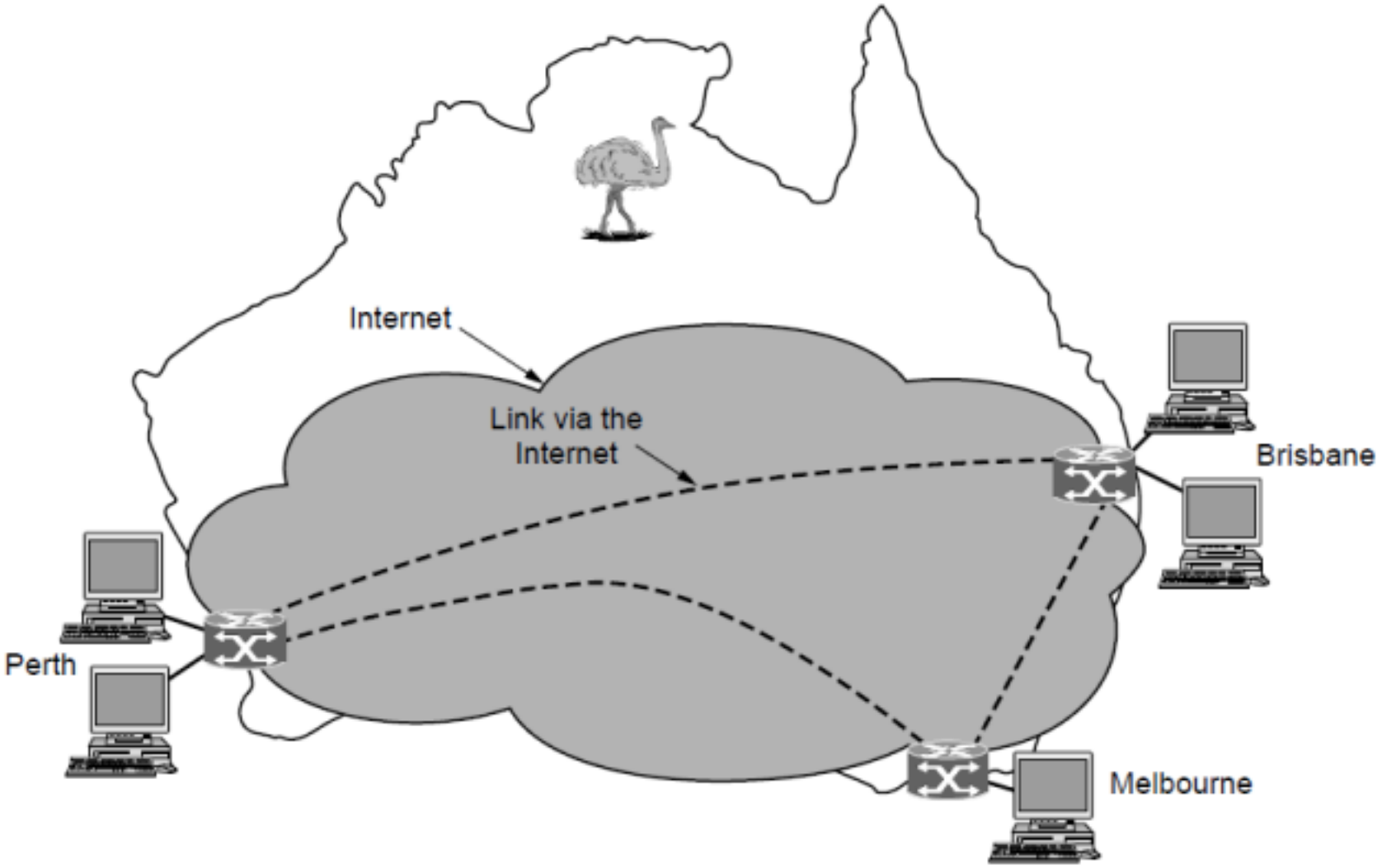
A metropolitan area network based on cable TV. *Computer Networks*, Fifth Edition by Andrew Tanenbaum and David Wetherall, © Pearson Education-Prentice Hall, 2011

Wide Area Networks (1)



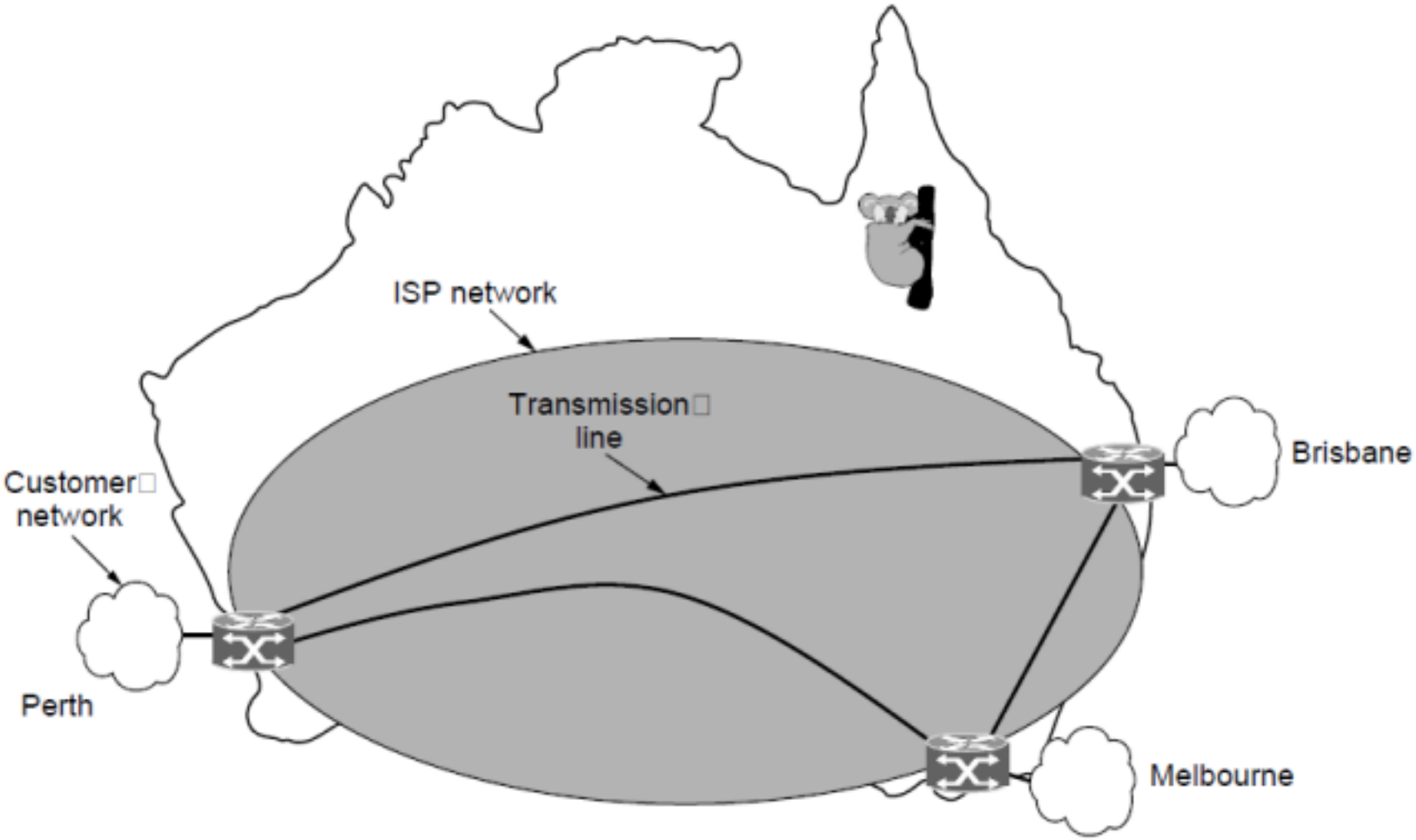
WAN that connects three branch offices in Australia

Wide Area Networks (2)



WAN using a virtual private network.

Wide Area Networks (3)

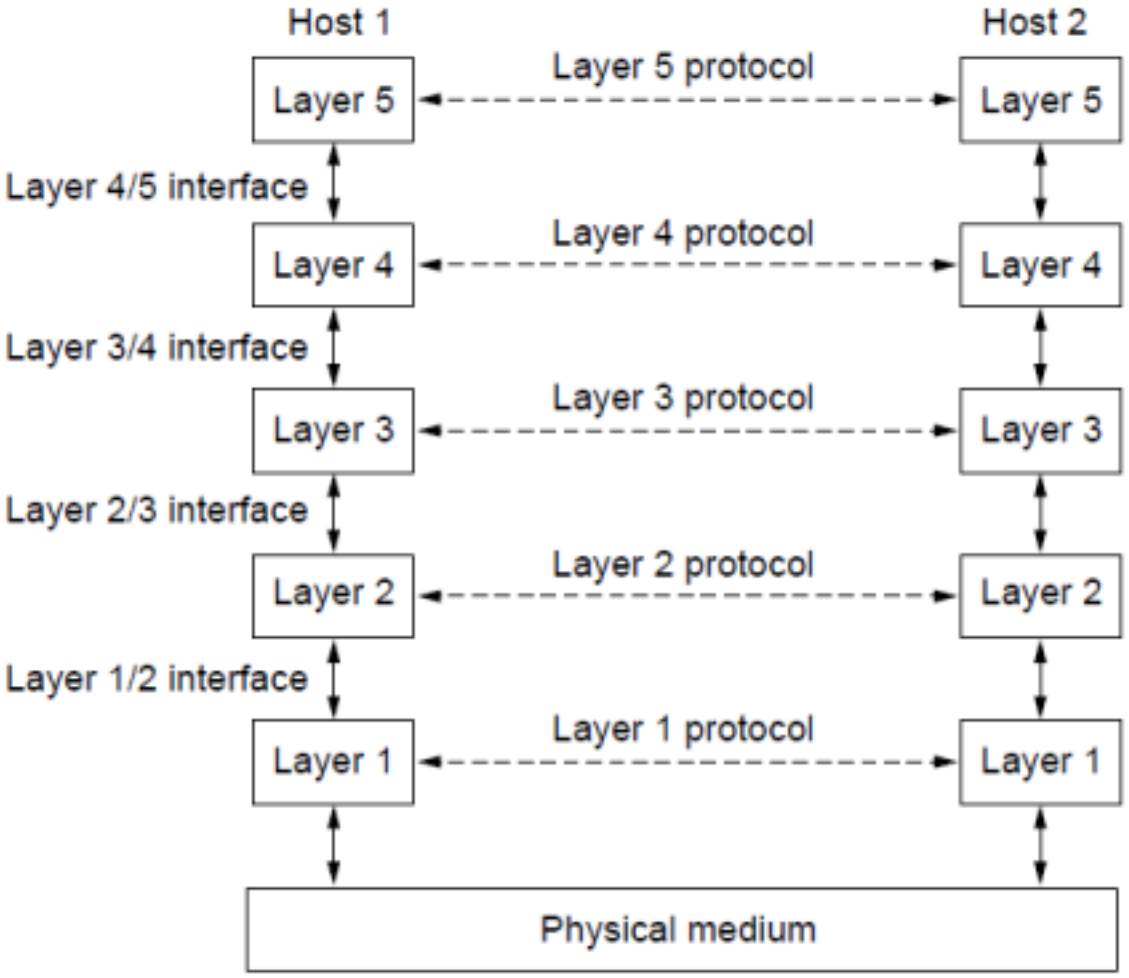


WAN using an ISP network.

Network Software

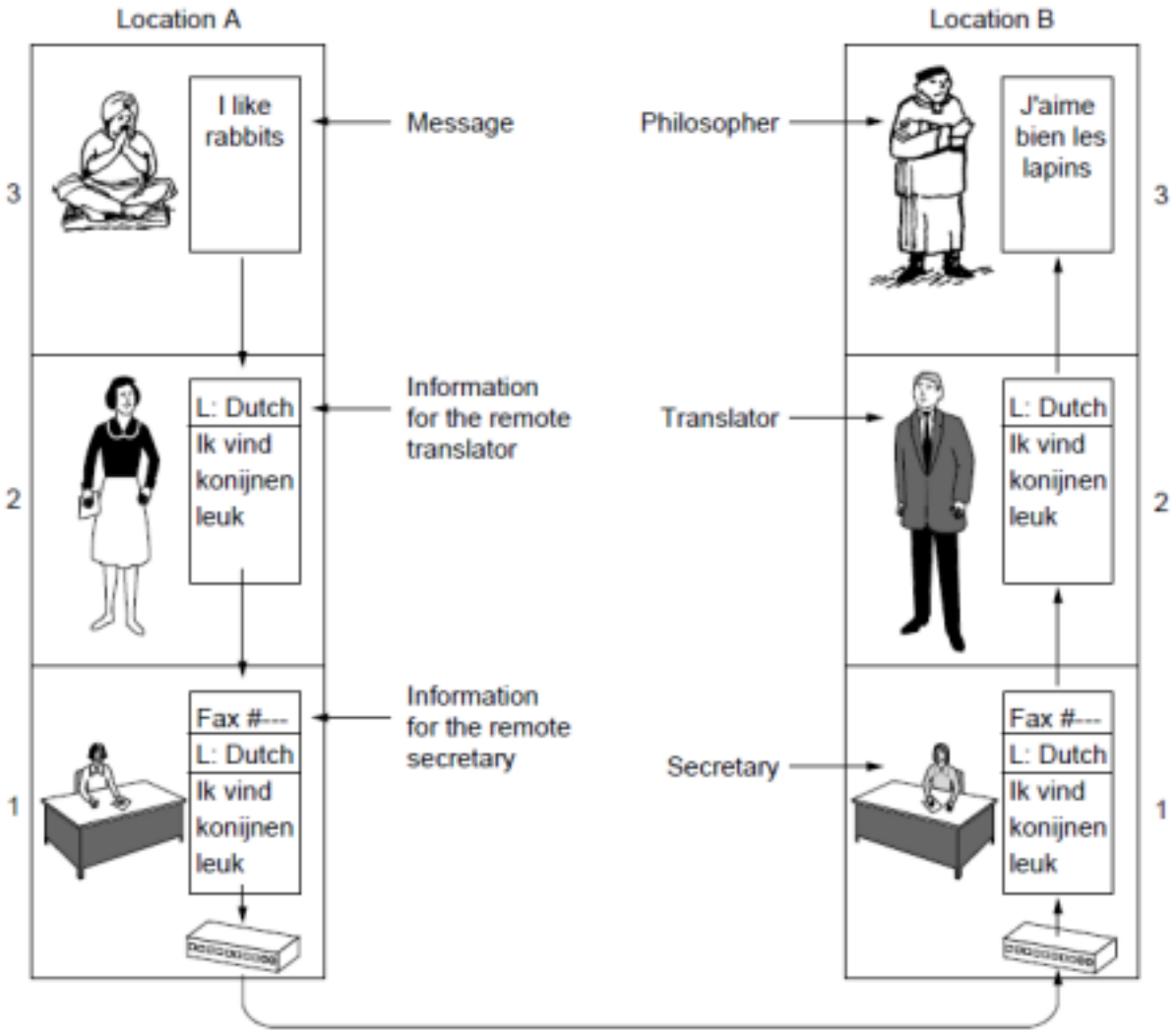
- Protocol hierarchies
- Design issues for the layers
- Connection-oriented versus connectionless service
- Service primitives
- Relationship of services to protocols

Protocol Hierarchies (1)



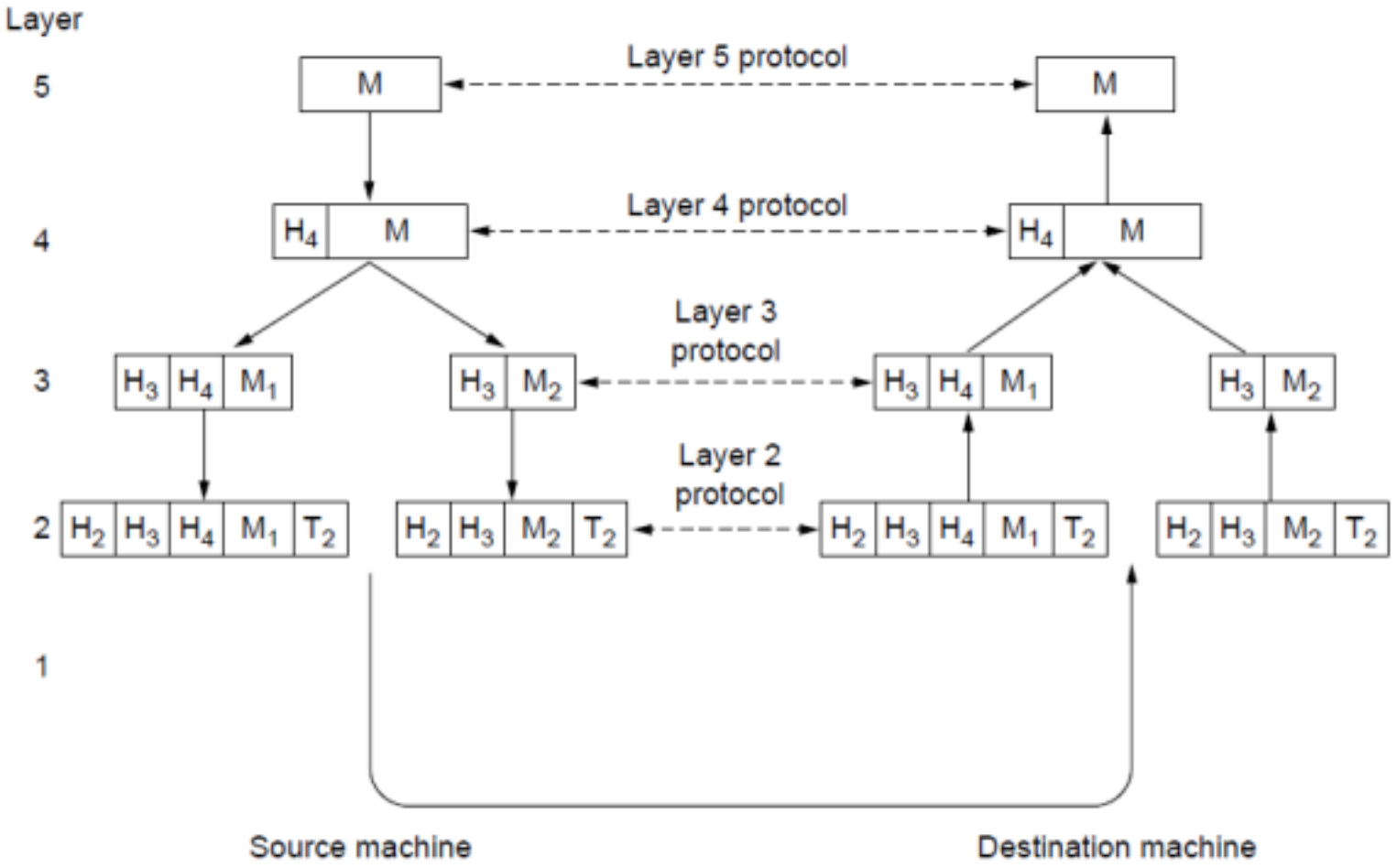
Layers, protocols, and interfaces.

Protocol Hierarchies (2)



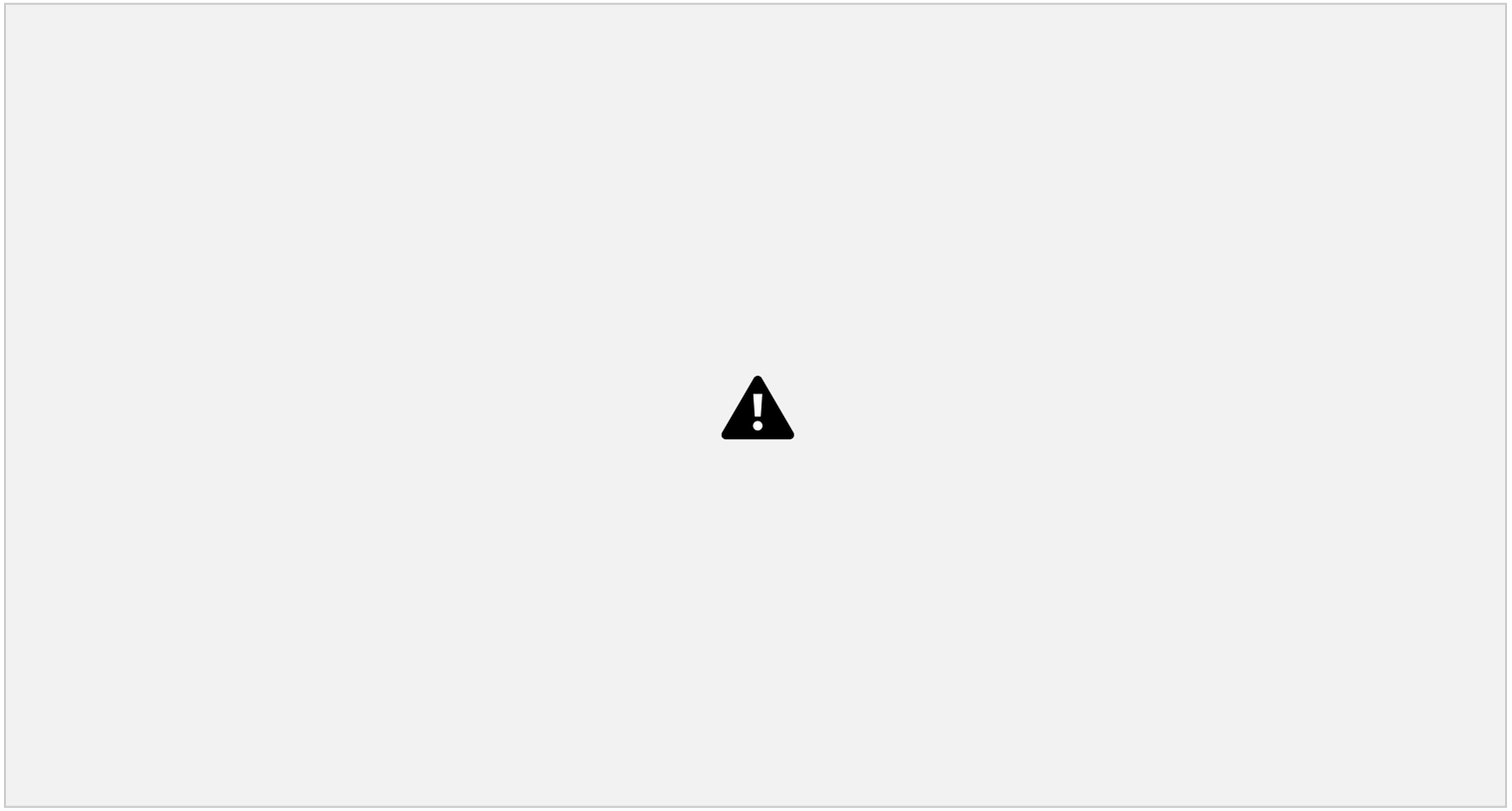
The philosopher-translator-secretary architecture

Protocol Hierarchies (3)



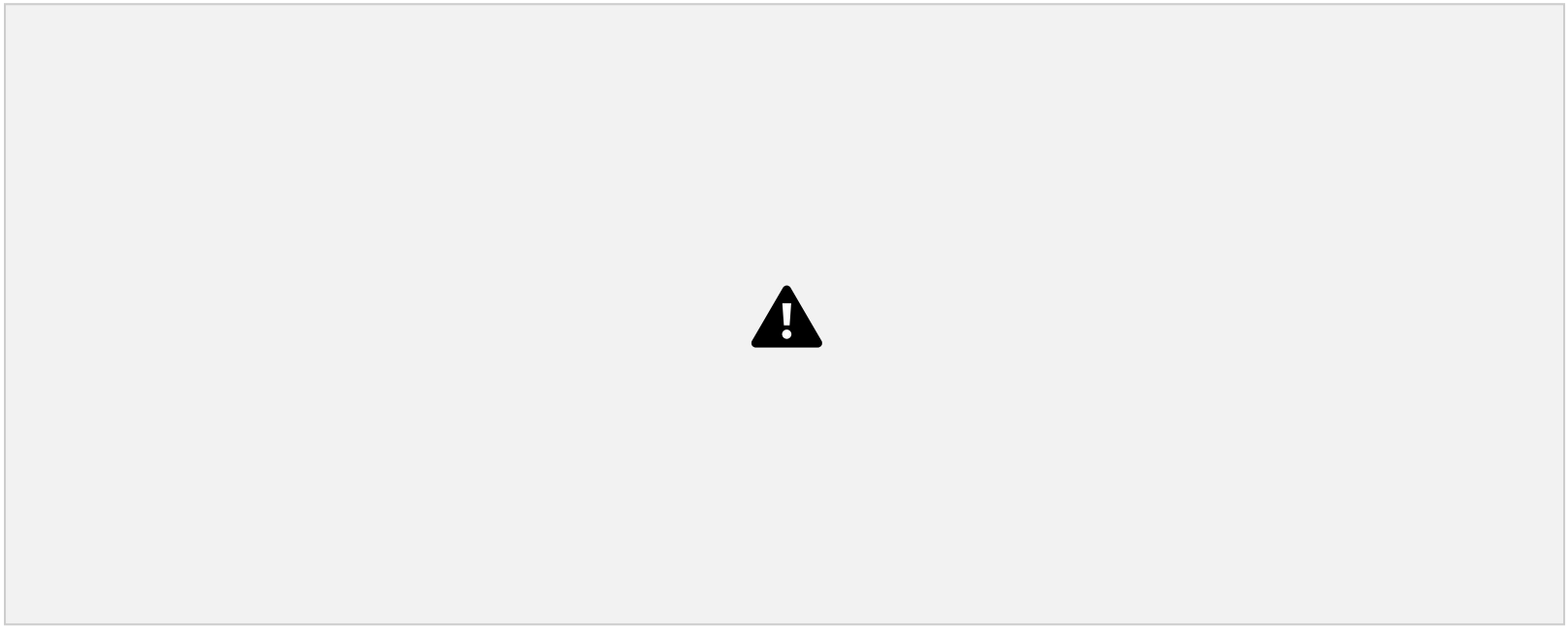
Example information flow supporting virtual communication in layer 5.

Connection-Oriented Versus Connectionless Service



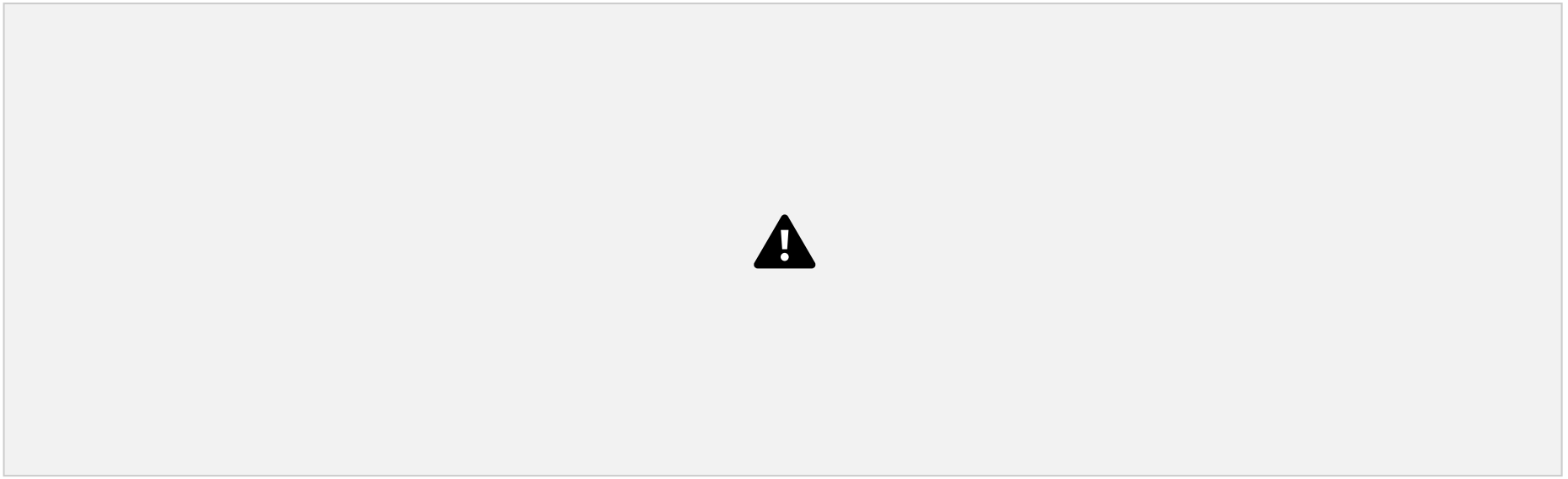
Six different types of service.

Service Primitives (1)



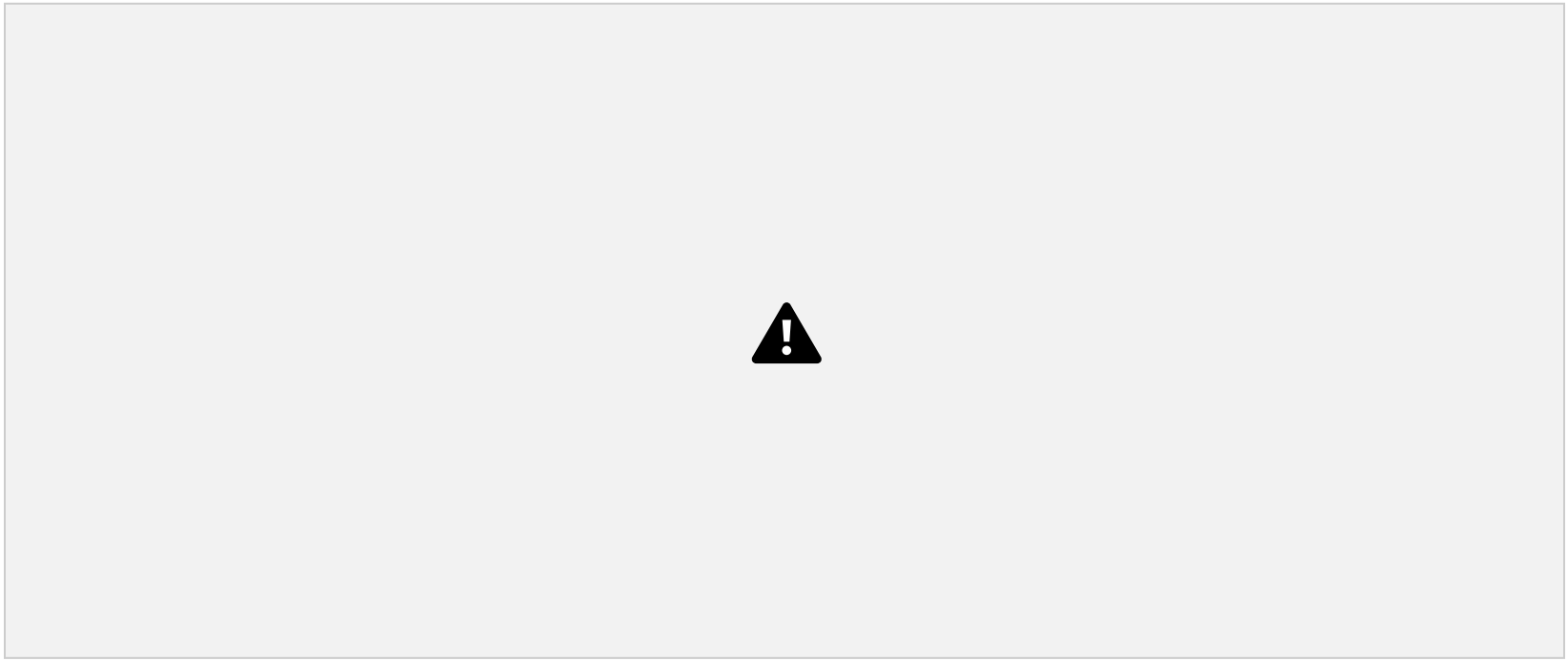
Six service primitives that provide a simple connection-oriented service

Service Primitives (2)



A simple client-server interaction using acknowledged datagrams.

The Relationship of Services to Protocols



The relationship between a service and a protocol.

Reference Models

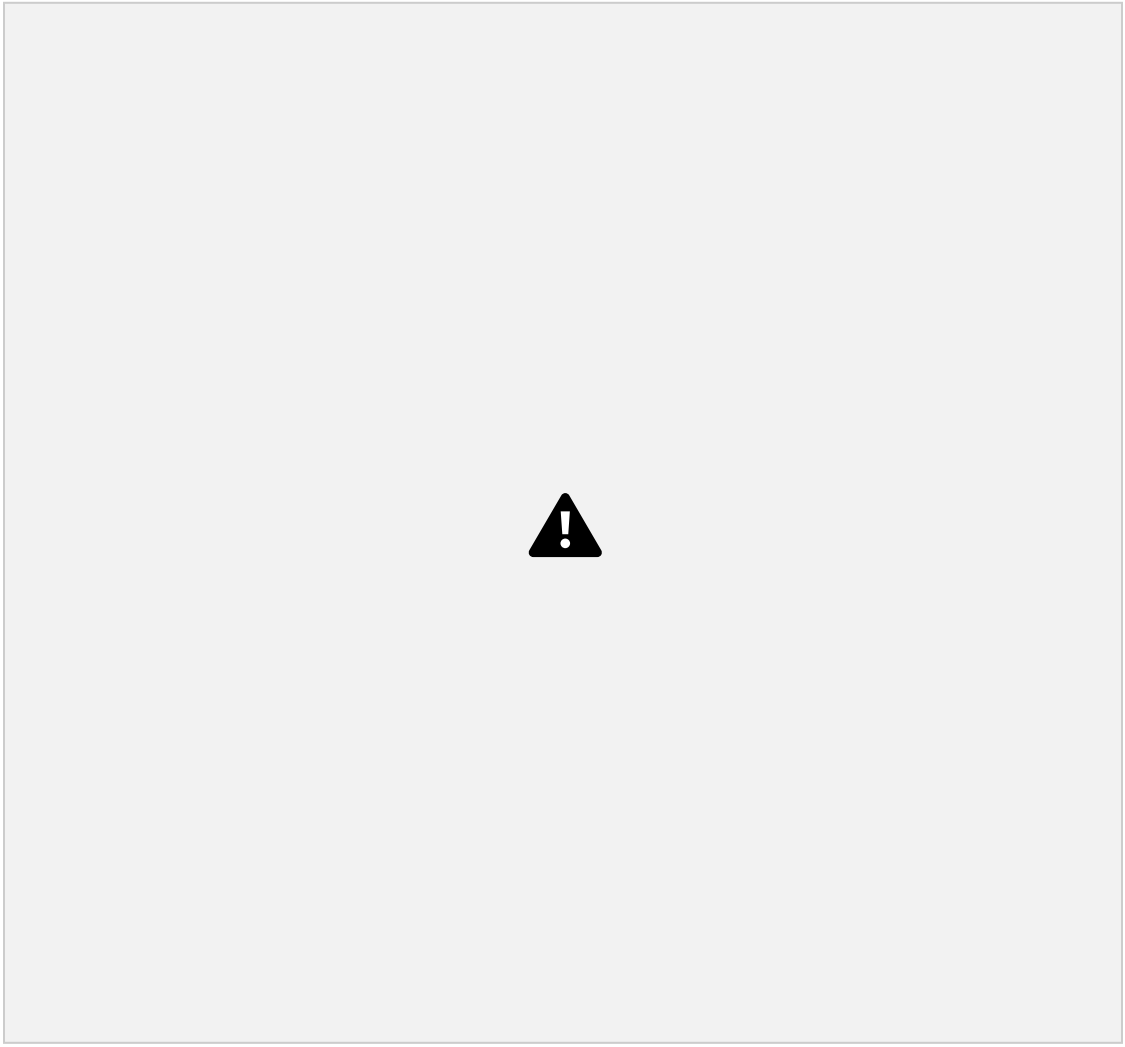
- OSI reference model
- TCP/IP reference model
- Model used for this text
- Comparison of OSI and TCP/IP
- Critique of OSI model and protocols
- Critique of TCP/IP model

The OSI Reference Model

Principles for the seven layers

- Layers created for different abstractions
- Each layer performs well-defined function
- Function of layer chosen with definition of international standard protocols in mind
- Minimize information flow across interfaces between boundaries
- Number of layers optimum

The OSI Reference Model



The OSI reference model

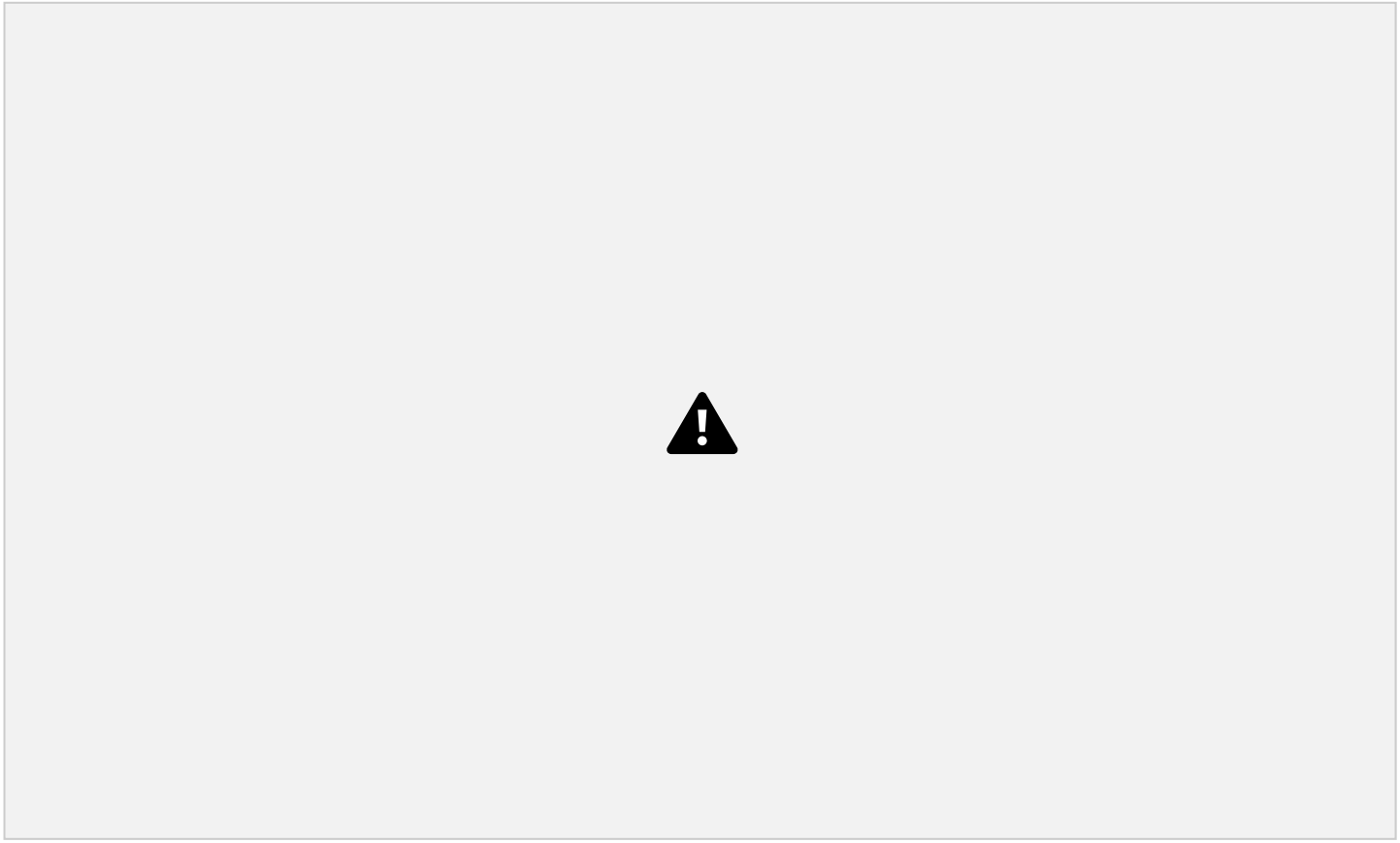
OSI Reference Model Layers

- Physical layer
- Data link layer
- Network layer
- Transport layer
- Session layer
- Presentation layer
- Application layer

The TCP/IP Reference Model Layers

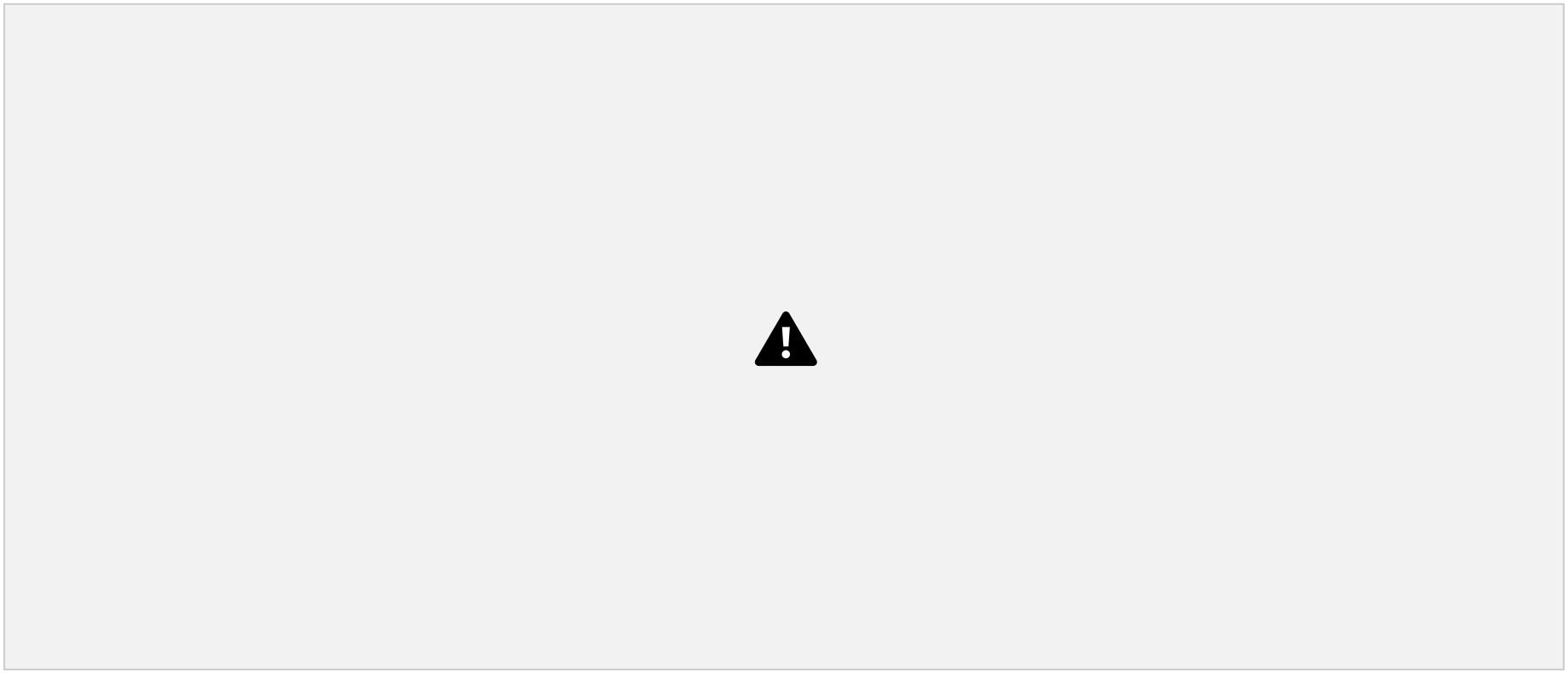
- Link layer
- Internet layer
- Transport layer
- Application layer

The TCP/IP Reference Model (1)



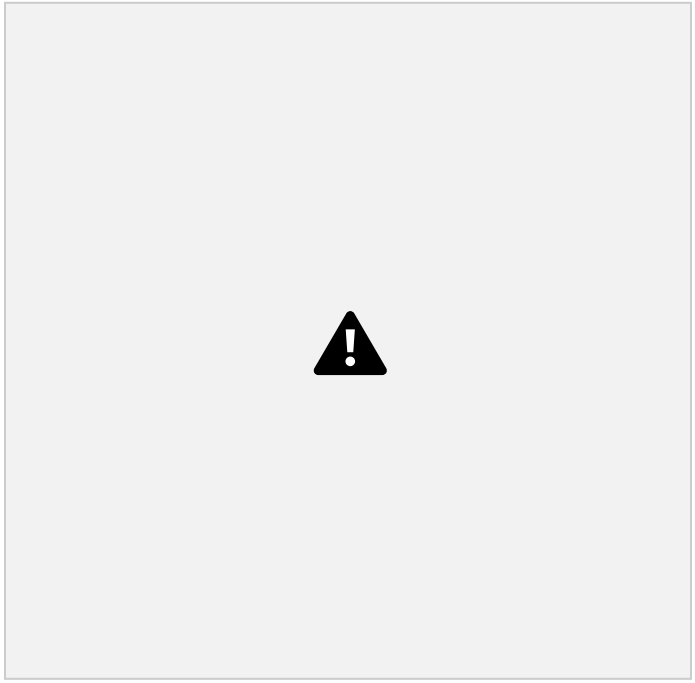
The TCP/IP reference model

The TCP/IP Reference Model (2)



The TCP/IP reference model with some protocols we will study

The Model Used in this Book



The reference model used in this book. *Computer Networks*, Fifth Edition

by Andrew Tanenbaum and David Wetherall, © Pearson Education-Prentice Hall, 2011

Comparison of the OSI and

TCP/IP Reference Models

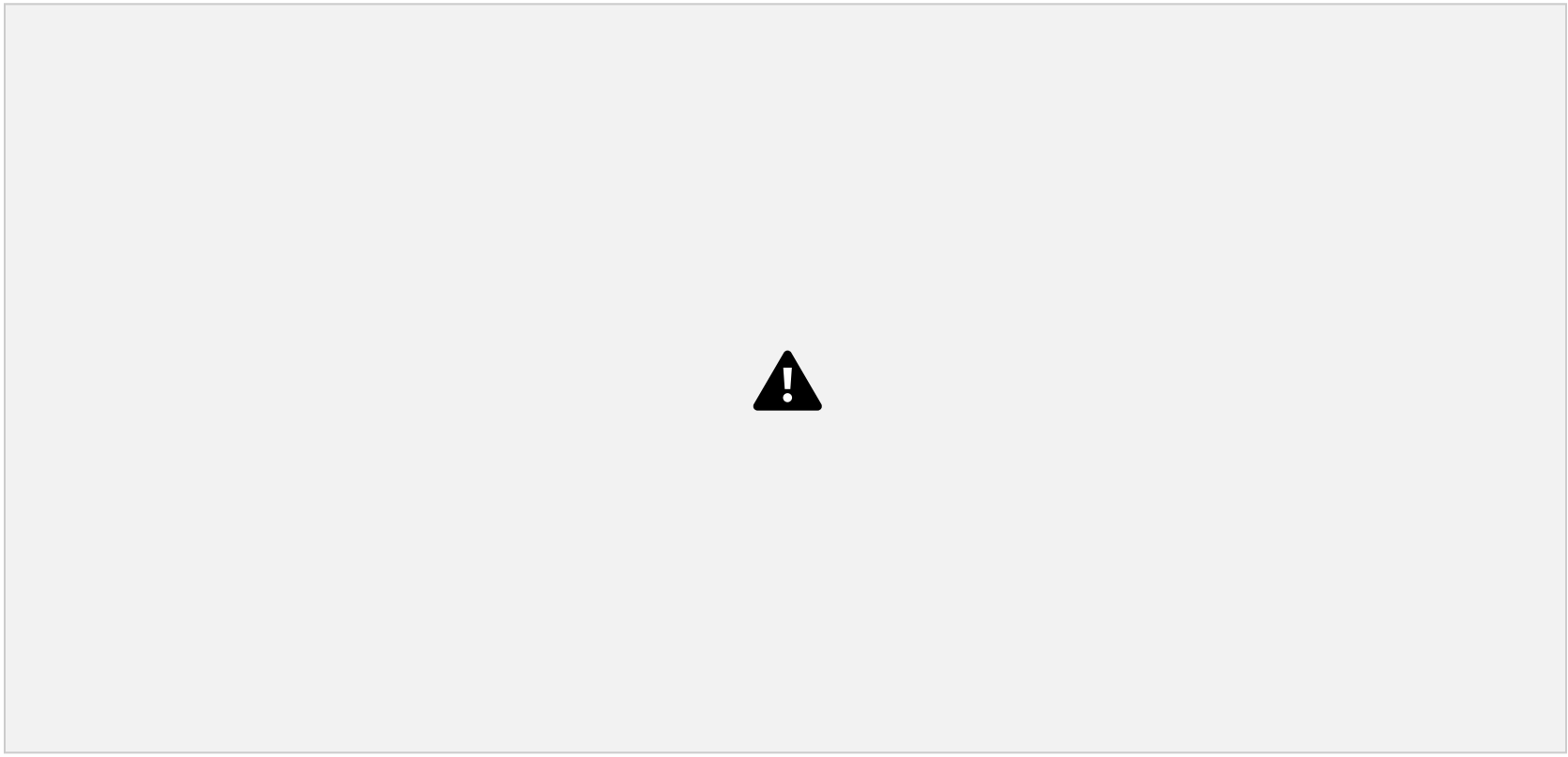
Concepts central to OSI model

- Services
- Interfaces
- Protocols

Critique of the OSI Model and Protocols

- Bad timing.
- Bad technology.
- Bad implementations.
- Bad politics.

OSI Model Bad Timing



The apocalypse of the two elephants.

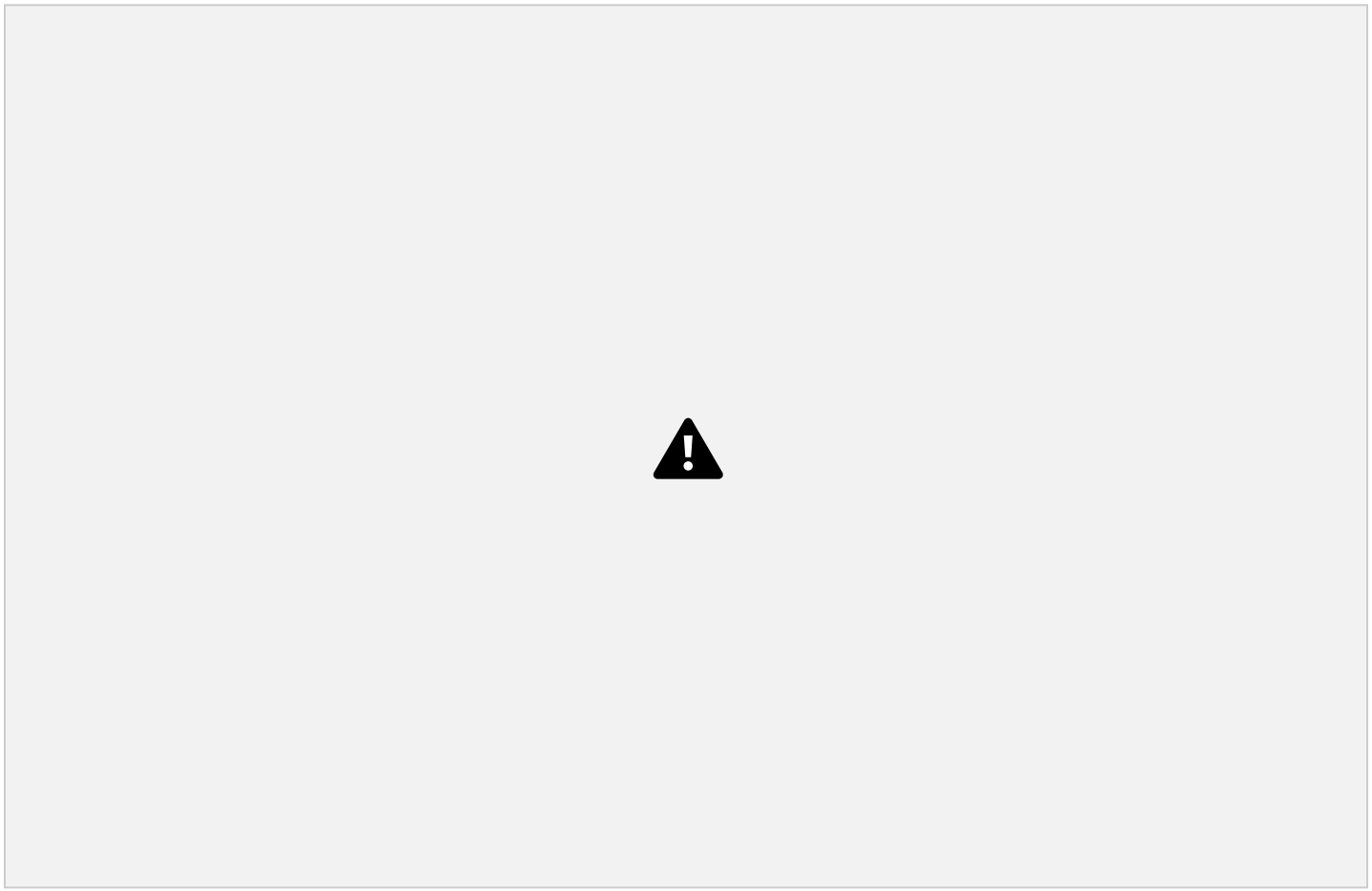
Example Networks

- Internet
- ARPANET
- NSFNET
- Third-generation mobile phone networks •

Wireless LANs: 802.11

- RFID and sensor networks

The ARPANET (1)

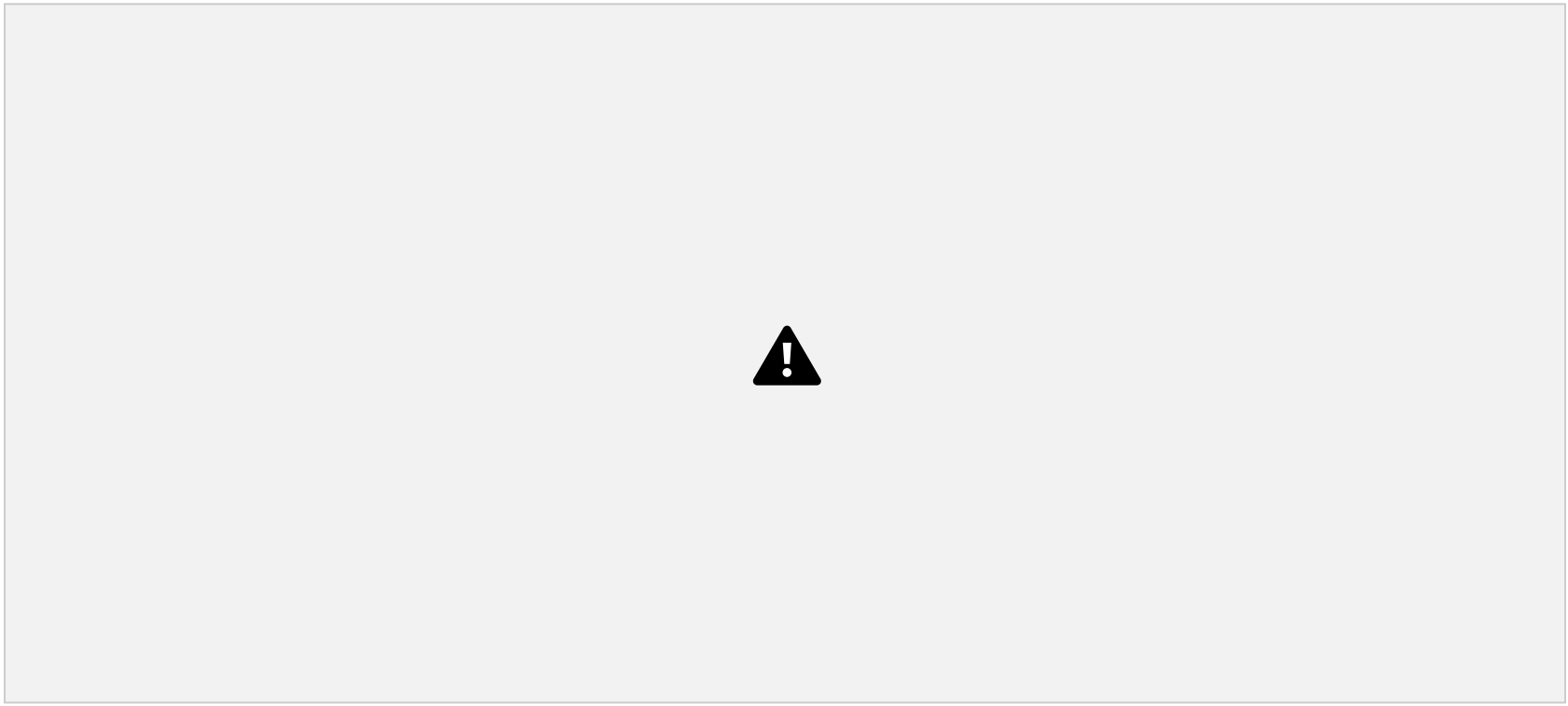


a)

Structure of the telephone system.

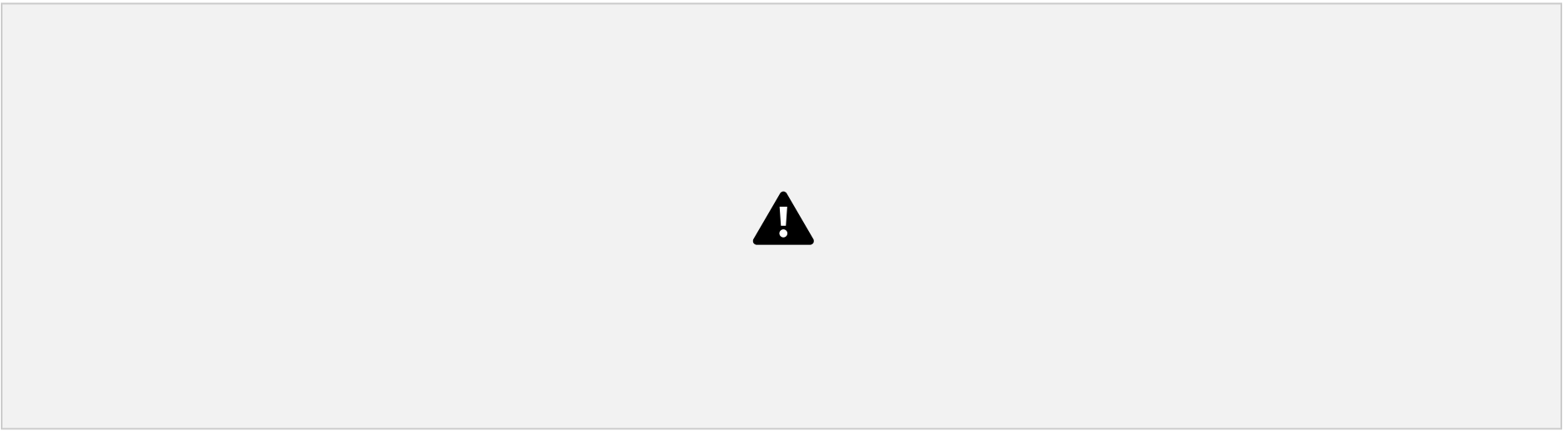
b) Baran’s proposed distributed switching system.

The ARPANET (2)



The original ARPANET design

The ARPANET (3)



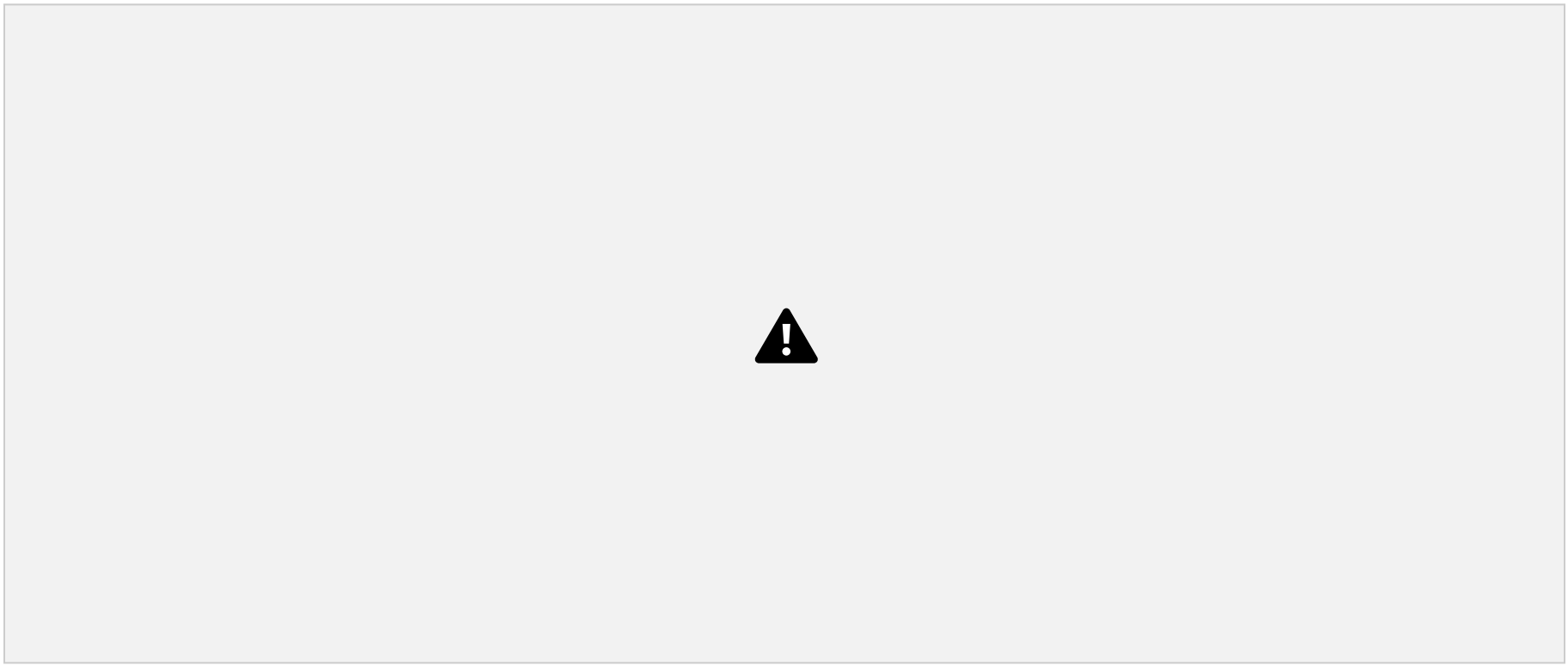
Growth of the ARPANET.

a) December 1969.

b) July 1970.

c) March 1971.

The ARPANET (4)

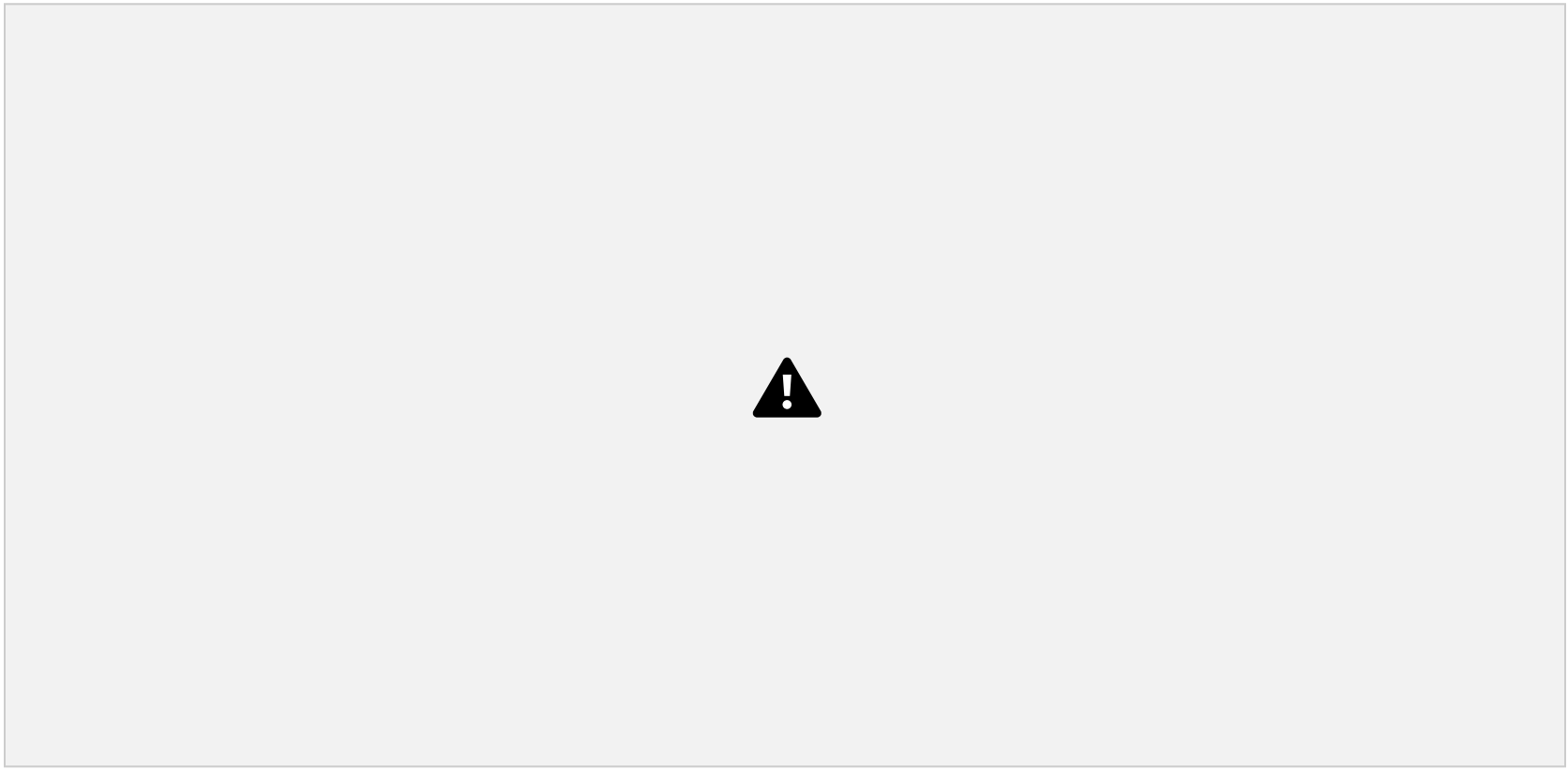


Growth of the ARPANET.

d) April 1972.

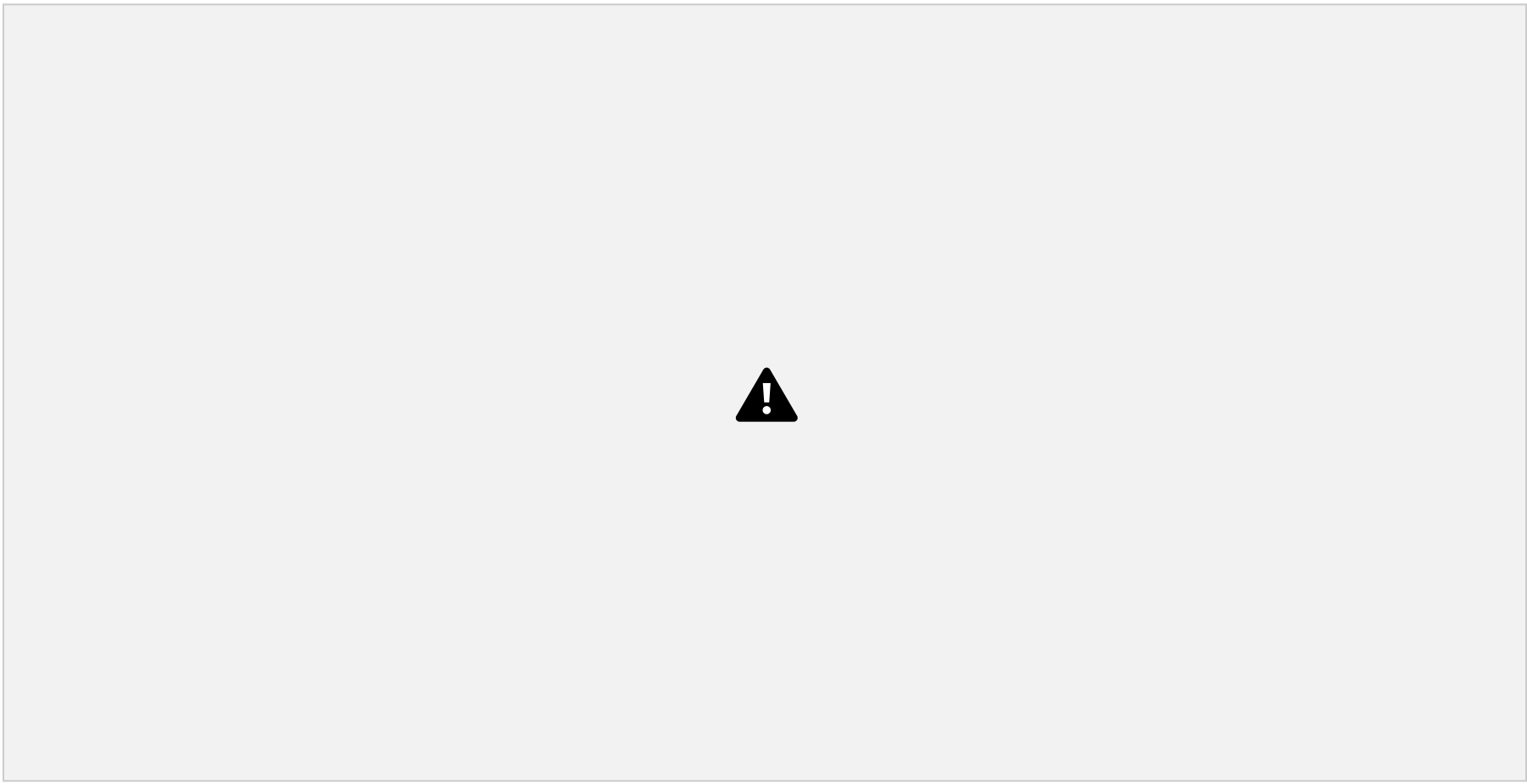
e) September 1972.

NSFNET



The NSFNET backbone in 1988.

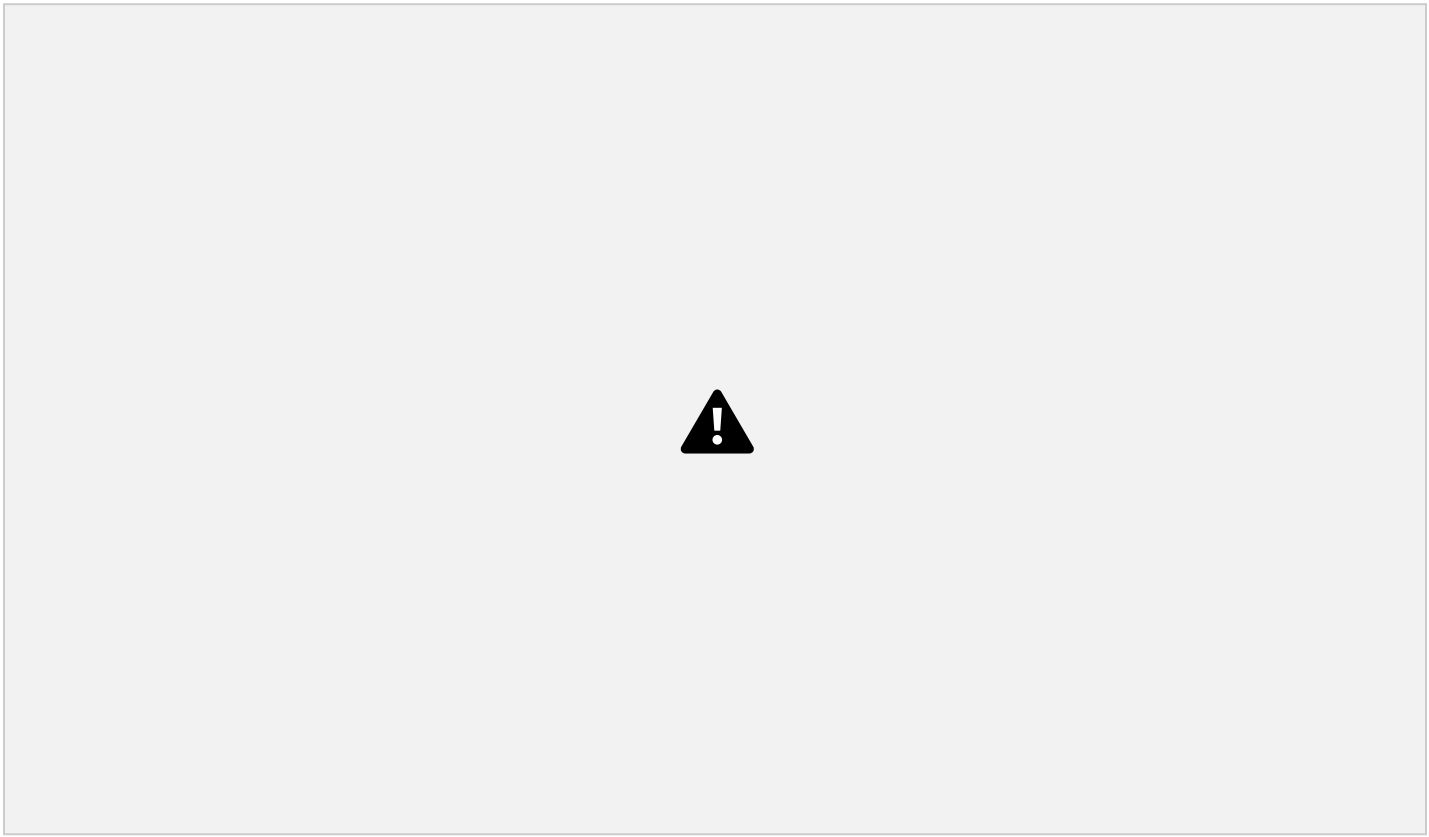
Architecture of the Internet



Overview of the Internet architecture

Third-Generation Mobile

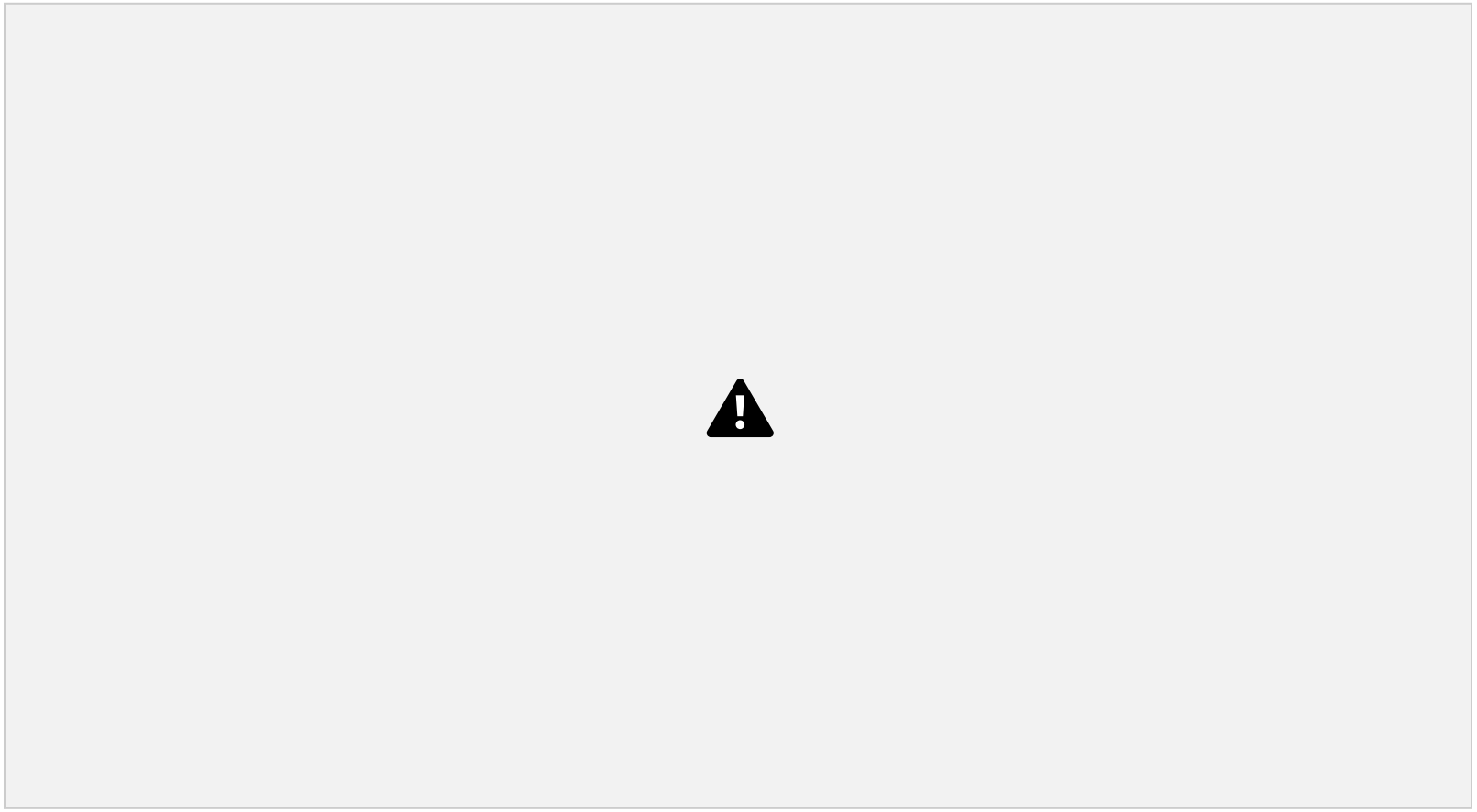
Phone Networks (1)



Cellular design of mobile phone networks

Third-Generation Mobile

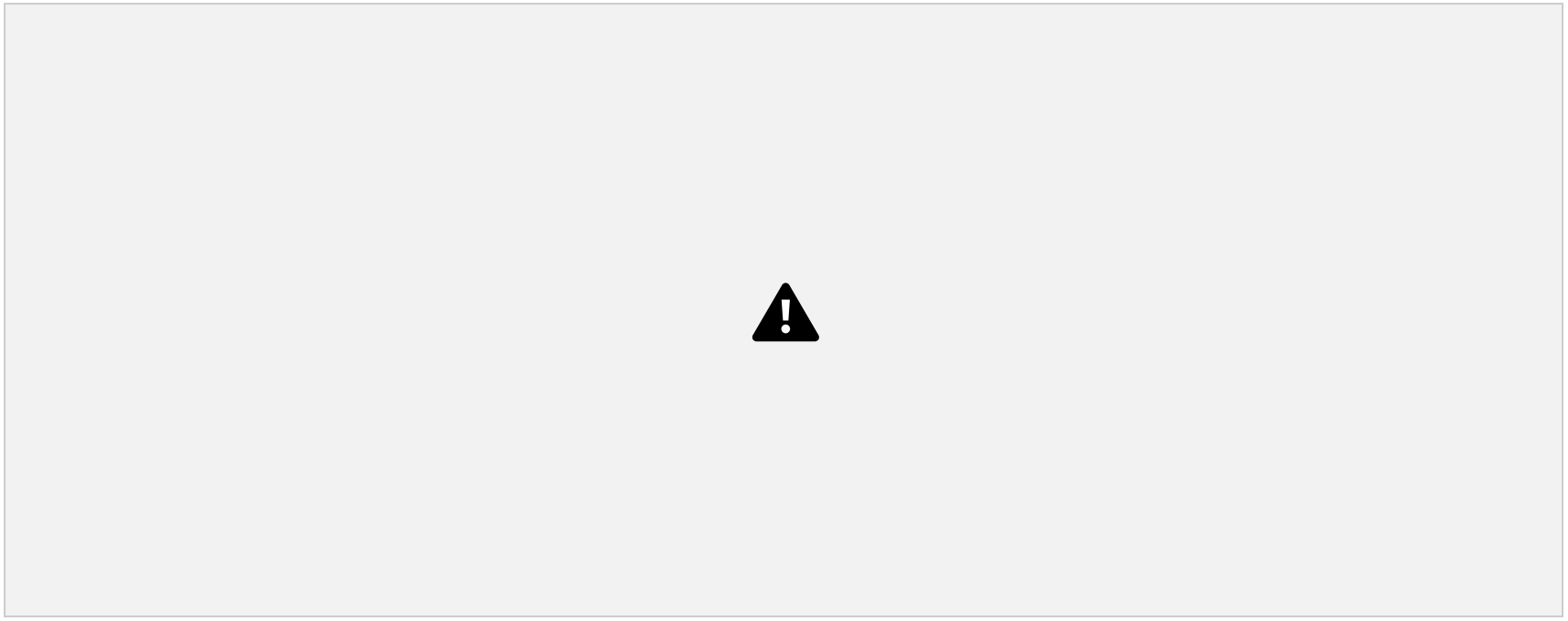
Phone Networks (2)



Architecture of the UMTS 3G mobile phone network.

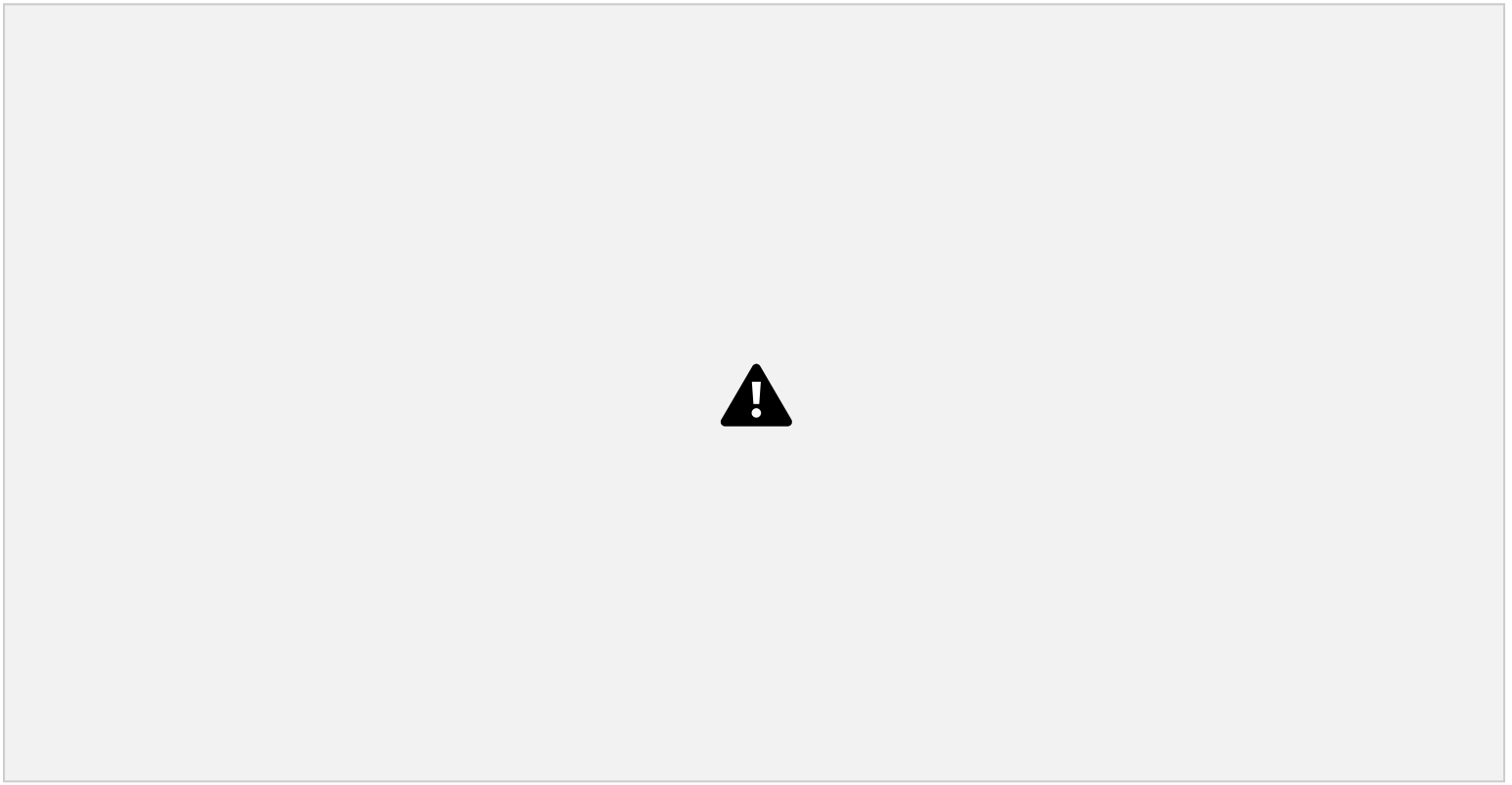
Third-Generation Mobile

Phone Networks (3)



Mobile phone handover (a) before, (b) after.

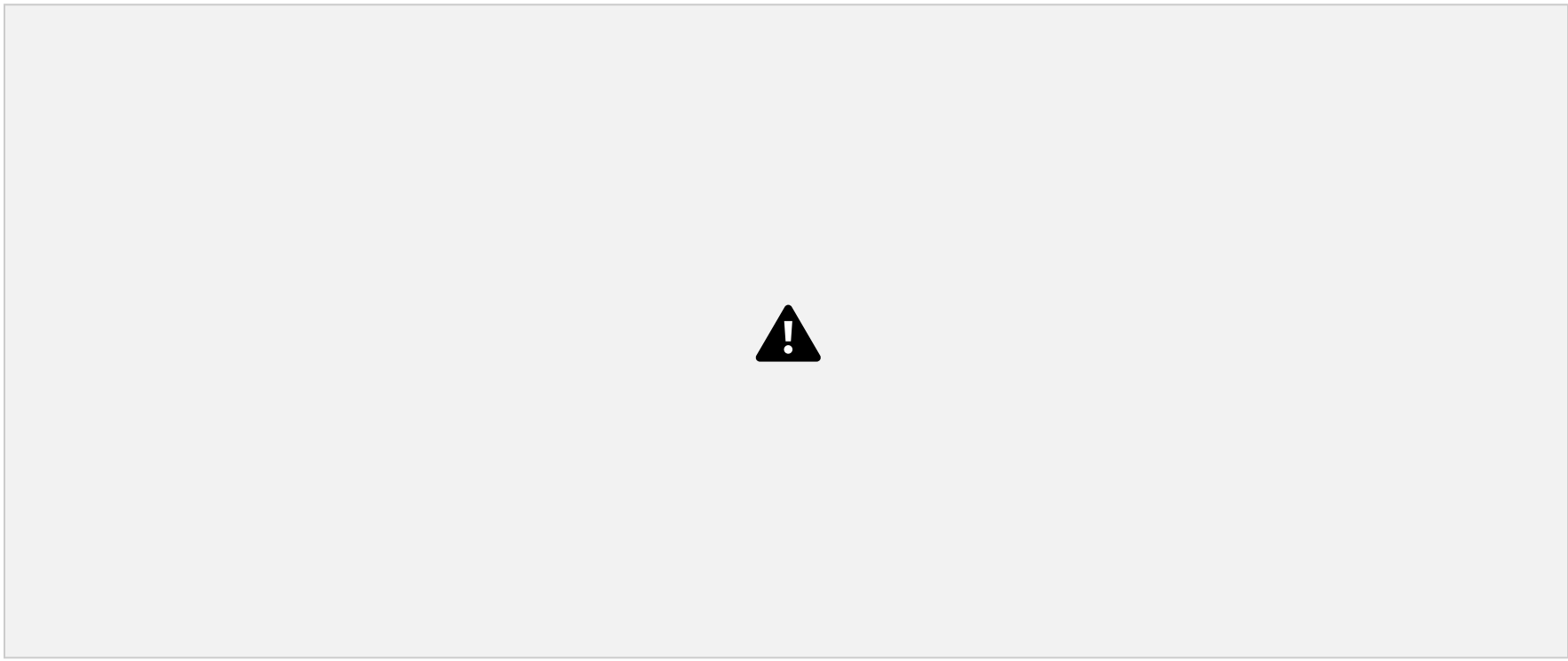
Wireless LANs: 802.11 (1)



(a) Wireless network with an access point.

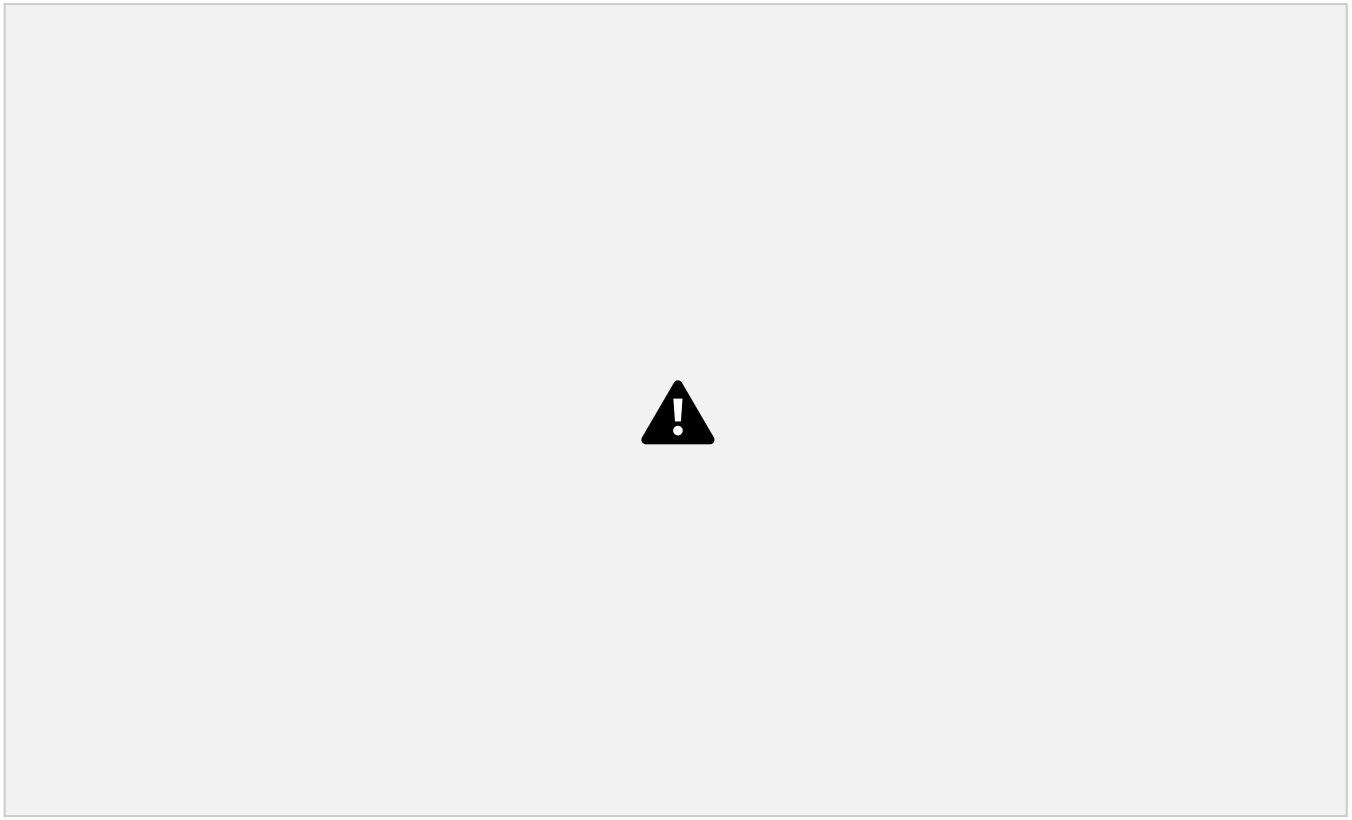
(b) Ad hoc network.

Wireless LANs: 802.11 (2)



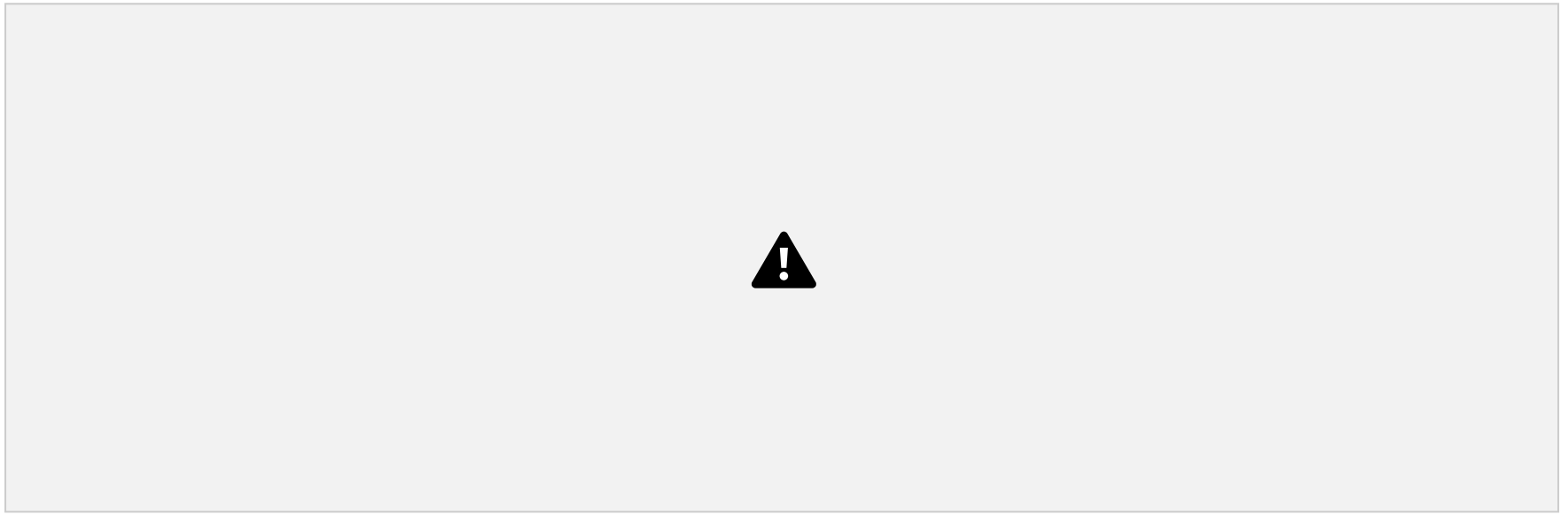
Multipath fading

Wireless LANs: 802.11 (3)



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

RFID and Sensor Networks (1)



RFID used to network everyday objects.

RFID and Sensor Networks (2)

Multihop topology of a sensor network

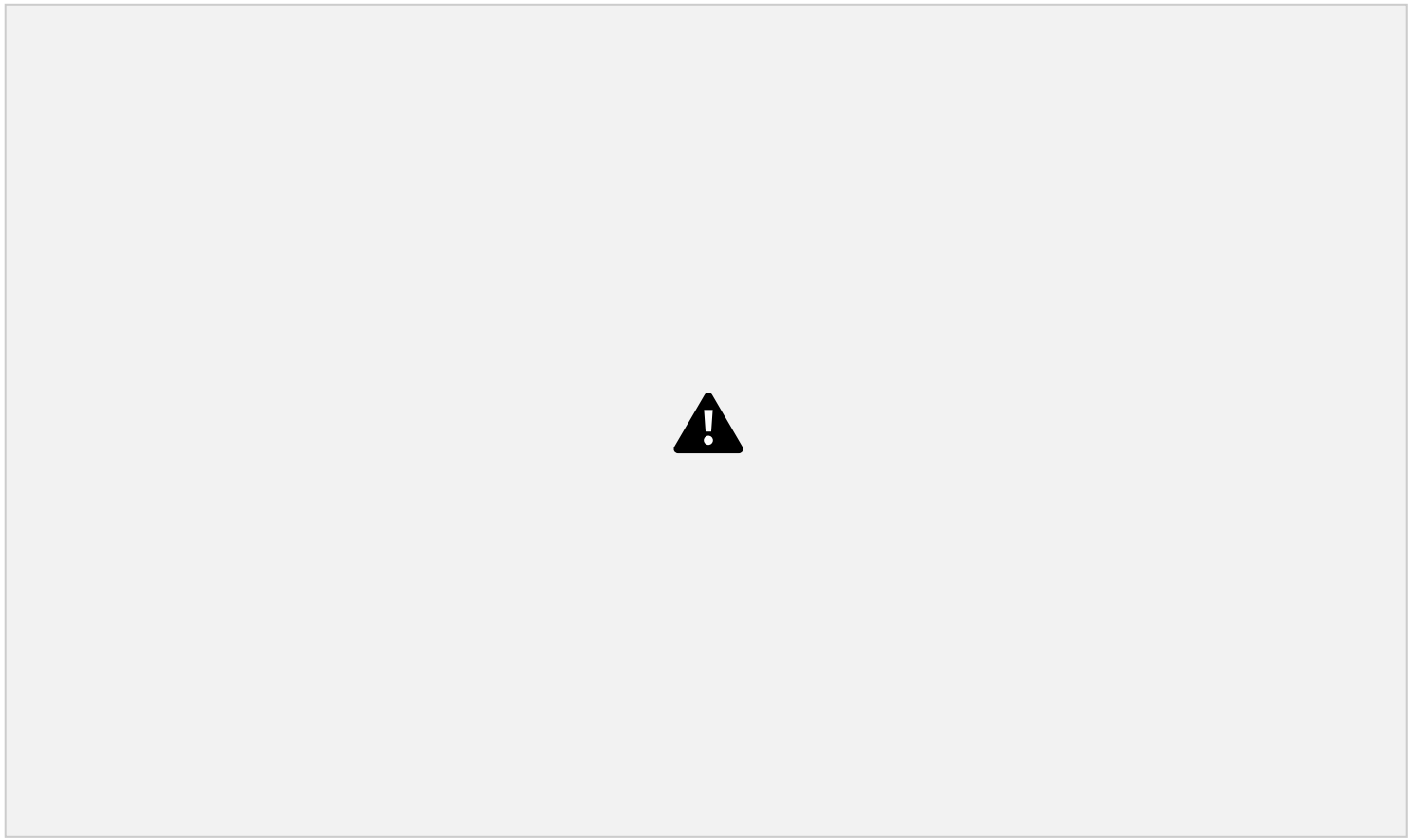
Network Standardization

- Who's Who in telecommunications •

Who's Who in international standards •

Who's Who in internet standards

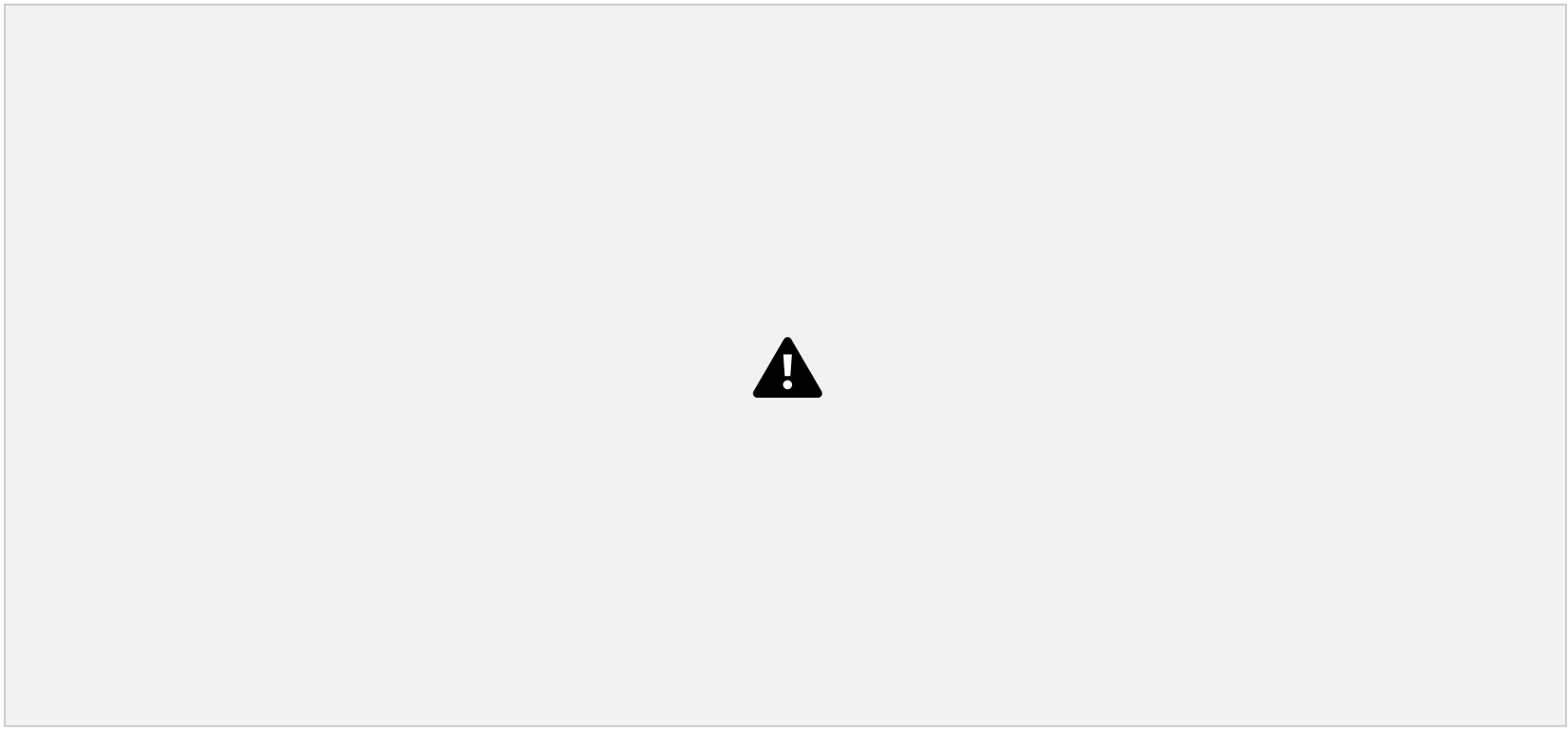
Who's Who in International Standards



(1) The 802 working groups. The important ones are marked with *.

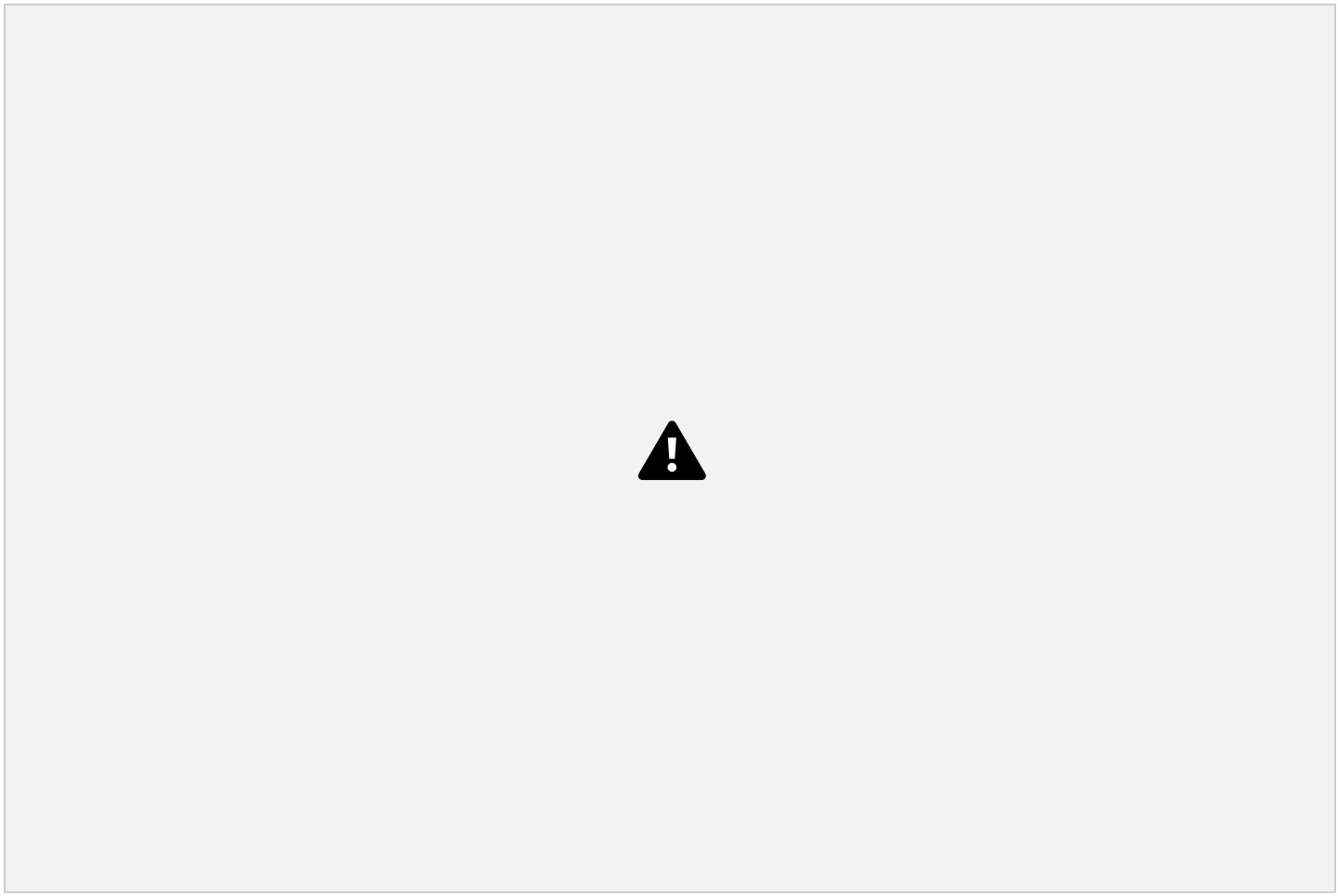
The ones marked with ↓ are hibernating. The one marked with † gave up and disbanded itself.

Who's Who in International Standards (2)



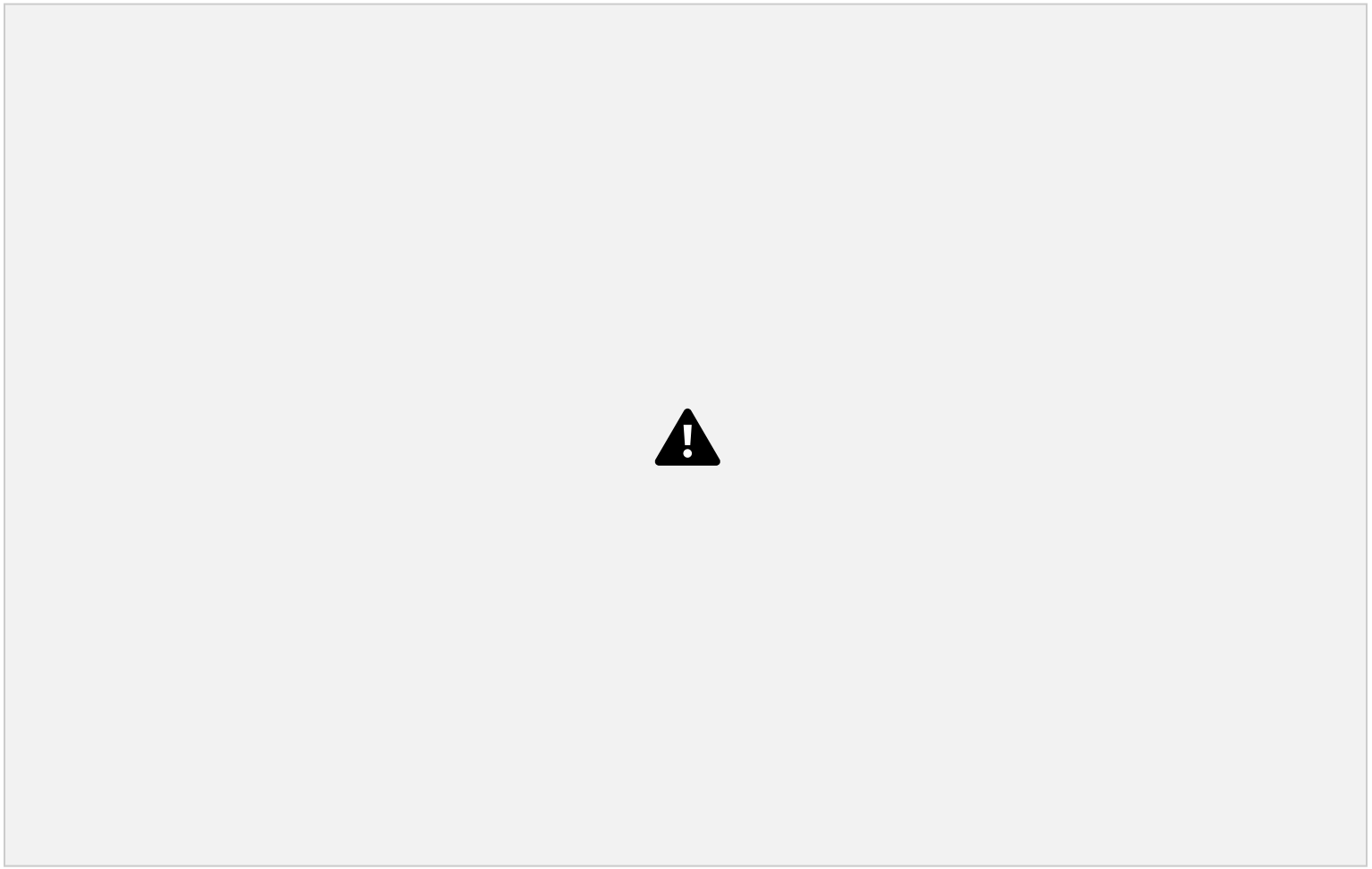
The 802 working groups. The important ones are marked with *. The ones marked with ↓ are hibernating. The one marked with † gave up and disbanded itself.

Metric Units (1)



The principal metric prefixes

Metric Units (2)



The principal metric prefixes

End

Chapter 1