Distributed Systems

EECE6029

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Multiple Processor Systems

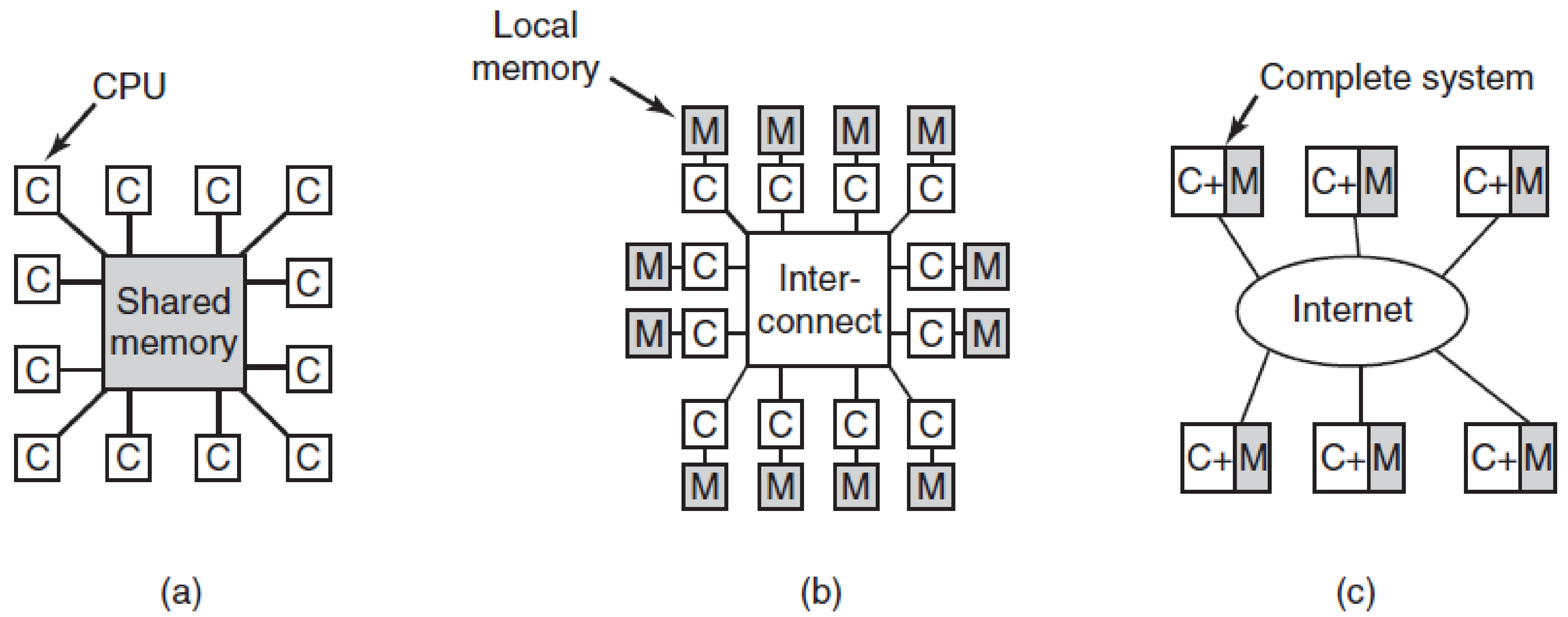
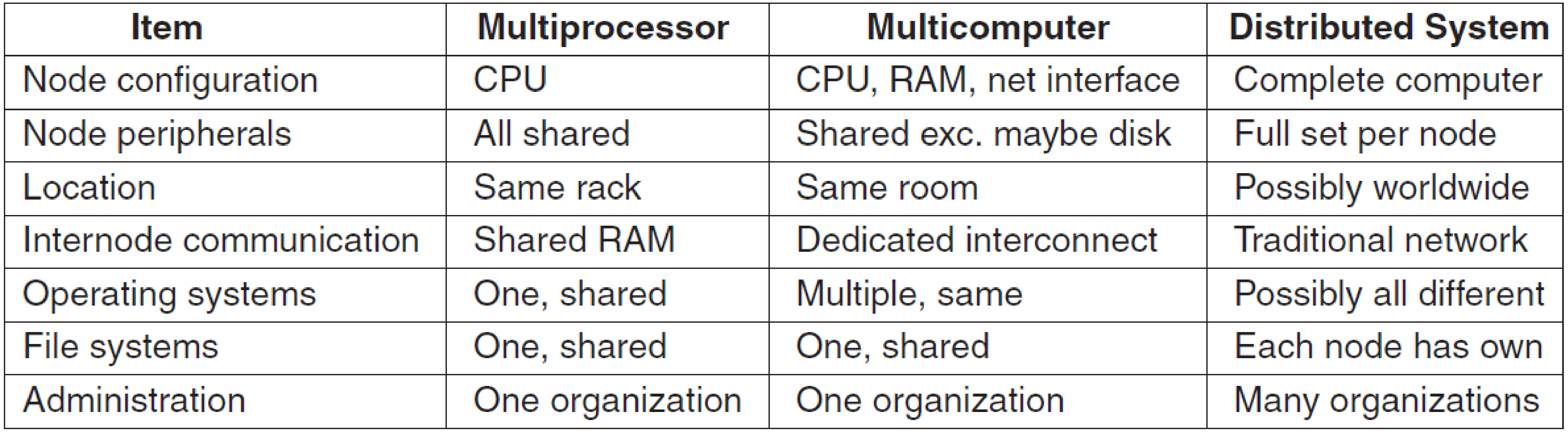


Figure 8-1. (a) A shared-memory multiprocessor. (b) A message-passing multi-computer. (c) A wide area distributed system.

Three Kinds of Multiple CPU Systems



Item	Multiprocessor	Multicomputer	Distributed System
Node configuration	CPU	CPU, RAM, net interface	Complete computer
Node peripherals	All shared	Shared exc. maybe disk	Full set per node
Location	Same rack	Same room	Possibly worldwide
Internode communication	Shared RAM	Dedicated interconnect	Traditional network
Operating systems	One, shared	Multiple, same	Possibly all different
File systems	One, shared	One, shared	Each node has own
Administration	One organization	One organization	Many organizations

Figure 8-26. Comparison of three kinds of multiple CPU systems.

Middleware over Operating Systems

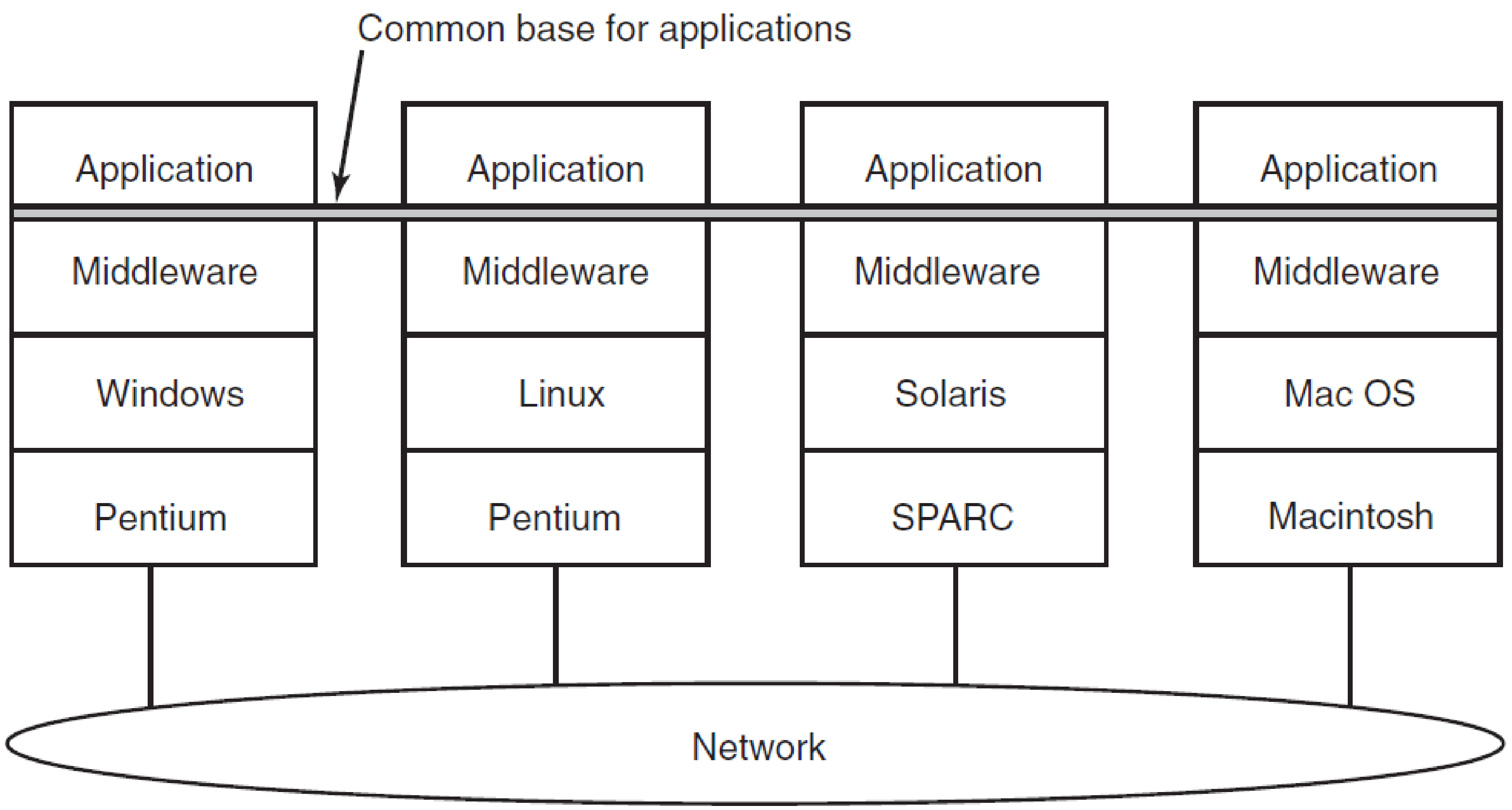
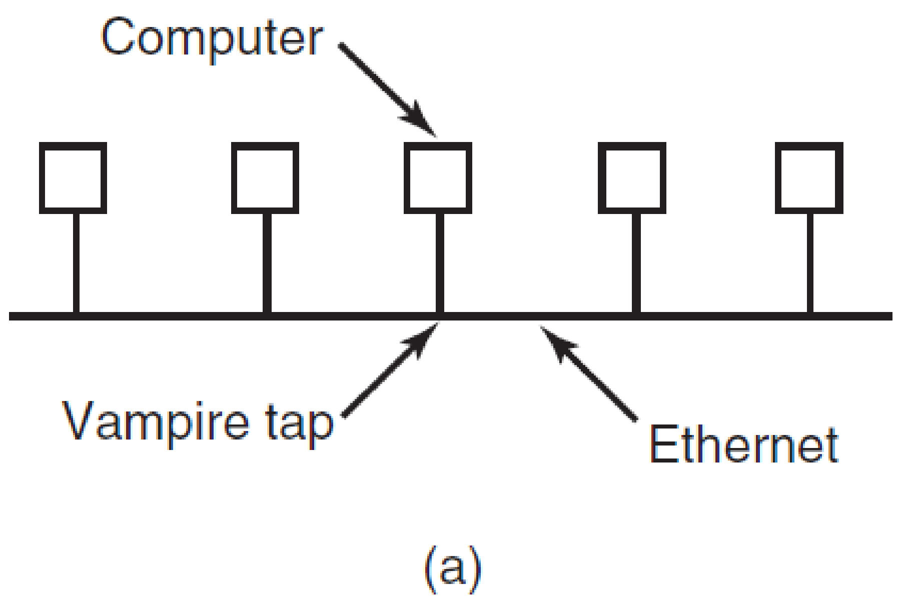


Figure 8-27. Positioning of middleware in a distributed system.

Ethernet



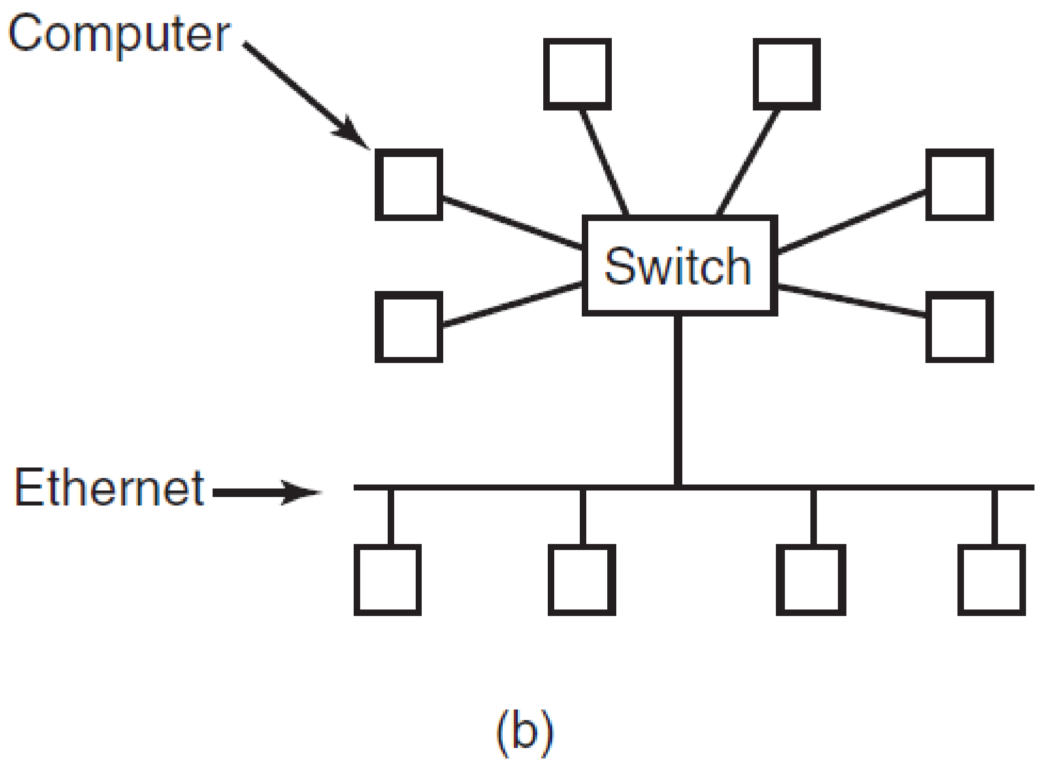


Figure 8-28. (a) Classic Ethernet. (b) Switched Ethernet.

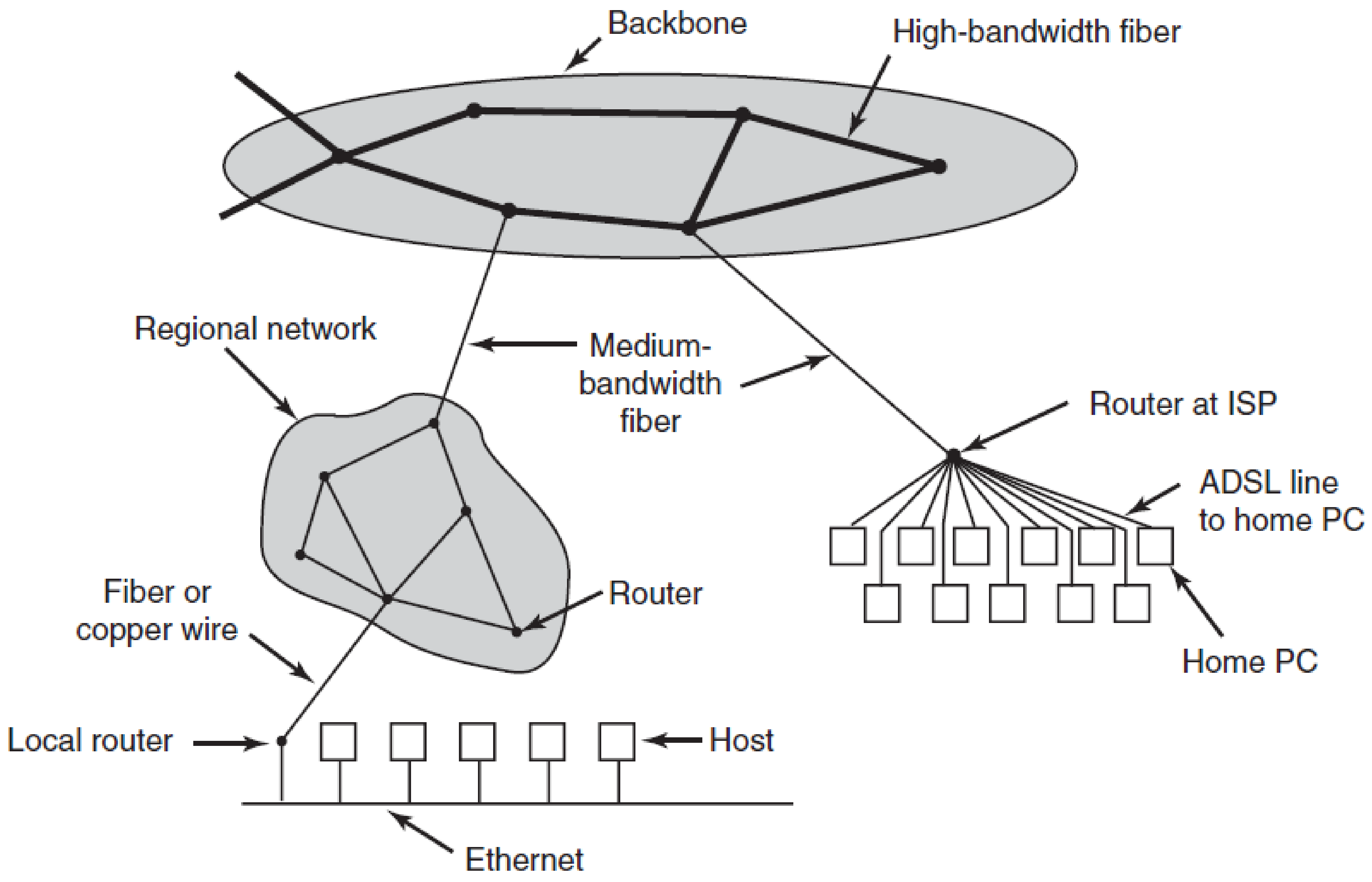
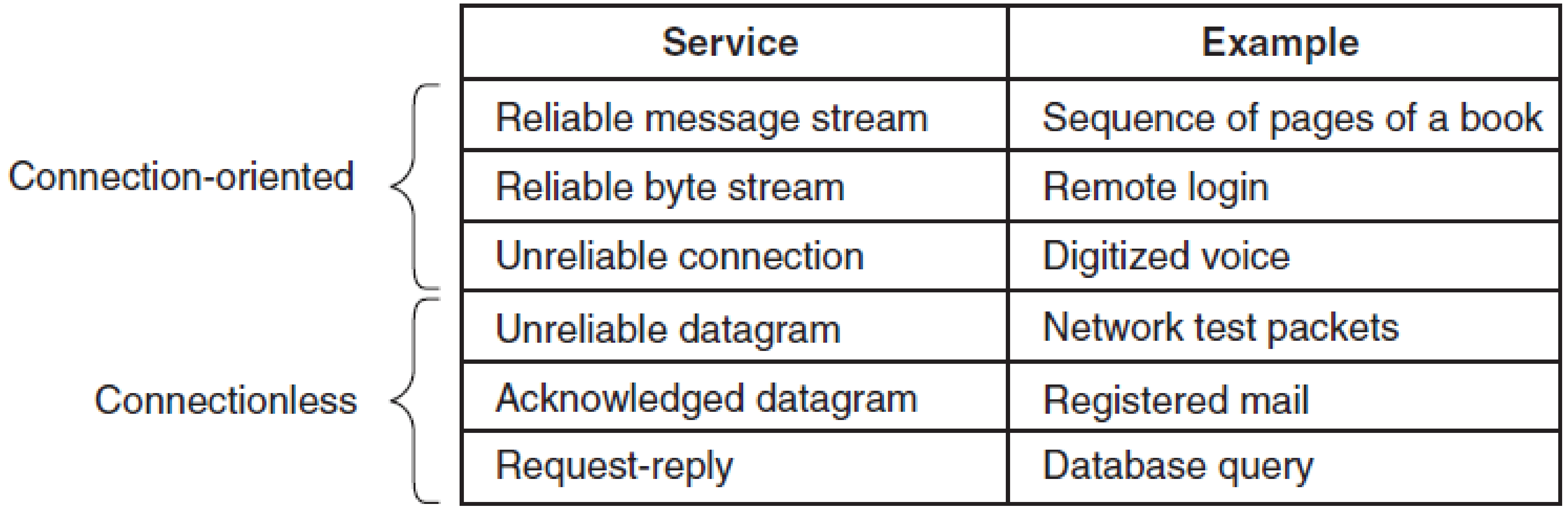


Figure 8-29. A portion of the Internet.

Network Service



	Service	Example
Connection-oriented	Reliable message stream	Sequence of pages of a book
	Reliable byte stream	Remote login
	Unreliable connection	Digitized voice
Connectionless	Unreliable datagram	Network test packets
	Acknowledged datagram	Registered mail
	Request-reply	Database query

Figure 8-30. Six different types of network service.

Protocol Headers

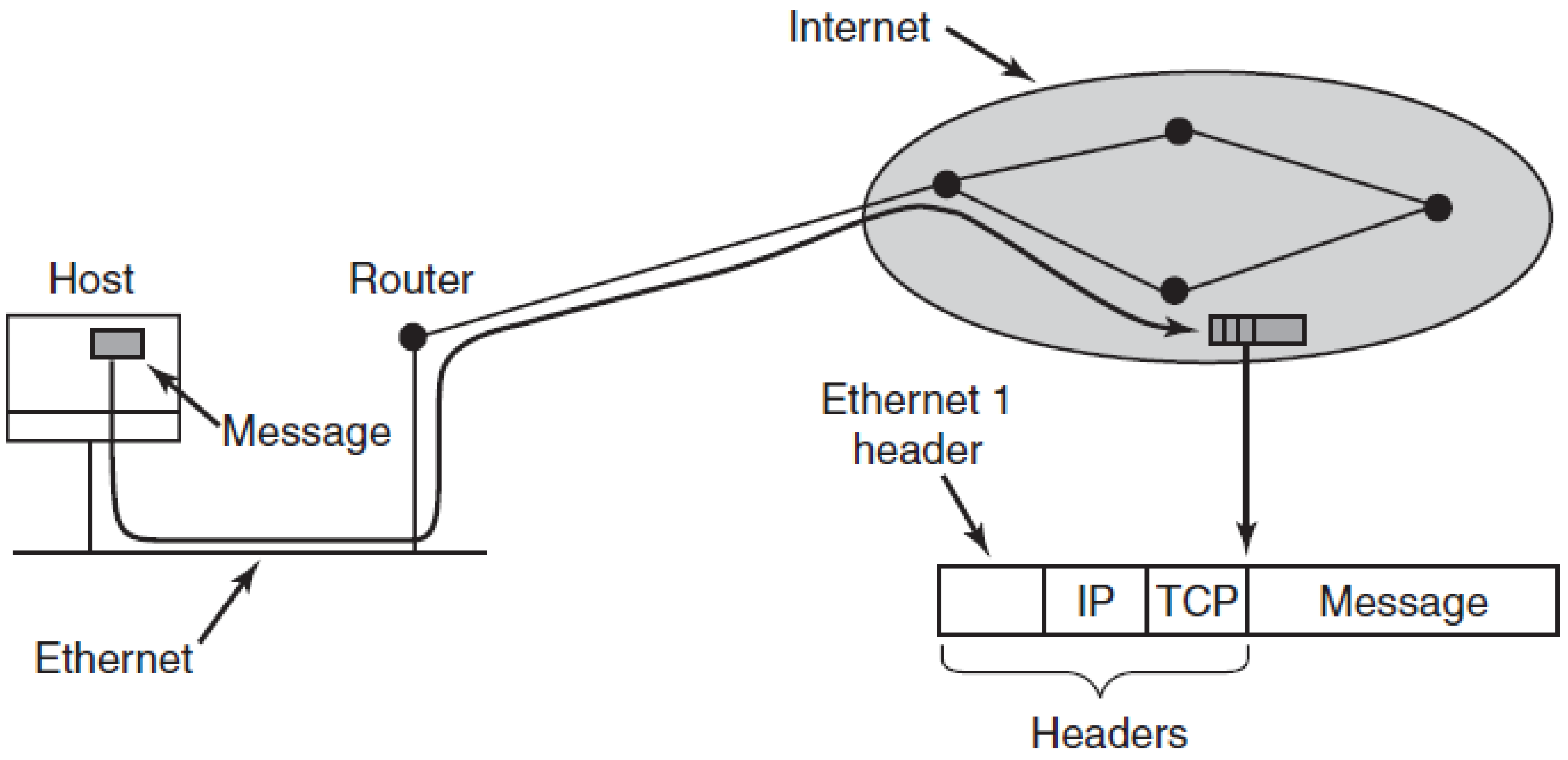


Figure 8-31. Accumulation of packet headers.

Hyperlinked Documents on the Web

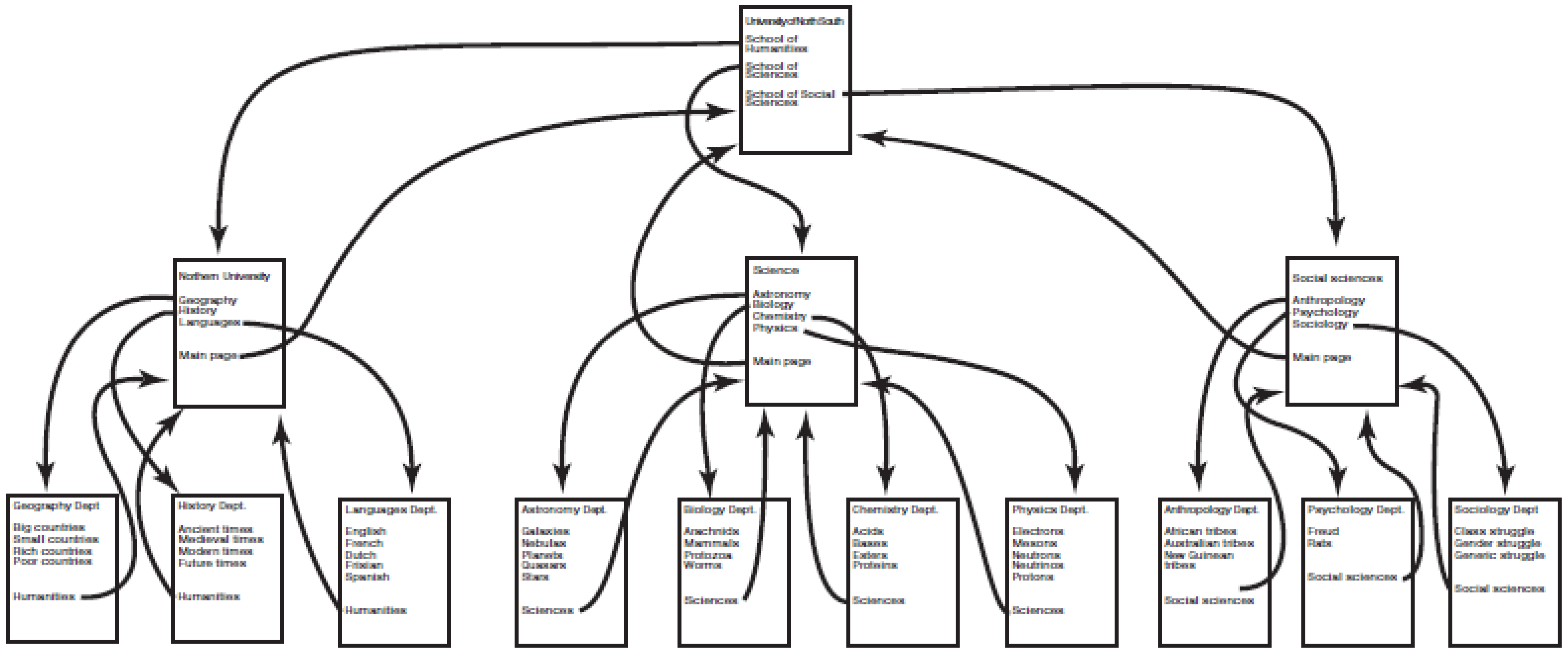


Figure 8-32. The Web is a big directed graph of documents.

File System-Based Middleware

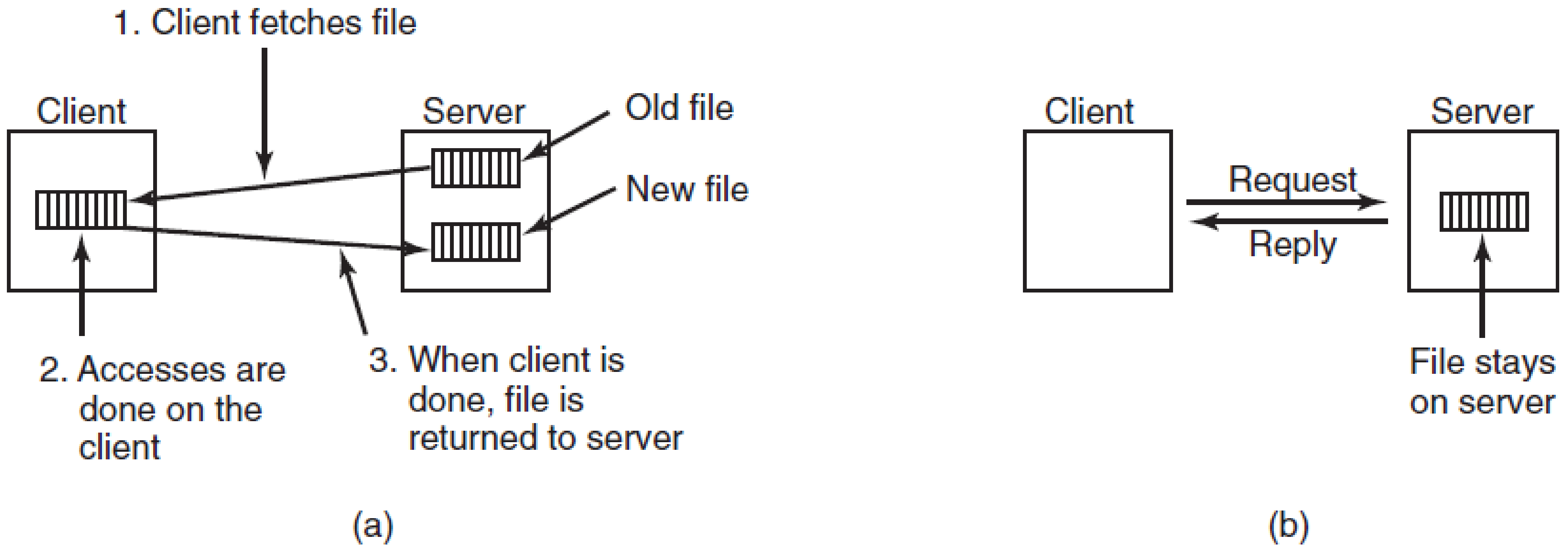
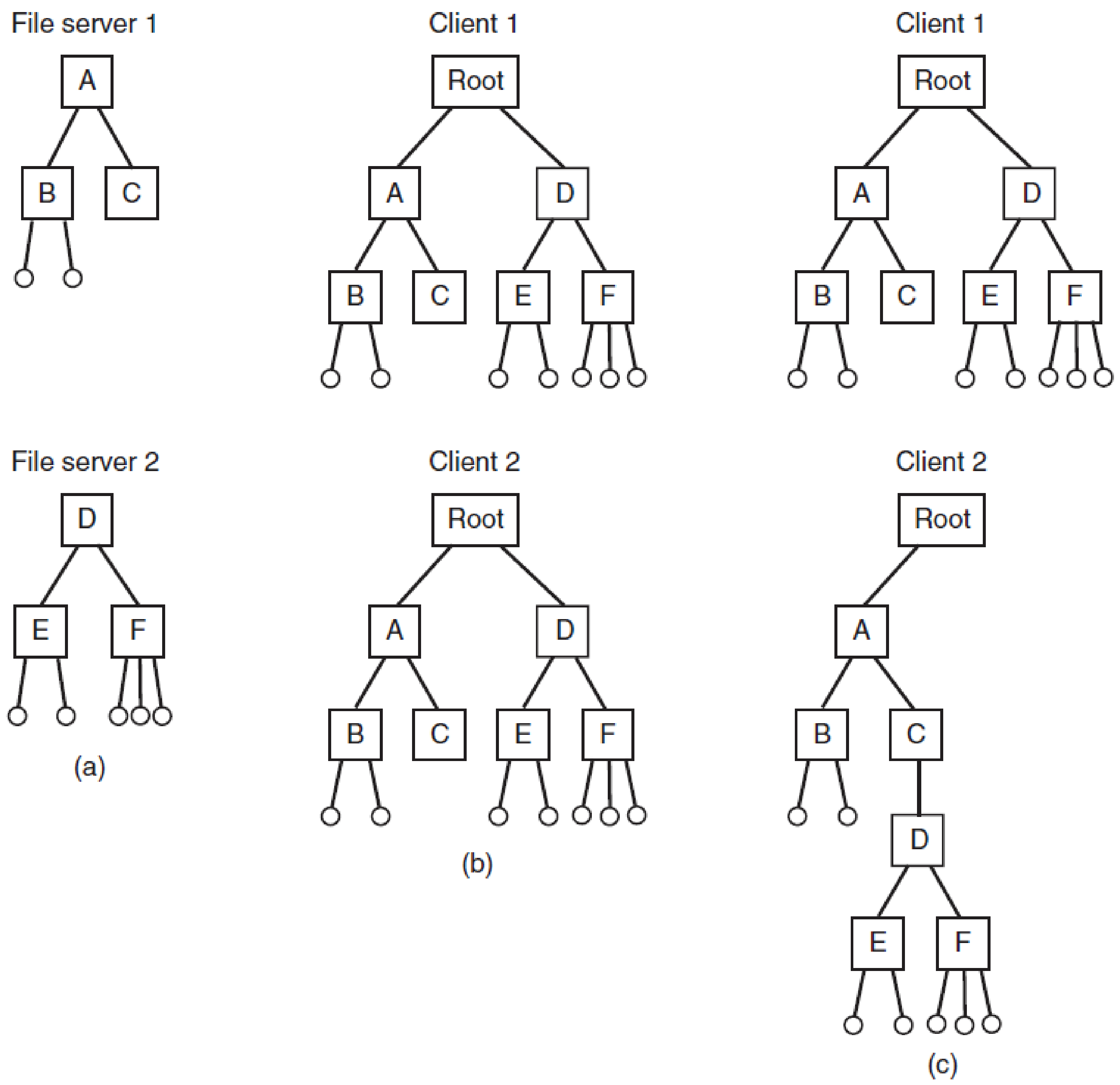


Figure 8-33. (a) The upload/download model. (b) The remote-access model.


File server 1
A
B
C
File server 2
D
E
F
(a)
Client 1
Root
A
D
B
C
E
F
Client 2
Root
A
D
B
C
E
F
(b)
Client 1
Root
A
D
B
C
E
F
Client 2
Root
A
B
C
D
E
F
(c)

Naming Transparency

- Three common approaches to file and directory naming in a distributed system:
  - Machine + path naming, such as /machine/path or machine:path.
  - Mounting remote file systems onto the local file hierarchy.
  - A single name space that looks the same on all machines.

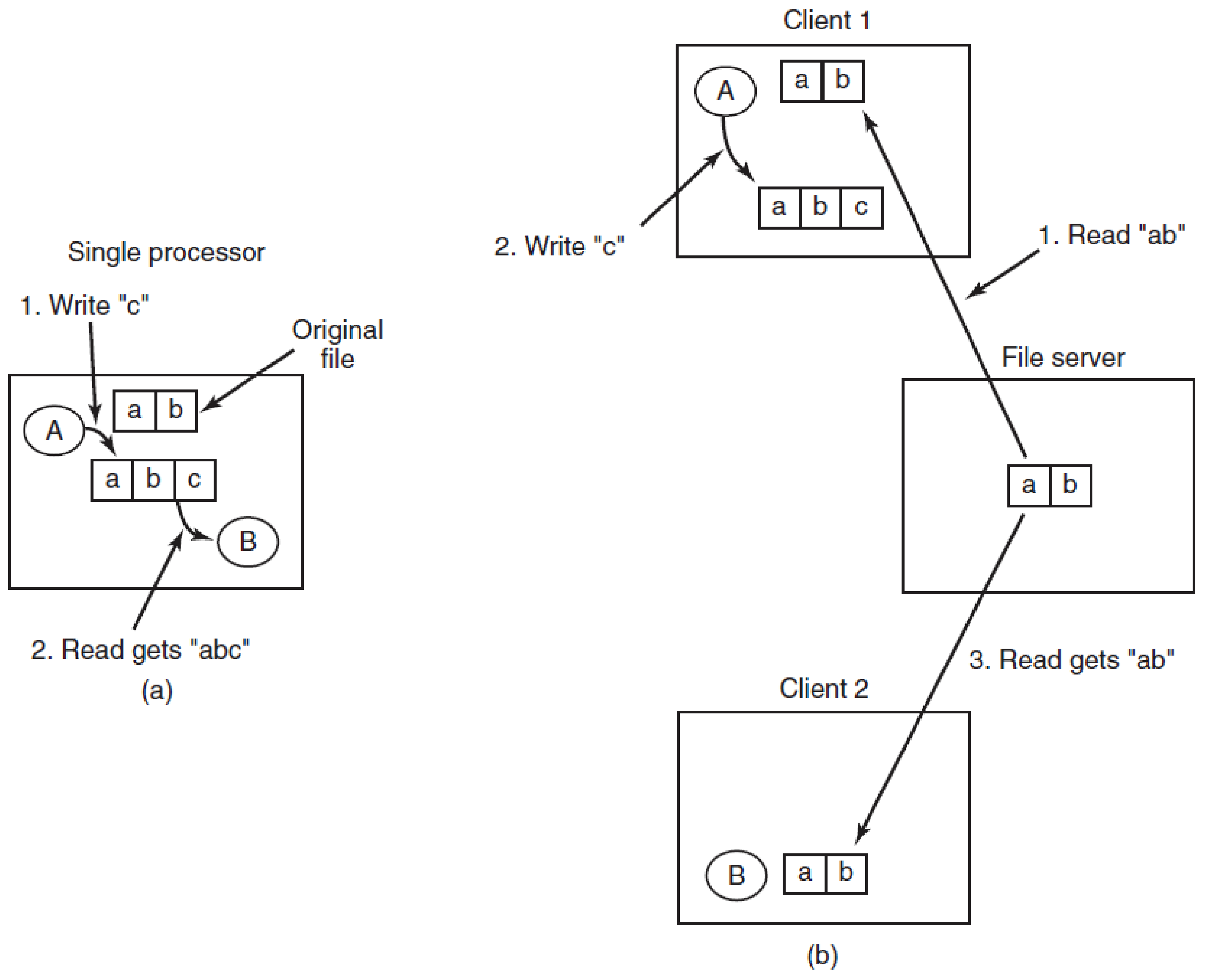


Figure 8-35. (a) Sequential consistency. (b) In a distributed system with caching, reading a file may return an obsolete value.

CORBA

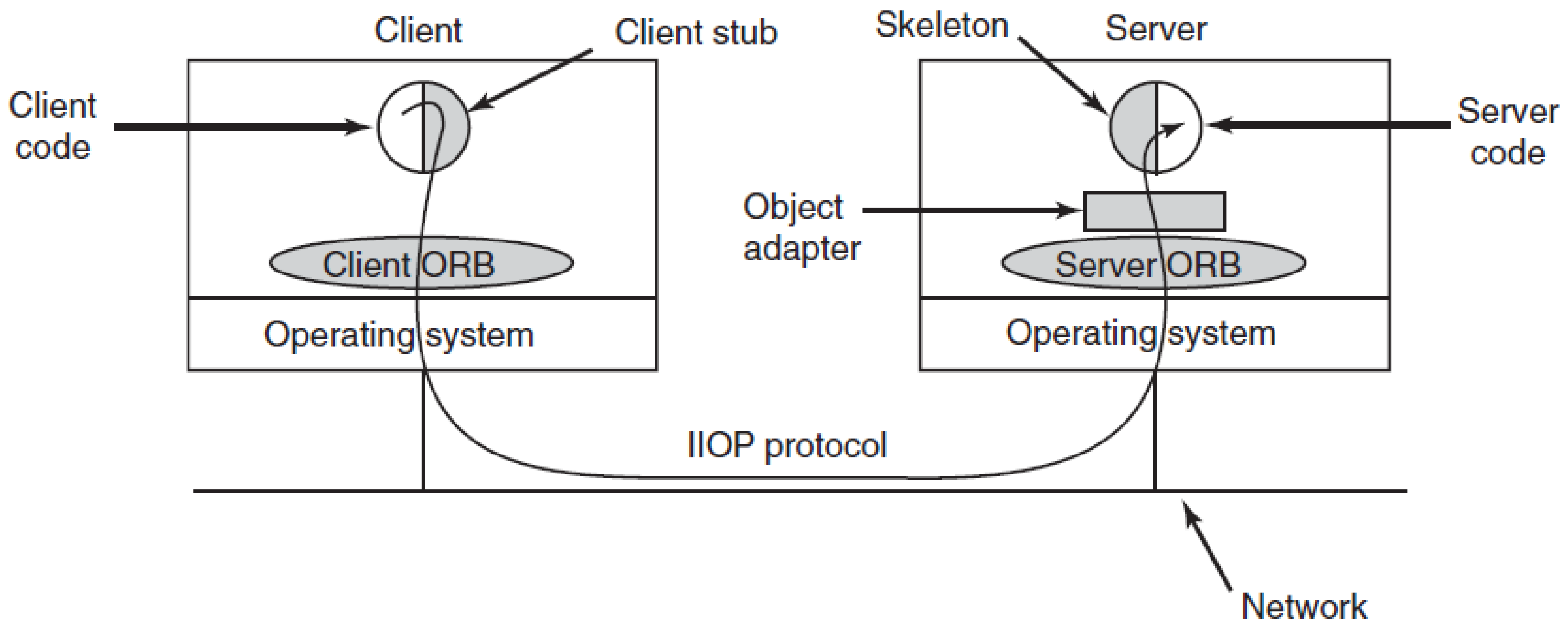


Figure 8-36. The main elements of a distributed system based on CORBA. The CORBA parts are shown in gray.

Coordination-Based Middleware Linda

- A system for communication and synchronization
- Independent processes communicate via an abstract tuple space
- A tuple is a structure of one or more fields, each of which is a value of some type supported by the base language

```
("abc", 2, 5)
("matrix-1", 1, 6, 3.14)
("family", "is-sister", "Stephany", "Roberta")
```

Figure 8-37. Three Linda tuples.

Matching Tuples in the Tuple Space

- A match occurs if the following three conditions are all met:
  - The template and the tuple have the same number of fields.
  - The types of the corresponding fields are equal.
  - Each constant or variable in the template matches its tuple field.
- out(“abc”,2,5); also eval
- in(“abc”,2,?i); blocks and removes a matching tuple.
- read(“abc”,2,?i); blocks but does not remove the tuple to read.

The Publish/Subscribe Architecture

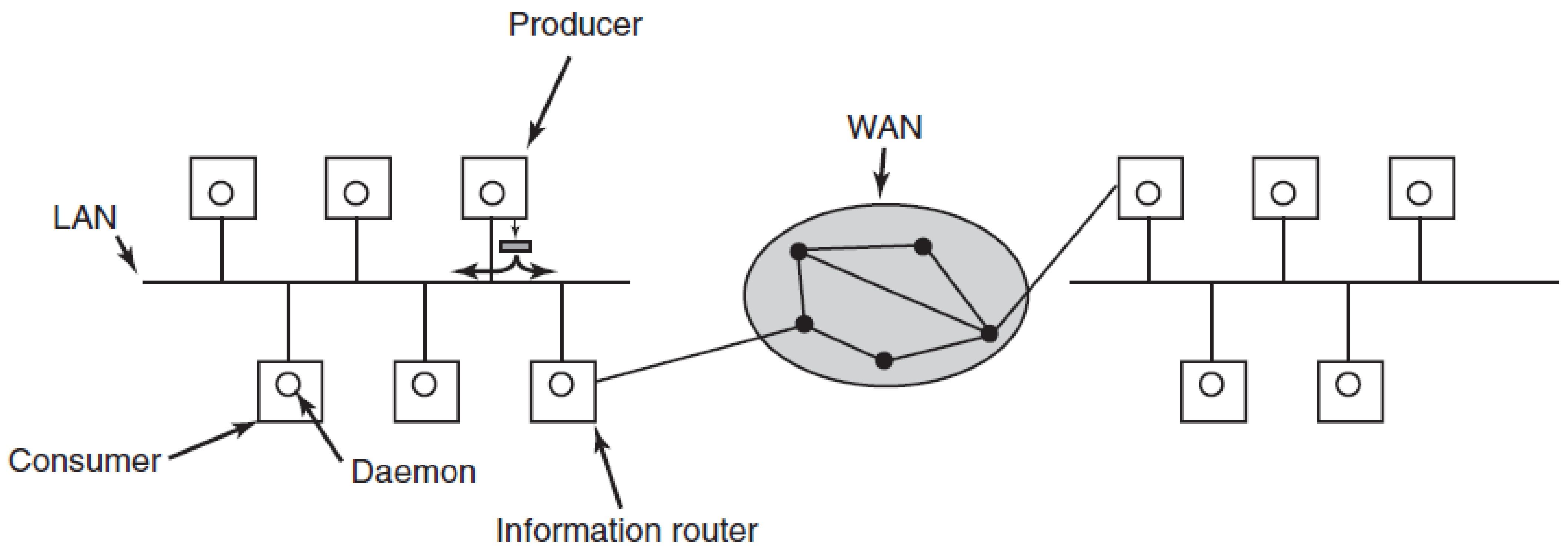


Figure 8-38. The publish/subscribe architecture.