Chapter 4

The Medium Access Control Sublayer

The Channel Allocation Problem

- Static Channel Allocation in LANs and MANs

- Dynamic Channel Allocation in LANs and MANs

Dynamic Channel Allocation in LANs and MANs

1. Station Model.

2. Single Channel Assumption.

3. Collision Assumption.
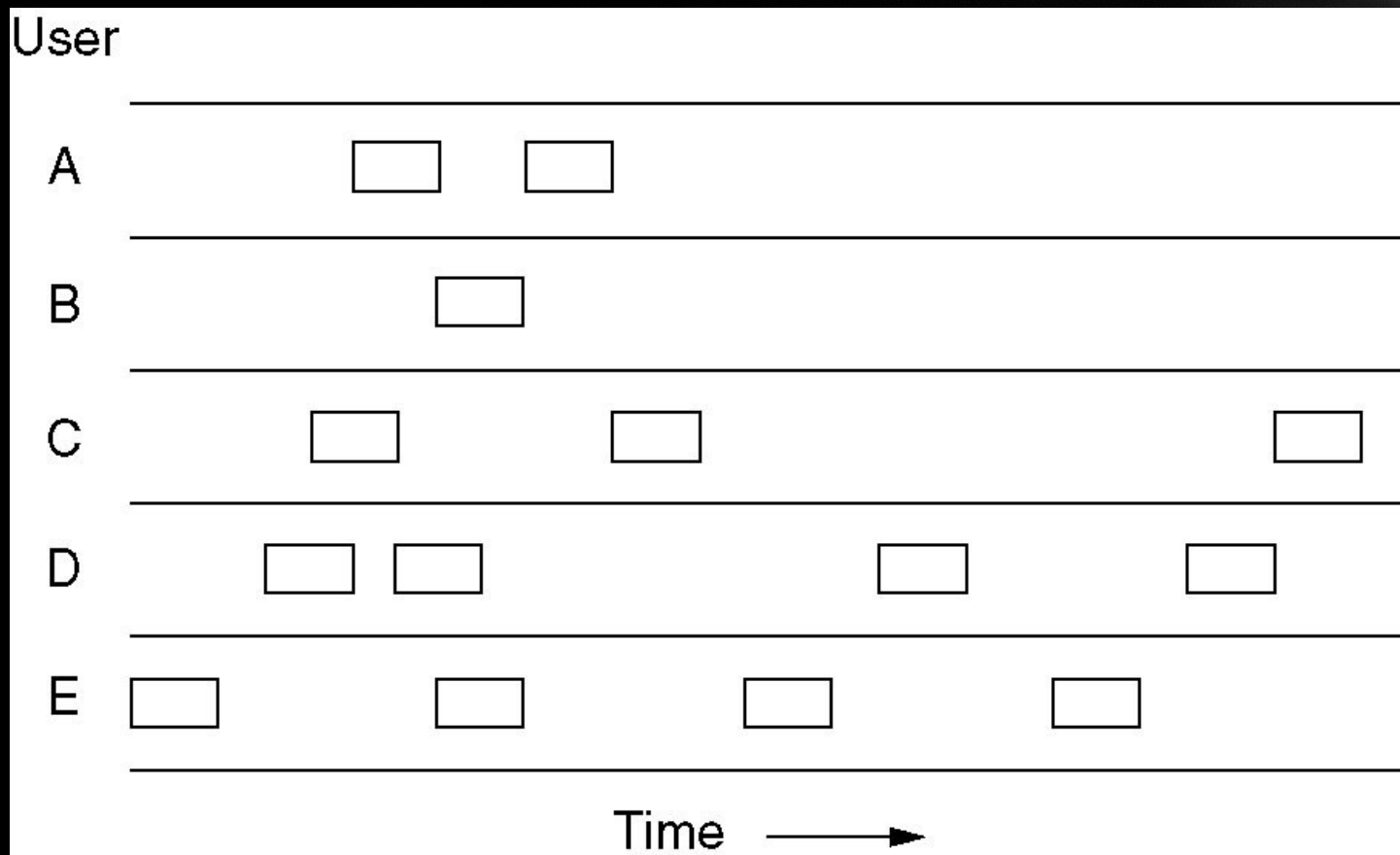
4. (a) Continuous Time.
   (b) Slotted Time.

5. (a) Carrier Sense.
   (b) No Carrier Sense.

Multiple Access Protocols

- ALOHA
- Carrier Sense Multiple Access Protocols
- Collision-Free Protocols
- Limited-Contention Protocols
- Wavelength Division Multiple Access Protocols
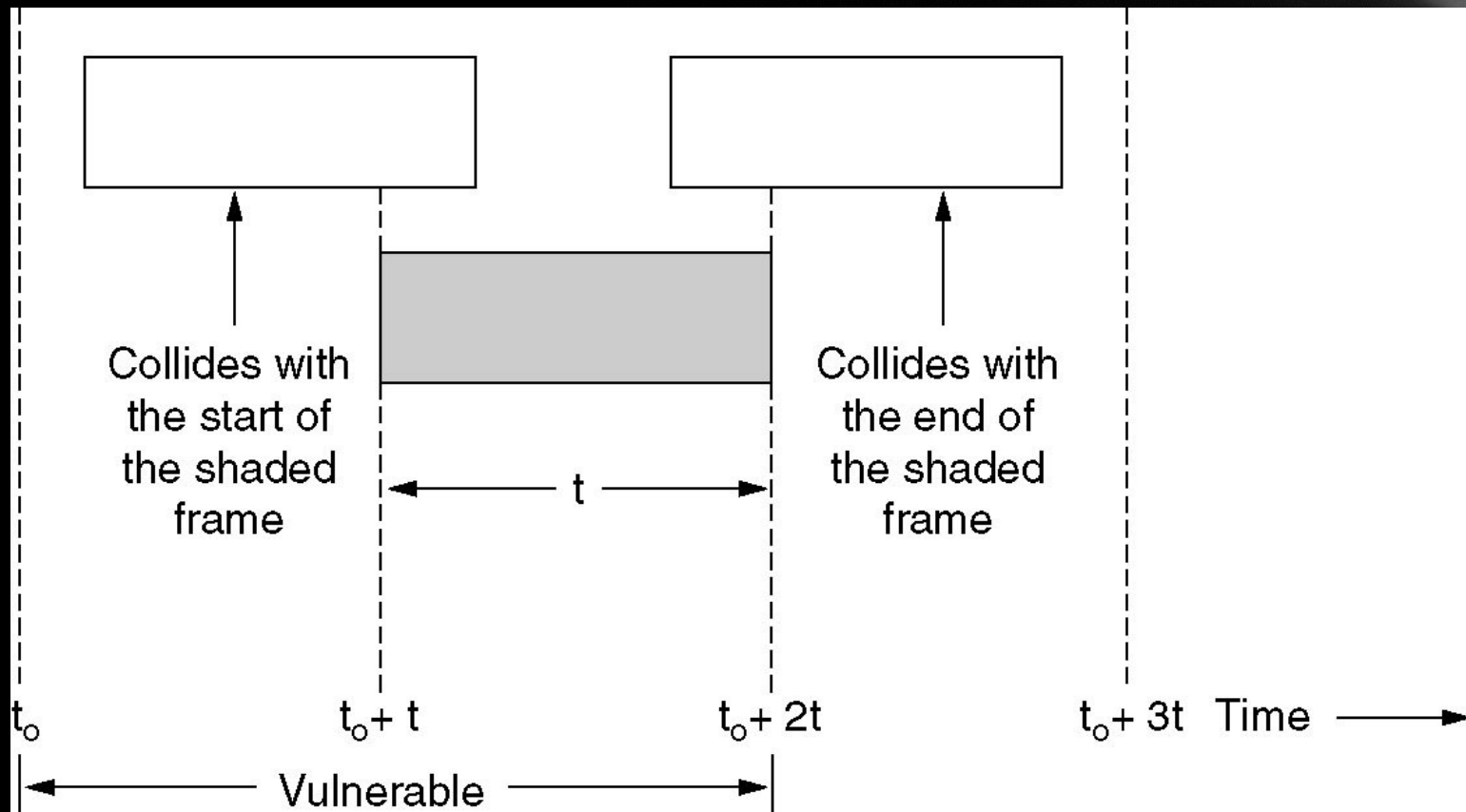- Wireless LAN Protocols

Pure ALOHA

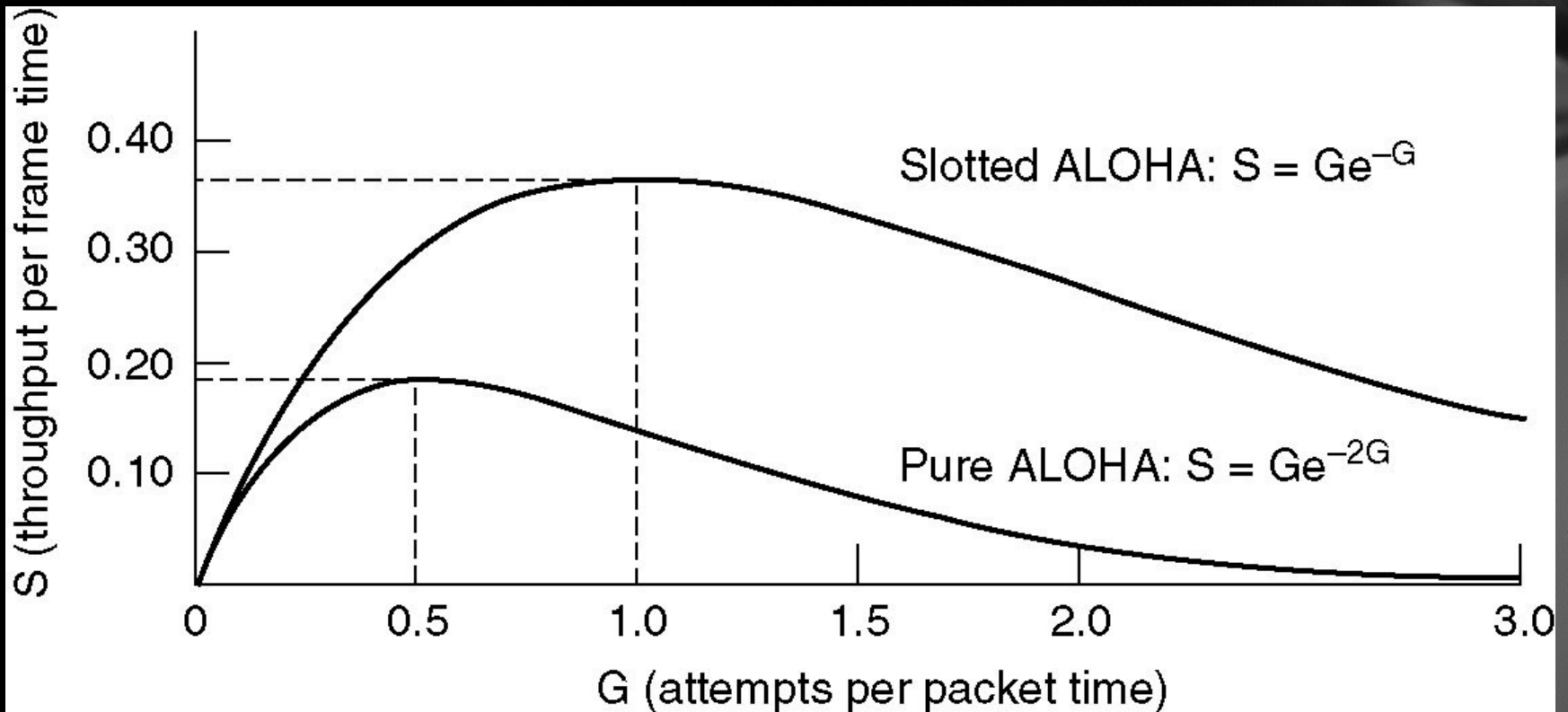In pure ALOHA, frames are transmitted at completely arbitrary times.

Pure ALOHA (2)

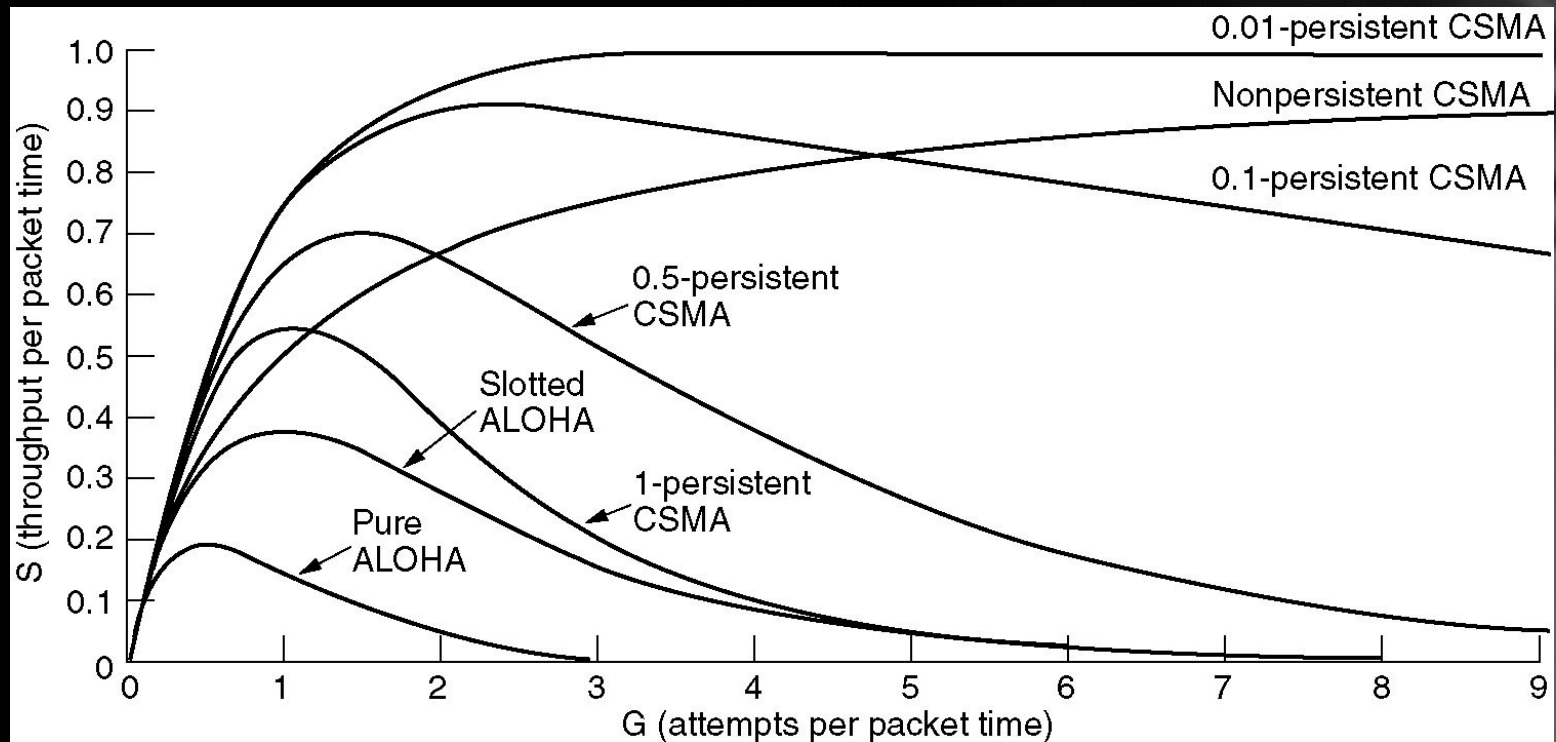Vulnerable period for the shaded frame.

Pure ALOHA (3)

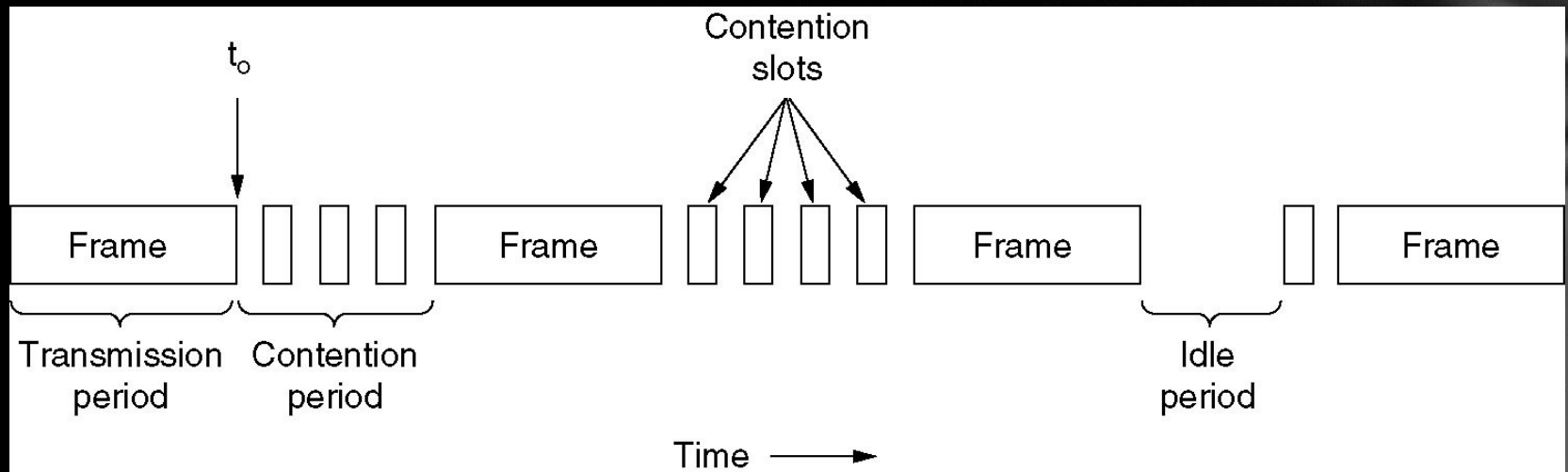Throughput versus offered traffic for ALOHA systems.
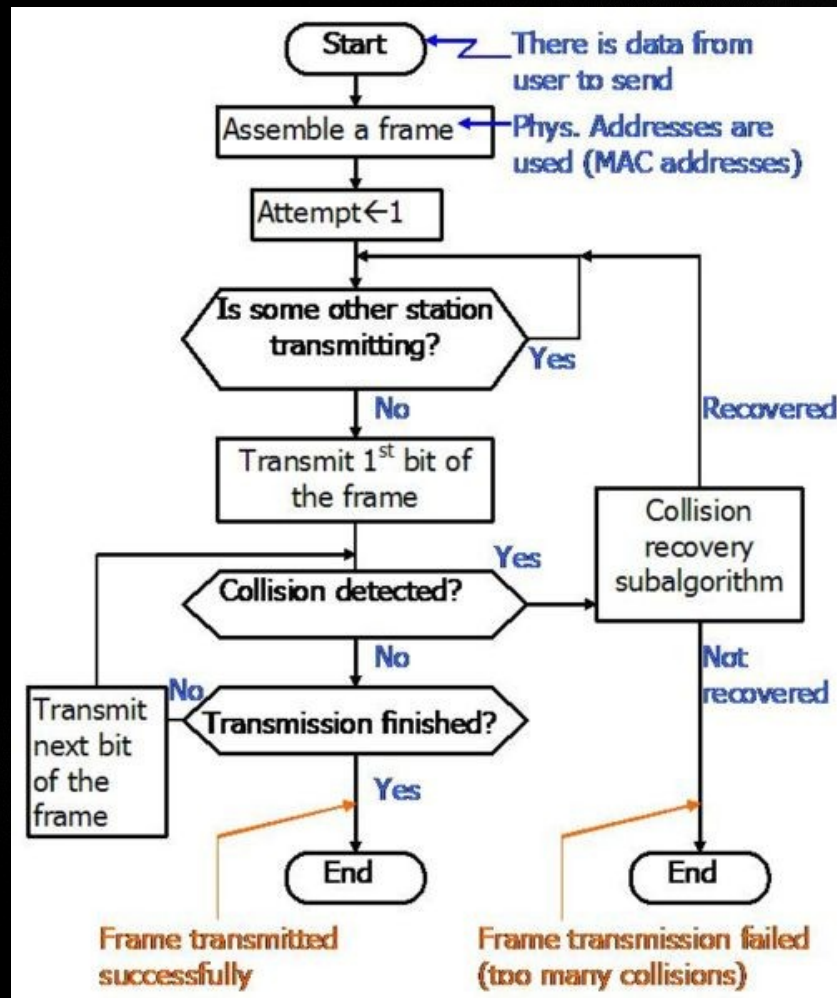
Persistent and Nonpersistent CSMA

Comparison of the channel utilization versus load for various random access protocols.

CSMA with Collision Detection

CSMA/CD can be in one of three states: contention, transmission, or idle.
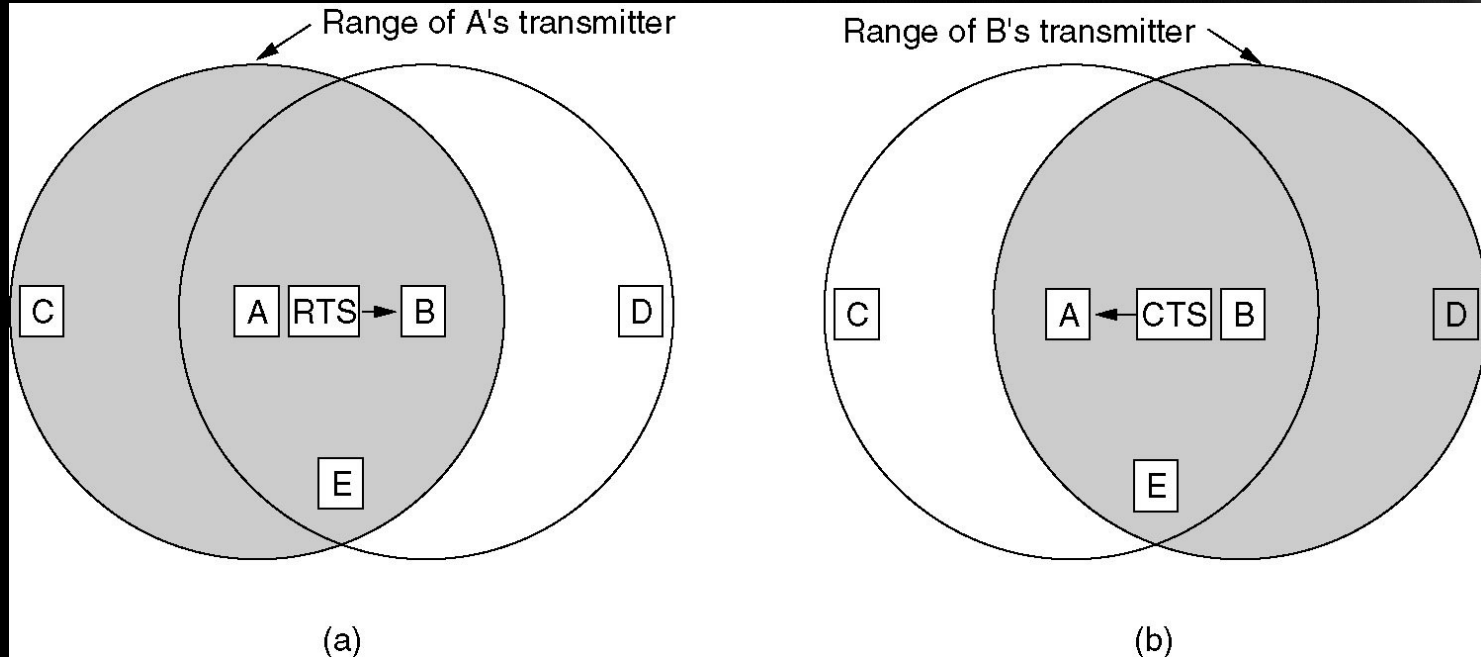
CSMA-CD Algorithm Flow Chart
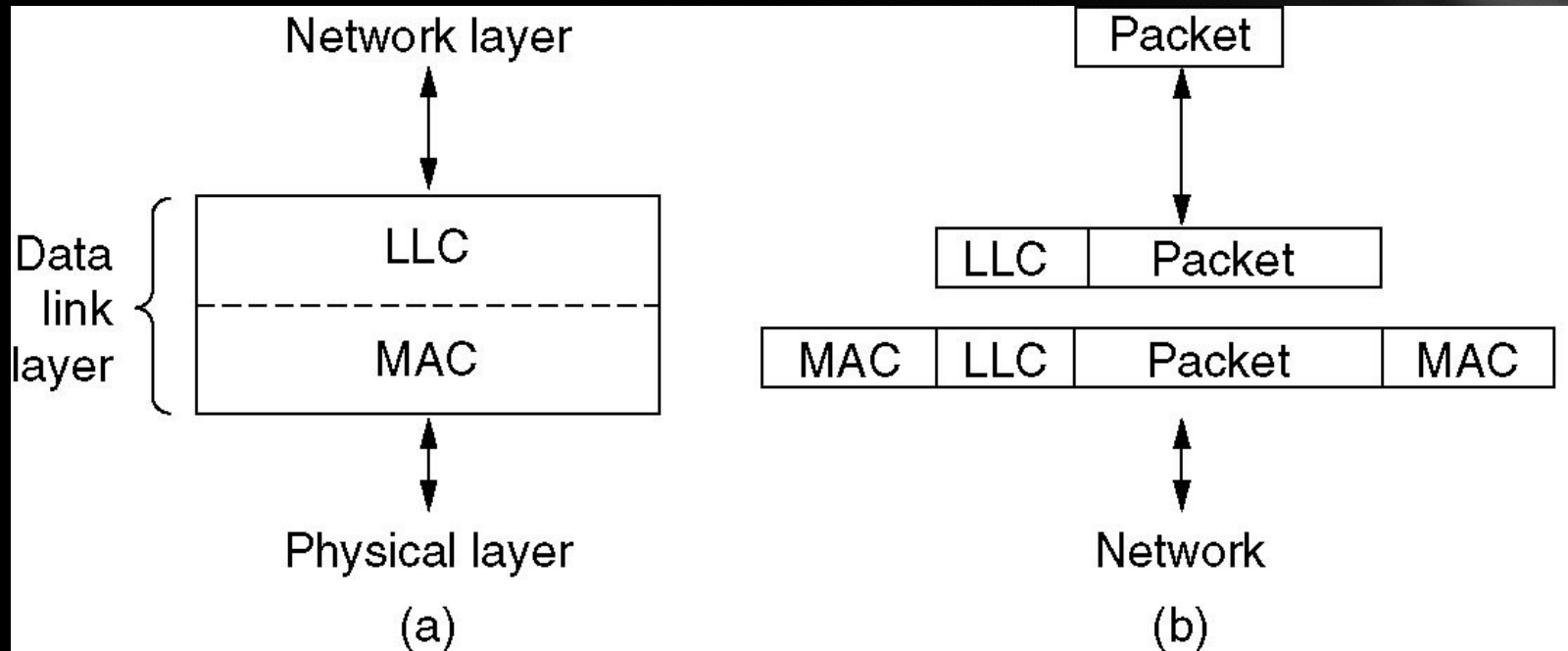
Wireless LAN Protocols

A wireless LAN. (a) A transmitting. (b) B transmitting.

Wireless LAN Protocols (2)

The MACA protocol. (a) A sending an RTS to B.

(b) B responding with a CTS to A.
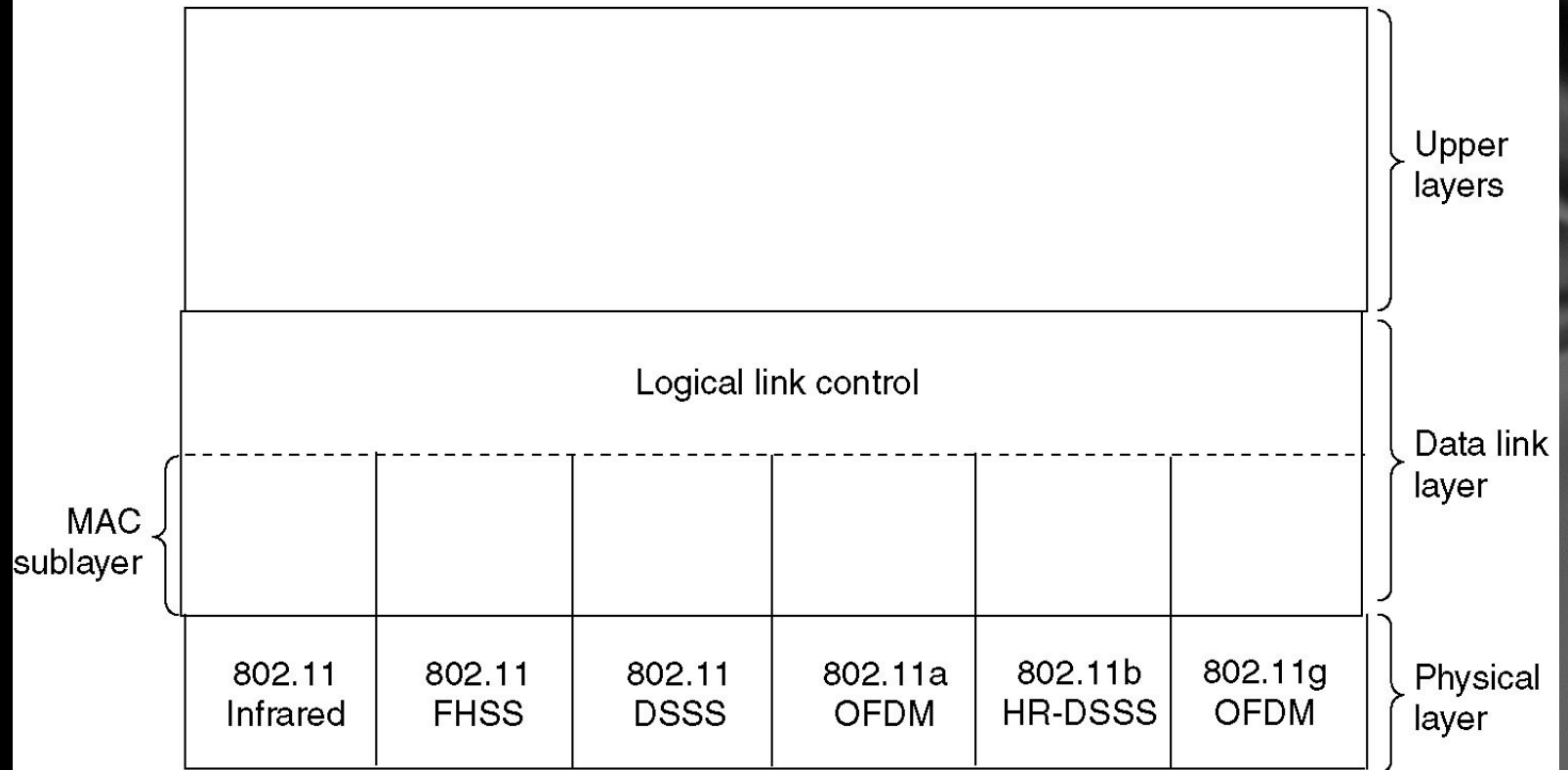
IEEE 802.2: Logical Link Control

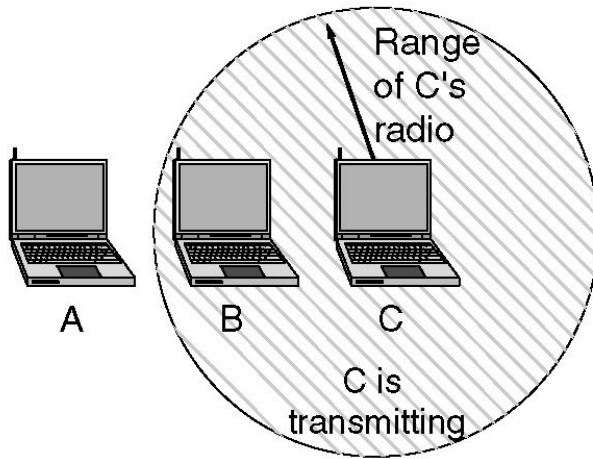(a) Position of LLC. (b) Protocol formats.

Wireless LANs

- The 802.11 Protocol Stack
- The 802.11 Physical Layer
- The 802.11 MAC Sublayer Protocol
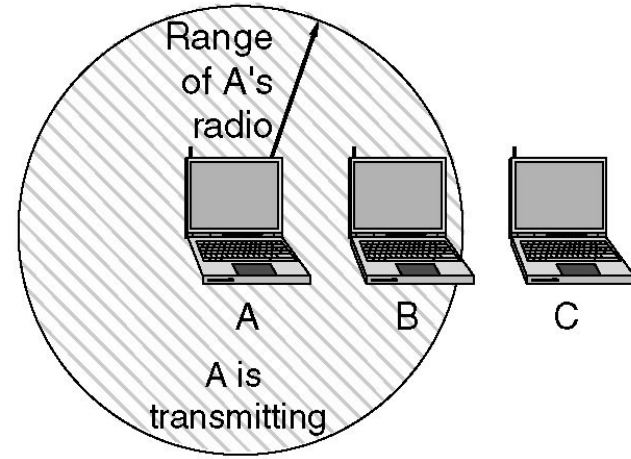- The 802.11 Frame Structure
- Services

Th

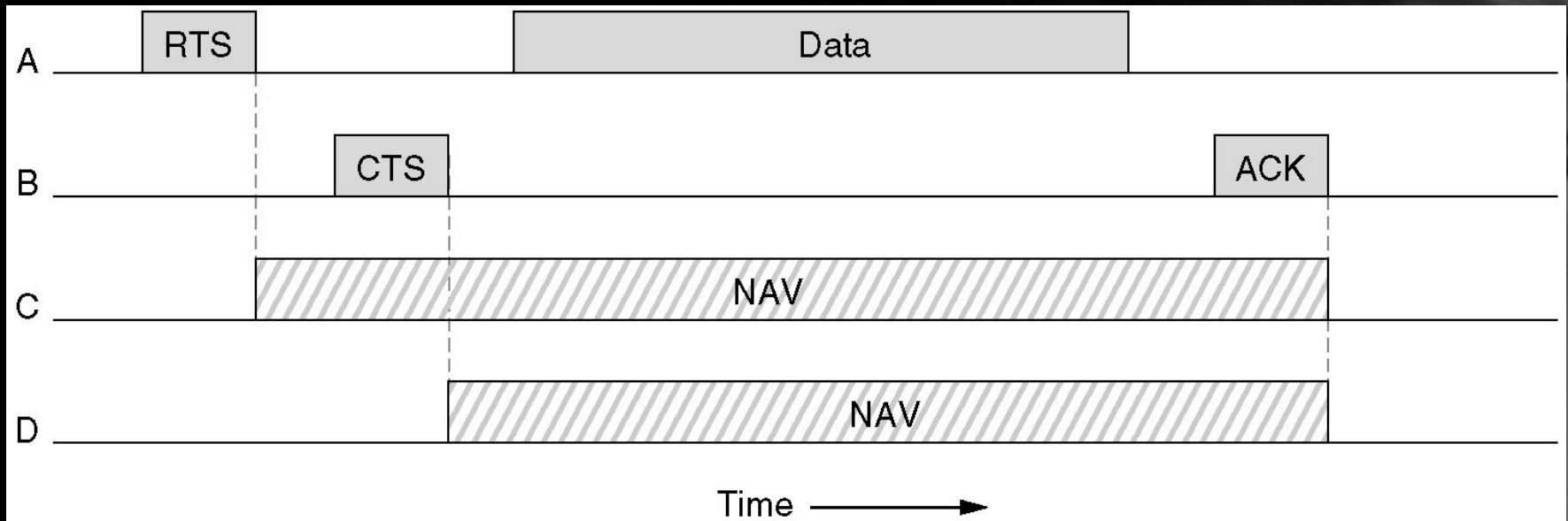|						Upper layers
Logical link control						Data link layer
MAC sublayer						
802.11 Infrared	802.11 FHSS	802.11 DSSS	802.11a OFDM	802.11b HR-DSSS	802.11g OFDM	Physical layer

The 802.11 MAC Sublayer Protocol

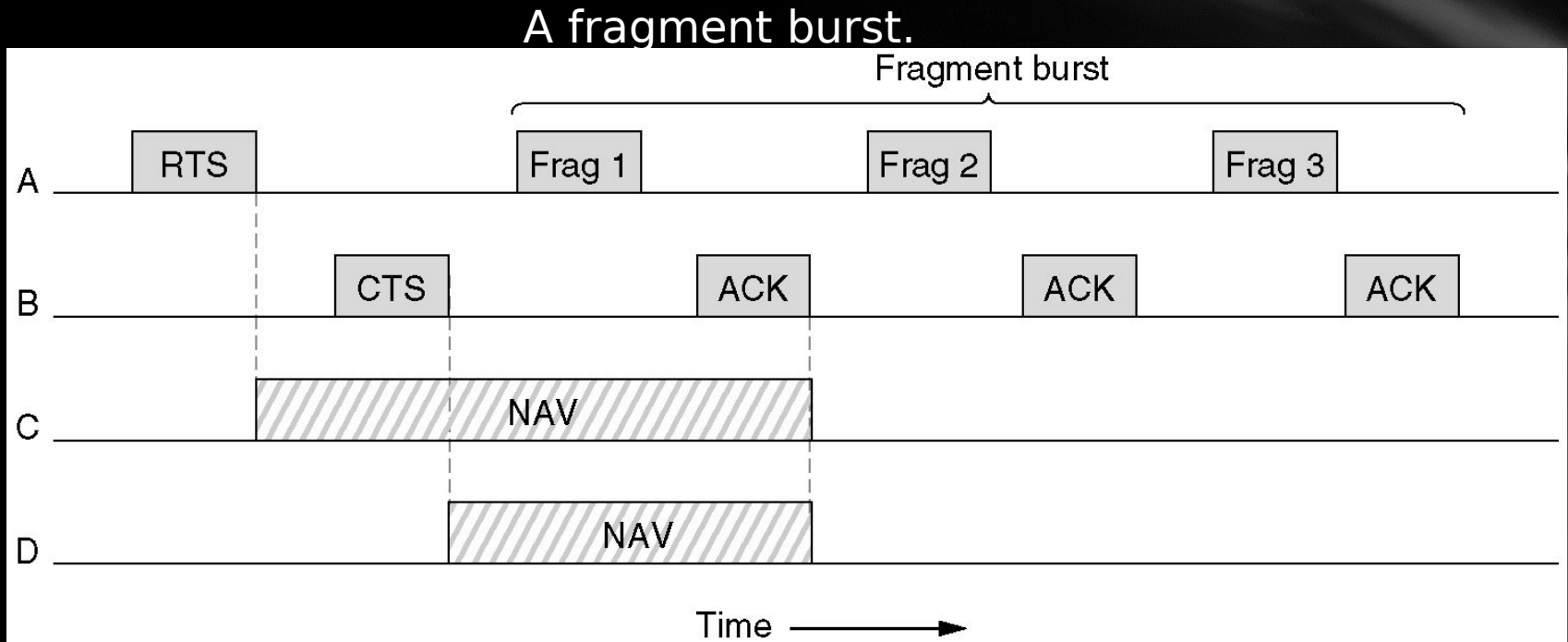

(a) The hidden station problem.

(b) The exposed station problem.

The 802.11 MAC Sublayer Protocol (2)

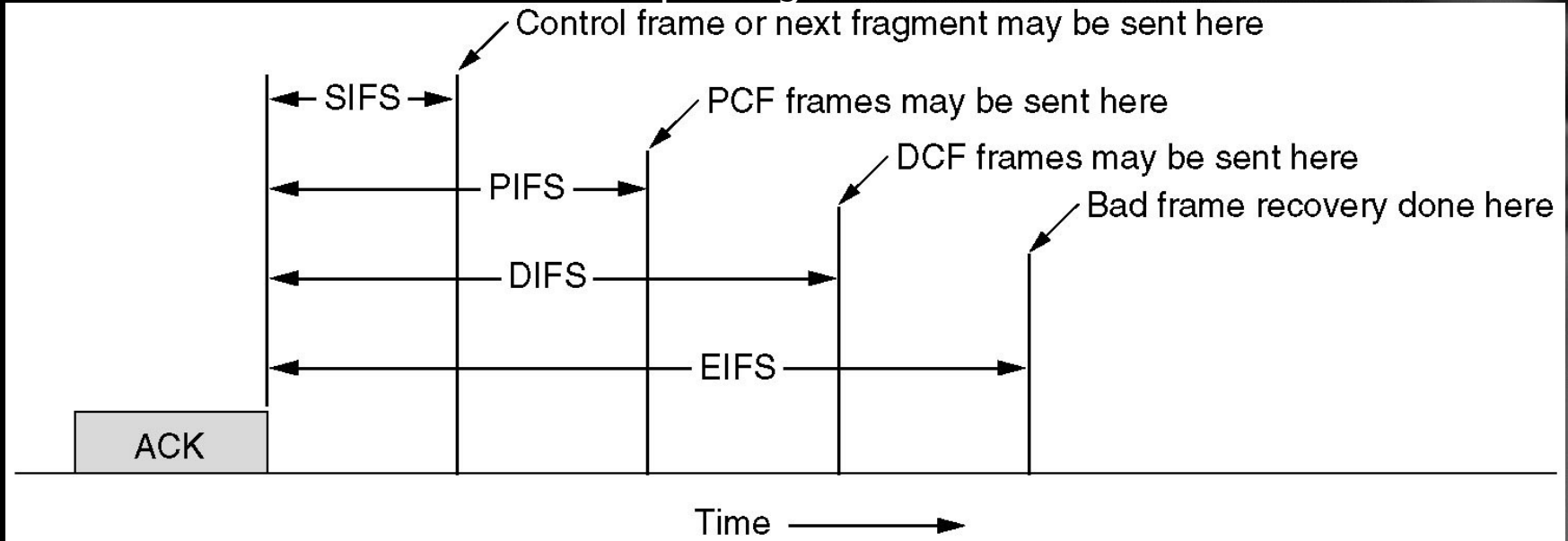The use of virtual channel sensing using CSMA/CA.

The 802.11 MAC Sublayer Protocol (3)

A fragment burst.

The 802.11 MAC Sublayer Protocol (4)

Interframe spacing in 802.11.

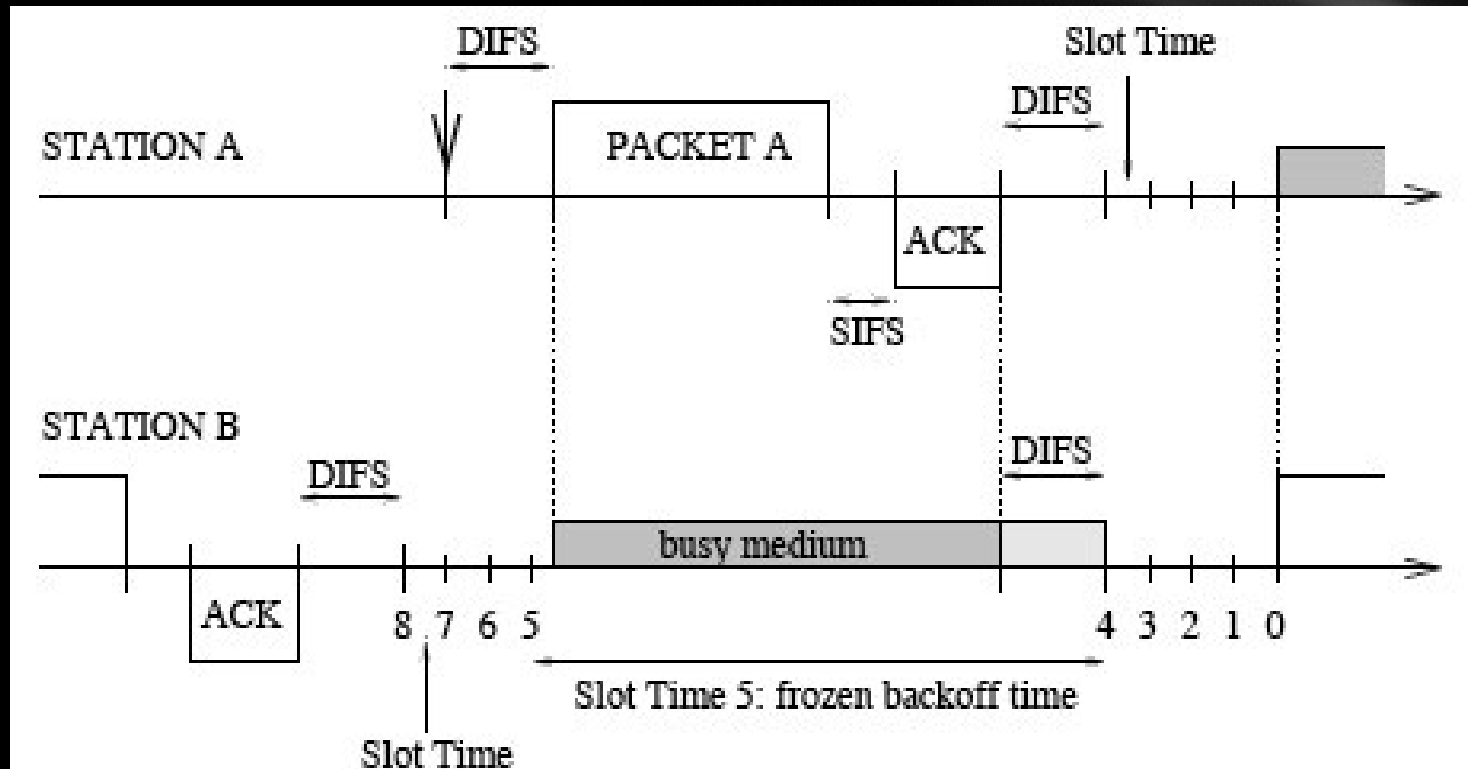# The Basic Access Mechanism

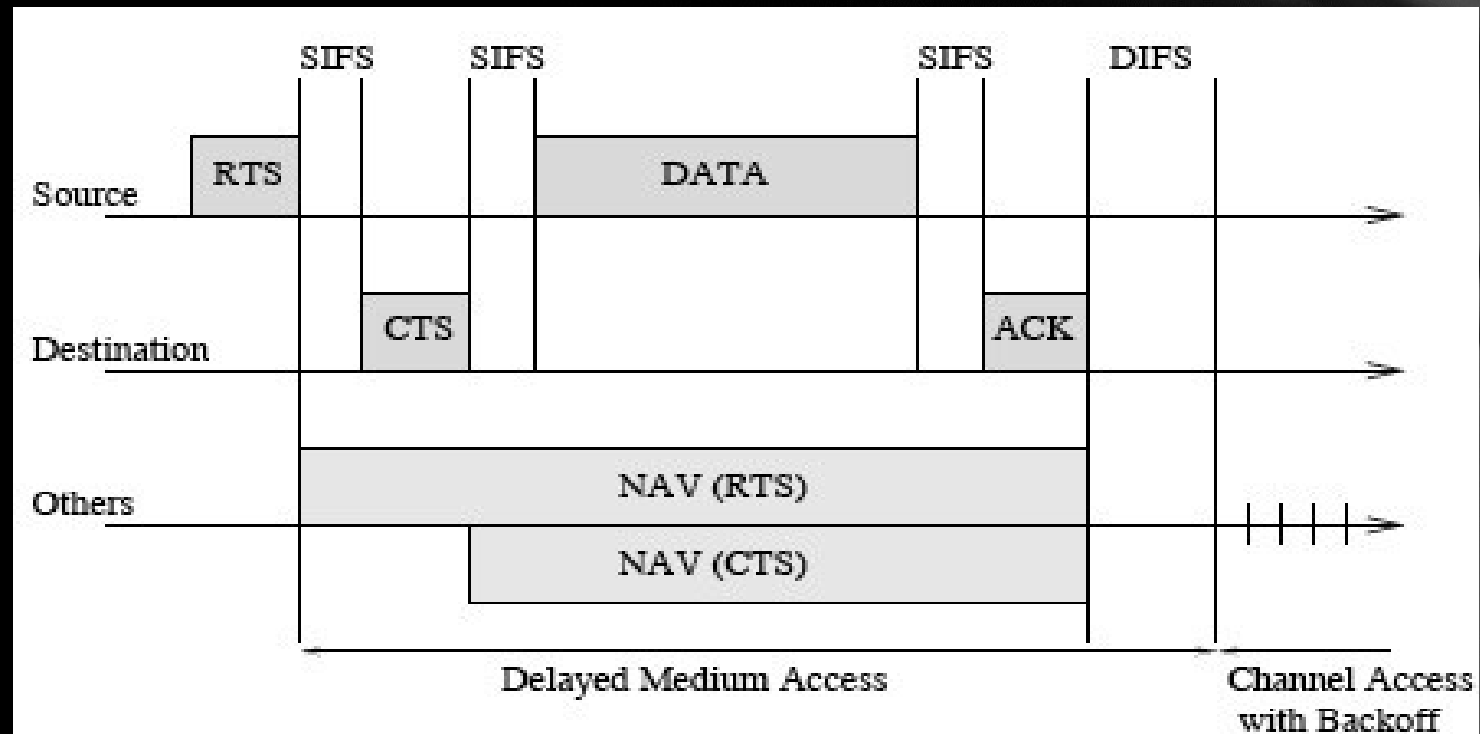Fig. 1. *Example of Basic Access Mechanism*

The RTS-CTS Access Mechanism

Fig. 2. *RTS/CTS Access Mechanism*

802.11 Services

Distribution Services

- Association
- Disassociation
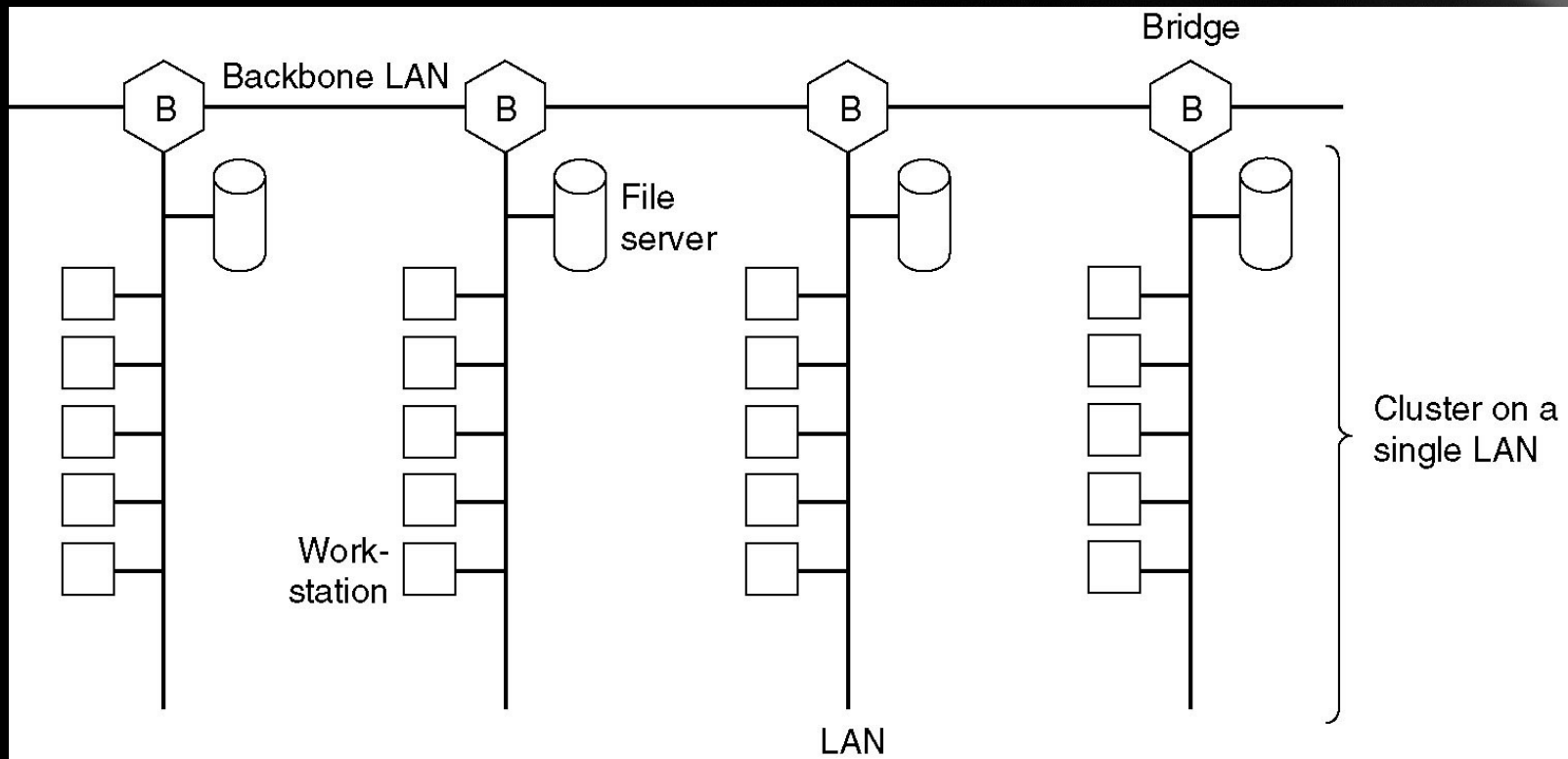- Reassociation
- Distribution
- Integration

802.11 Services

Intracell Services

- Authentication
- Deauthentication
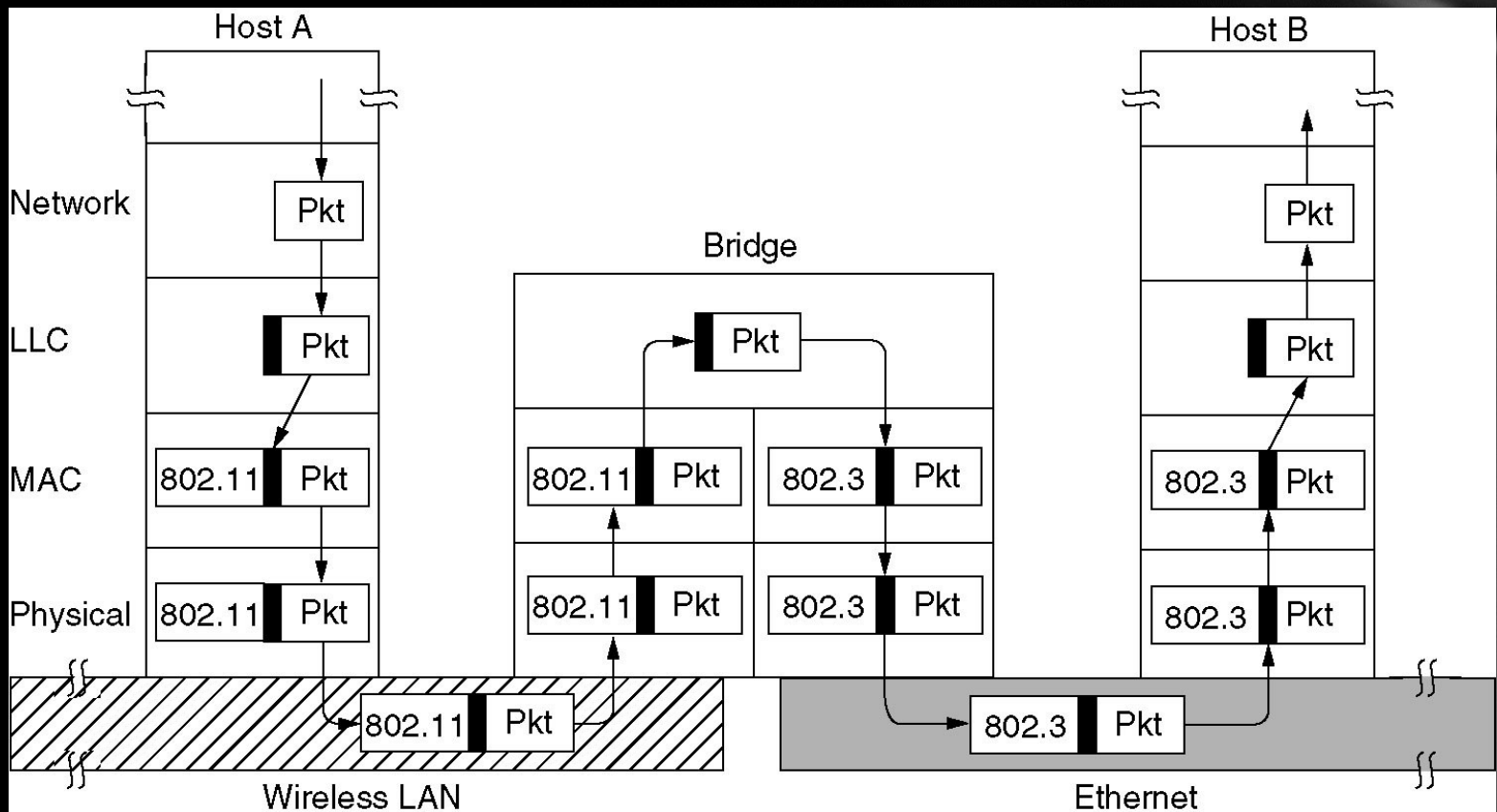- Privacy
- Data Delivery

Data Link Layer Switching

Multiple LANs connected by a backbone to handle a total load higher than the capacity of a single LAN.
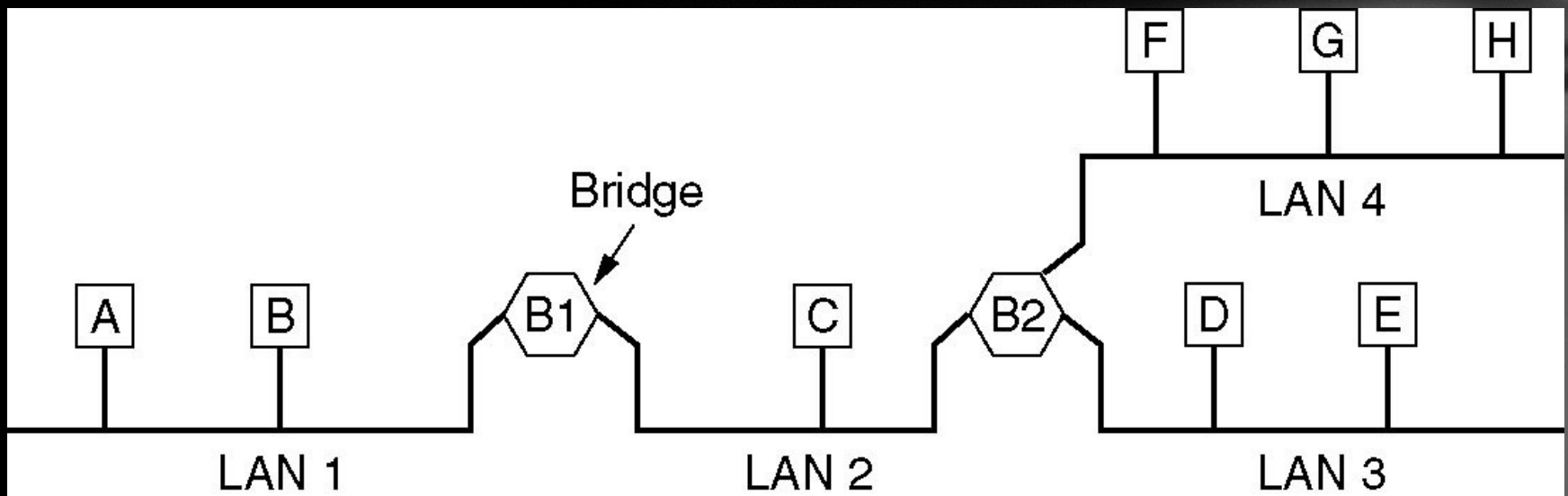
Bridges from 802.x to 802.y

Operation of a LAN bridge from 802.11 to 802.3.
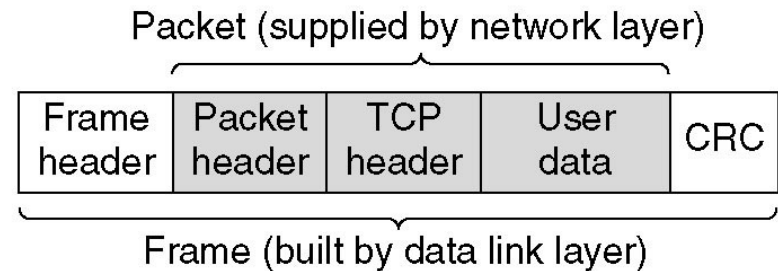
Local Internetworking

A configuration with four LANs and two bridges.

Repeaters, Hubs, Bridges, Switches, Routers and Gateways

Application layer	Application gateway
Transport layer	Transport gateway
Network layer	Router
Data link layer	Bridge, switch
Physical layer	Repeater, hub

(a)

Packet (supplied by network layer)

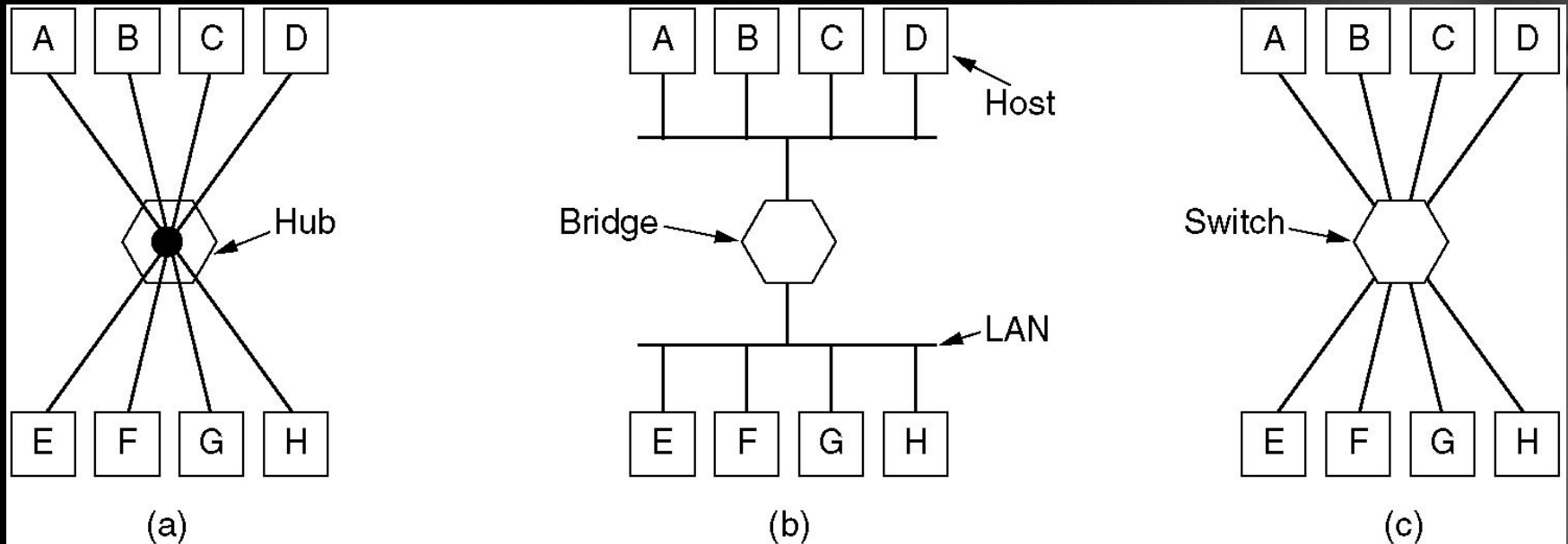| Frame header | Packet header | TCP header | User data | CRC |

Frame (built by data link layer)

(b)

(a) Which device is in which layer.

(b) Frames, packets, and headers.

Switches, Routers and Gateways (2)

(a) A hub. (b) A bridge. (c) a switch.

Bridges from 802.x to 802.y (2)

The IEEE 802 frame formats. The drawing is not to scale.