

Access method

Lec 9

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Channel Access Methods

- When several devices are connected to a single channel, there must be some rules to govern these devices as they access, transmit, and release the channel.
- There are three basic channel access methods:
 - Contention
 - Polling
 - Token passing
- Different access methods have different overhead effects on network traffic.

Contention

- With contention systems, network devices may transmit whenever they want.
- No referee mandates when a device may or may not use the channel.
- This scheme is simple to design
- The scheme provides equal access rights to all stations.
- Stations simply transmit whenever they are ready, without considering what other stations are doing.
- Unfortunately, the "transmit whenever ready" strategy has one important shortcoming.
- Stations can transmit at the same time.
- When this happens, the resulting co-mingling of signals usually damages both to the point that a frame's information is lost.
- This unhappy event is called a "collision."

Collision

- Newer contention protocols were developed that called for stations to listen to the channel first before transmitting.
- If the listening station detects a signal, it will not start transmitting and try again later.
- These protocols are called CSMA (Carrier Sense, Multiple Access with collision detection) protocols.
- These protocols will reduce collisions.
- However, collisions may still occur when two stations sense the cable, detect nothing, and subsequently transmit.
- In order to reduce collisions, CSMA/CD protocols compute a random backoff time before retransmitting the frame .

Examples of CSMA/CD protocols :

- *IEEE* 802.3 (Ethernet)

Advantages

- CSMA/CD control software is relatively simple and produces little overhead.
- CSMA/CD network works best on a bus topology with bursty transmission.

Disadvantages

- CSMA/CD protocols are probabilistic and depends on the network (cable) loading.
- Considered unsuitable for channels controlling automated equipment that must have certain control over channel access. (This could be OK for different channel access).
- We can set priorities to give faster access to some devices (This is, probably, not an issue in some applications)

Polling access method

- Polling is an access method that designates one device (called a "controller", "primary", or "master") as a channel access administrator.
- This device (Master) queries each of the other devices ("secondaries") in some predetermined order to see whether they have information to transmit.
- If so, they transmit (usually through the master).

Polling access method

- Secondaries may be linked to the master in many different configurations.
- One of the most common polling topologies is a star, where the points of the star are secondaries and the master is the hub.
- To get data from a secondary, the master addresses a request for data to the secondary, and then receives the data from the secondary sends (if secondary sends any).
- The primary then polls another secondary and receives the data from the secondary, and so forth.
- System limits how long each secondary can transmit on each poll.

Advantages

- Polling centralizes channel access control.
- Maximum and minimum access times and data rates on the channel are predictable and fixed.
- Priorities can be assigned to ensure faster access from some secondaries.
- Polling is deterministic and is considered suitable for channels controlling some kinds of automated equipment.

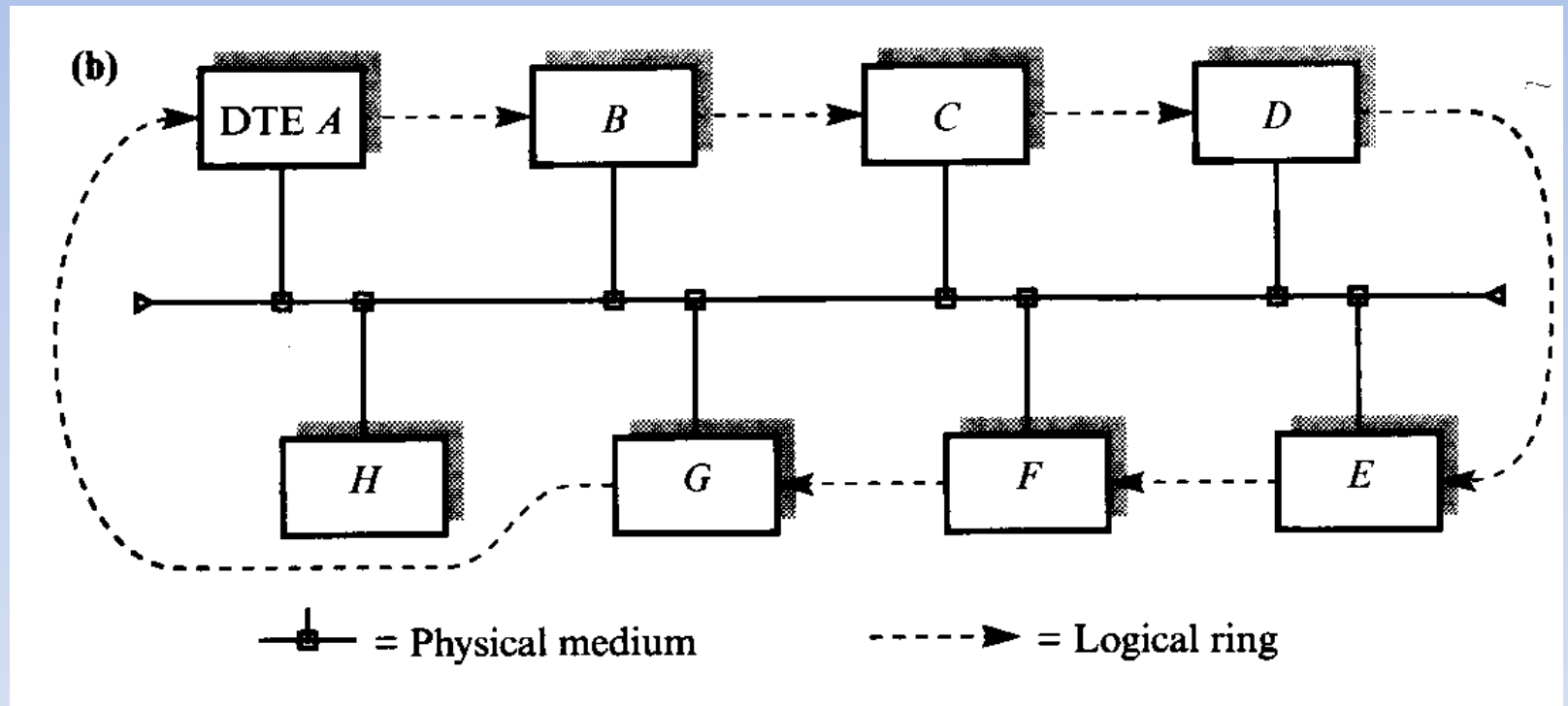
Disadvantages

- Polling systems often use a lot of bandwidth sending notices and acknowledgments or listening for messages.
- Line turnaround time on a half- duplex line further increases time overhead.
- This overhead reduces both the channel's data rate under low loads and its throughput.

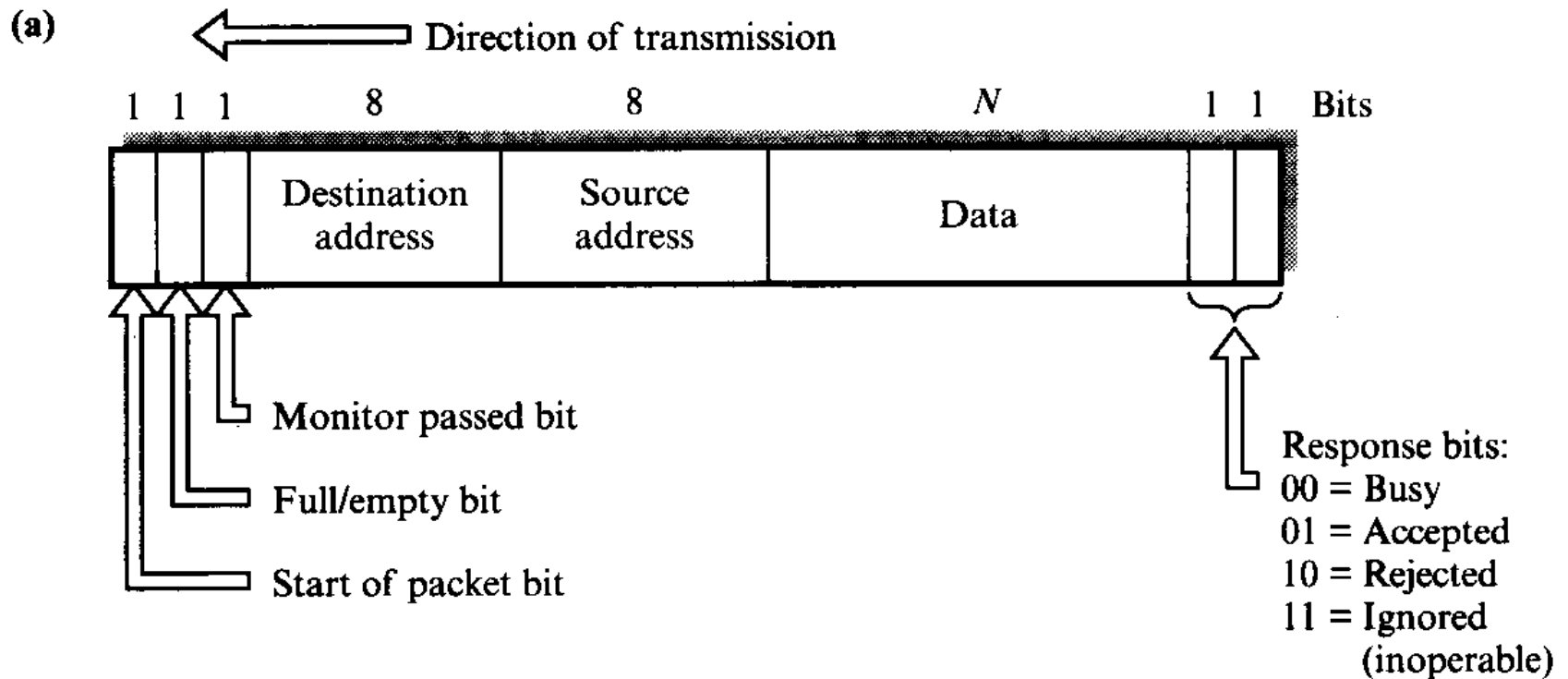
Token passing System

- In token-passing systems, a small frame (the token) is passed in an orderly fashion from one device to another.
- A token is a special authorizing message that temporarily gives control of the channel to the device holding the token.
- Passing the token around distributes access control among the channel's devices.
- Each device knows from which device it receives the token and to which device it passes the token.
- Each device periodically gets control of the token, performs its duties, and then retransmits the token for the next device to use.
- System rules limit how long each device can control the token.

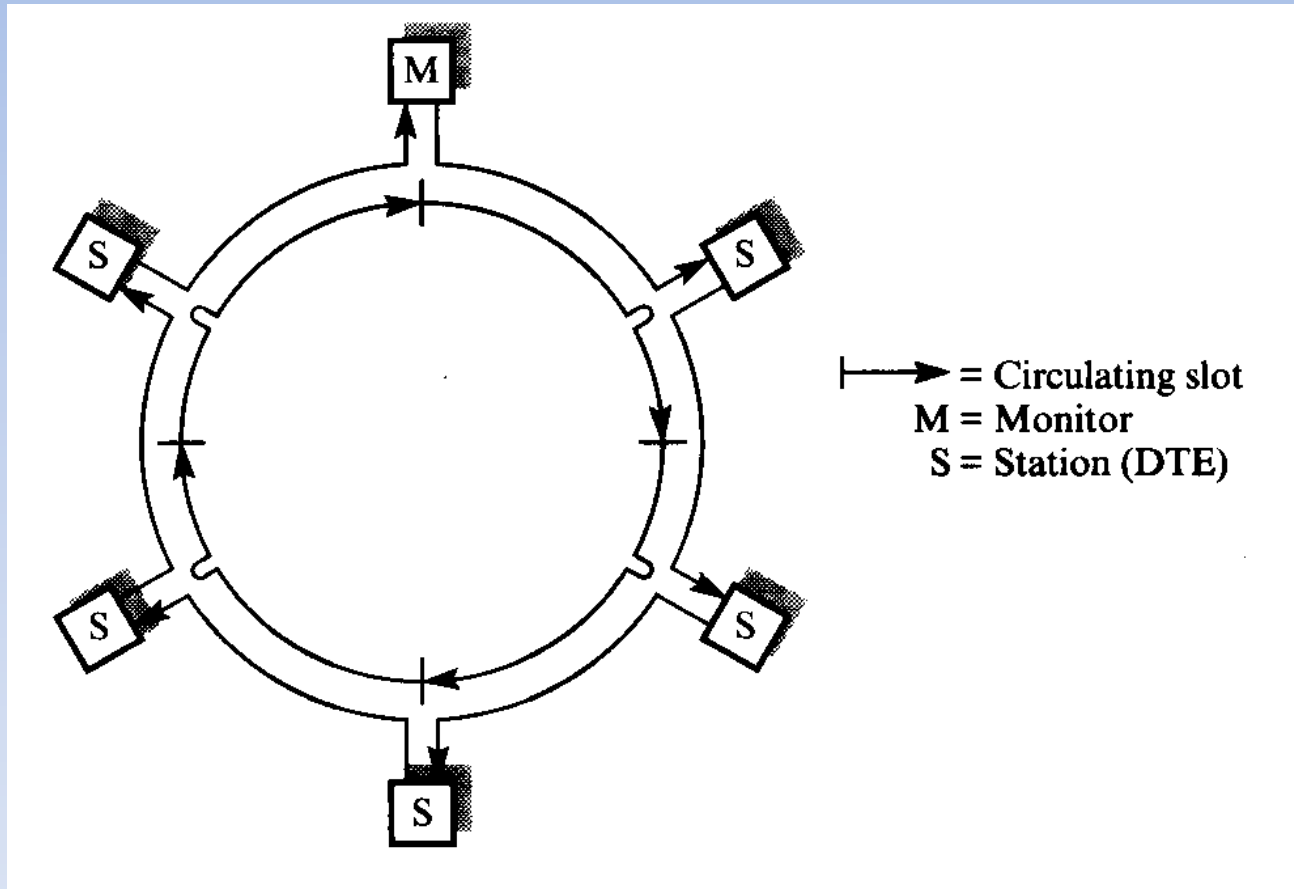
Control token MAC: Token bus



Slotted ring principles: bit definitions of each slot



Slotted ring principles: Outline topology



Advantages

- Even though there is more overhead using tokens than using CSMA/CD, performance differences are not noticeable with light traffic and are considerably better with heavy loads because CSMA/CD will spend a lot of time resolving collisions.
- A deterministic access method such as Token Ring guarantees that every node will get access to the network within a given length of time. In probabilistic access method (such as CSMA/CD) nodes have to check for network activity when they want to access the network.

Disadvantages

- Components are more expensive than for Ethernet .
- Token Ring architecture is not very easy to extend to wide-area networks (WANs).
- Token Ring network is much more expensive than Ethernet. This is due to the complex token passing protocol.