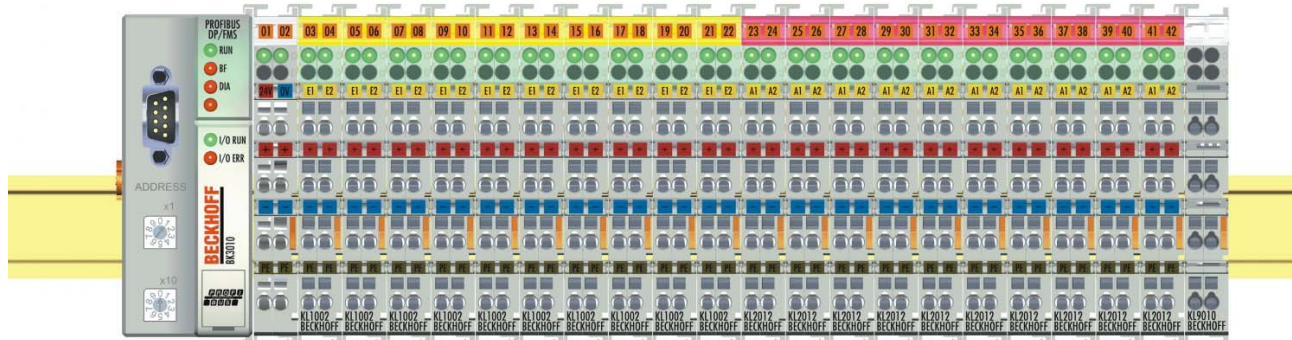
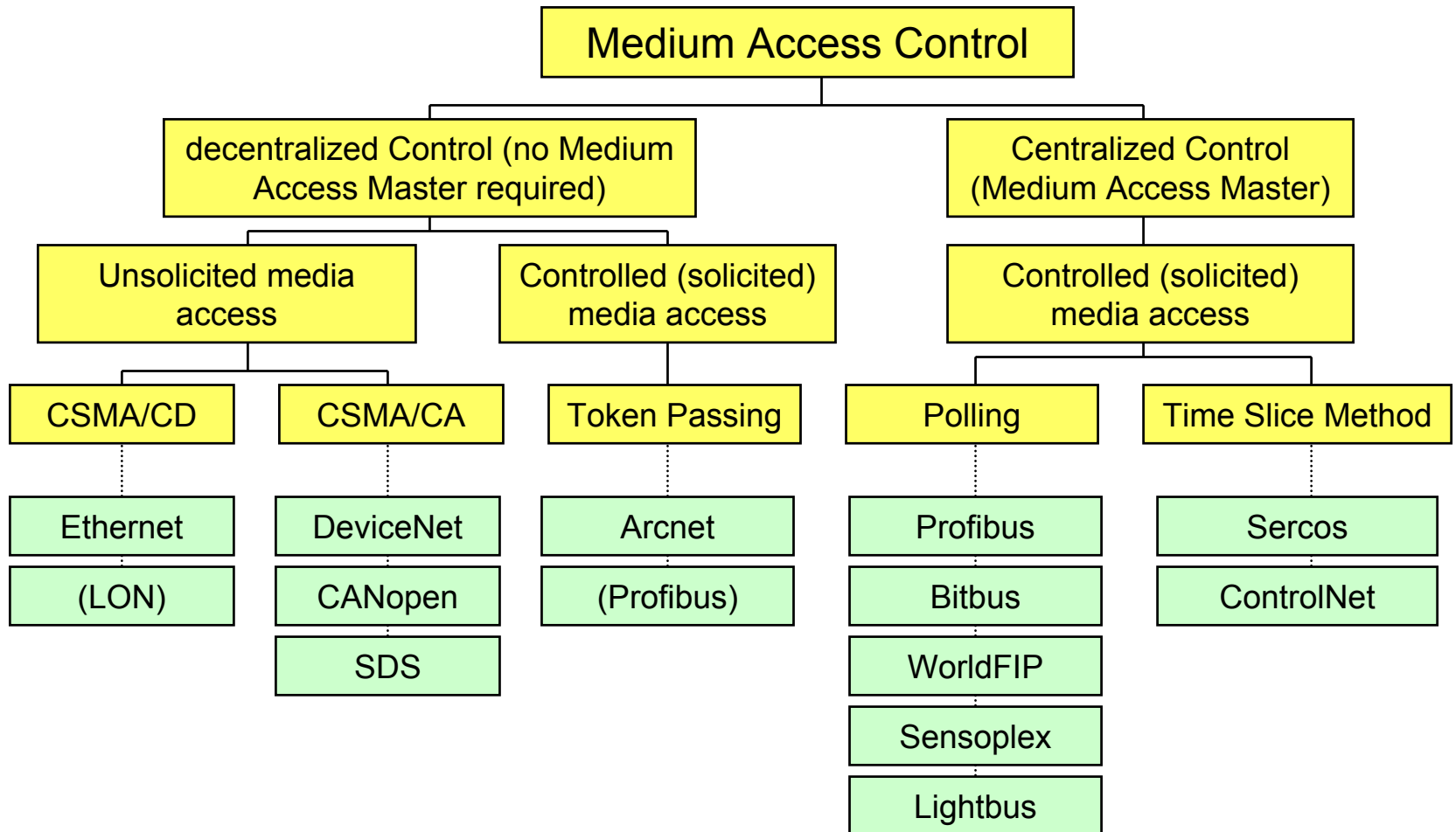


# Features of Fieldbus Systems

- MAC: Medium Access Control
- Addressing
- Transmission Media
- Topology
- Node Hierarchy



# Medium Access Control



# Medium Access Control: CSMA/CD

**C**arrier

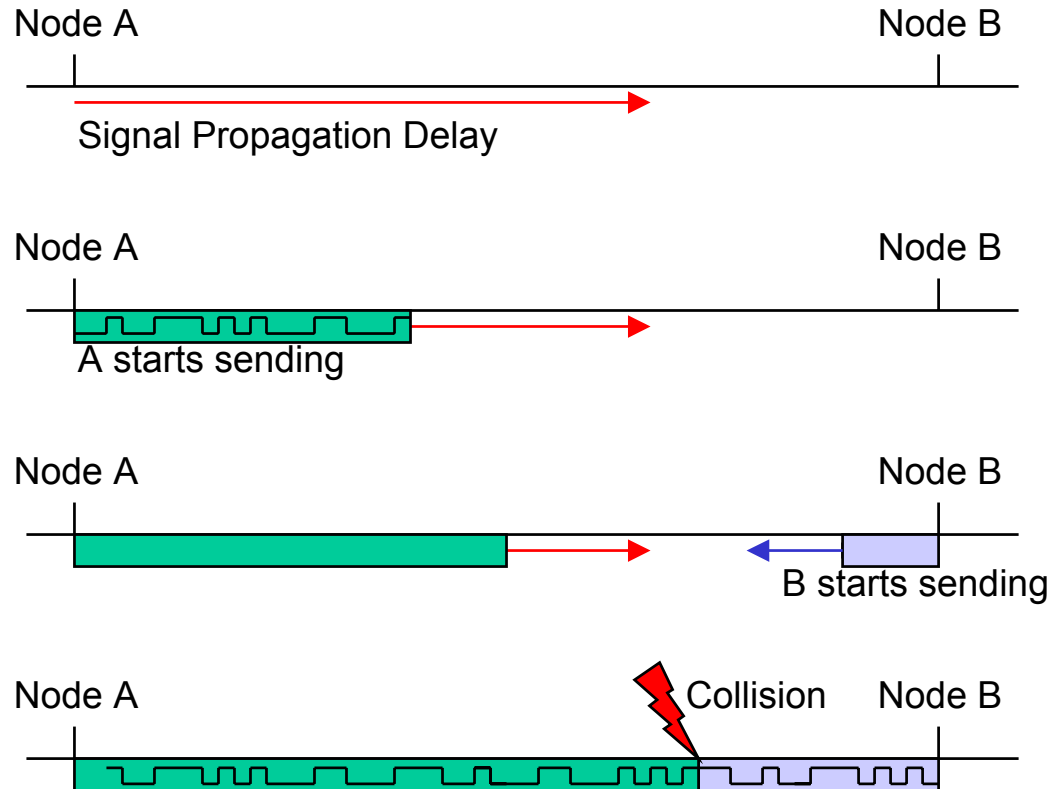
**S**ense

**M**ultiple

**A**ccess /

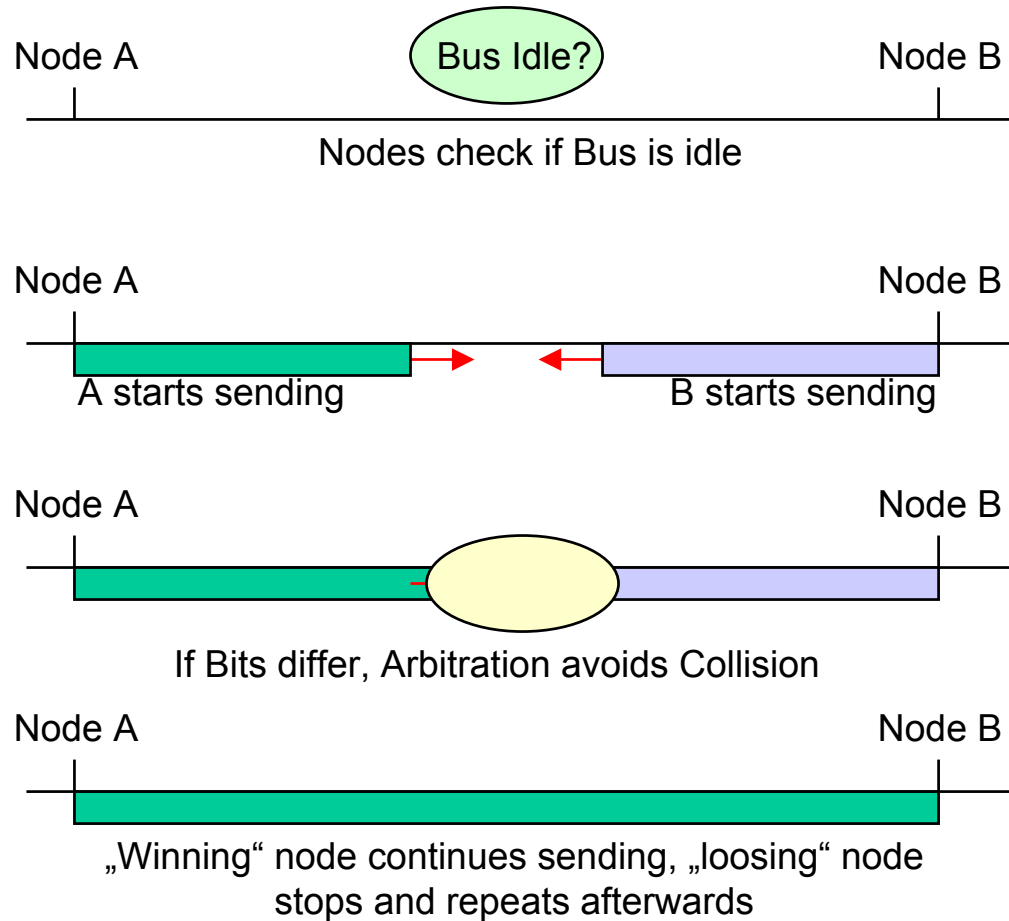
**C**ollision

**D**etection



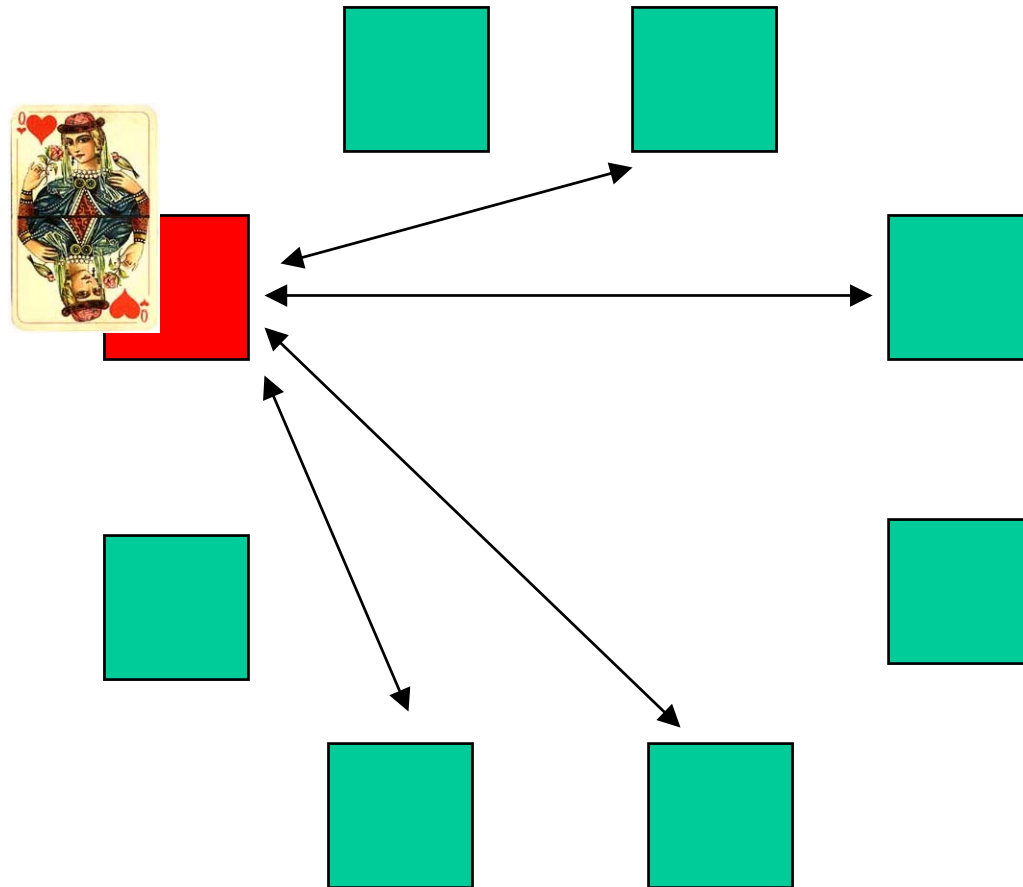
# Medium Access Control: CSMA/CA

**C**arrier  
**S**ense  
**M**ultiple  
**A**ccess /  
**C**ollision  
**A**voiding  
 (CAN  
 based  
 systems)



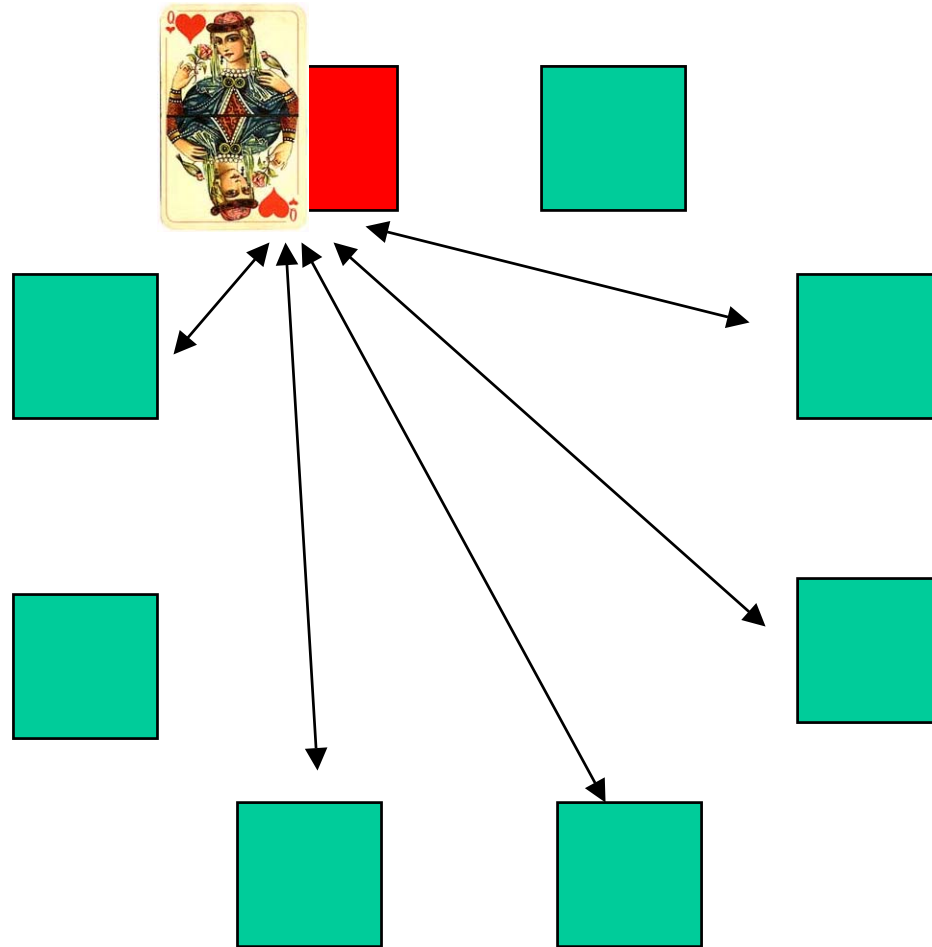
# Medium Access Control: Token Passing

The node that holds the token controls the network traffic



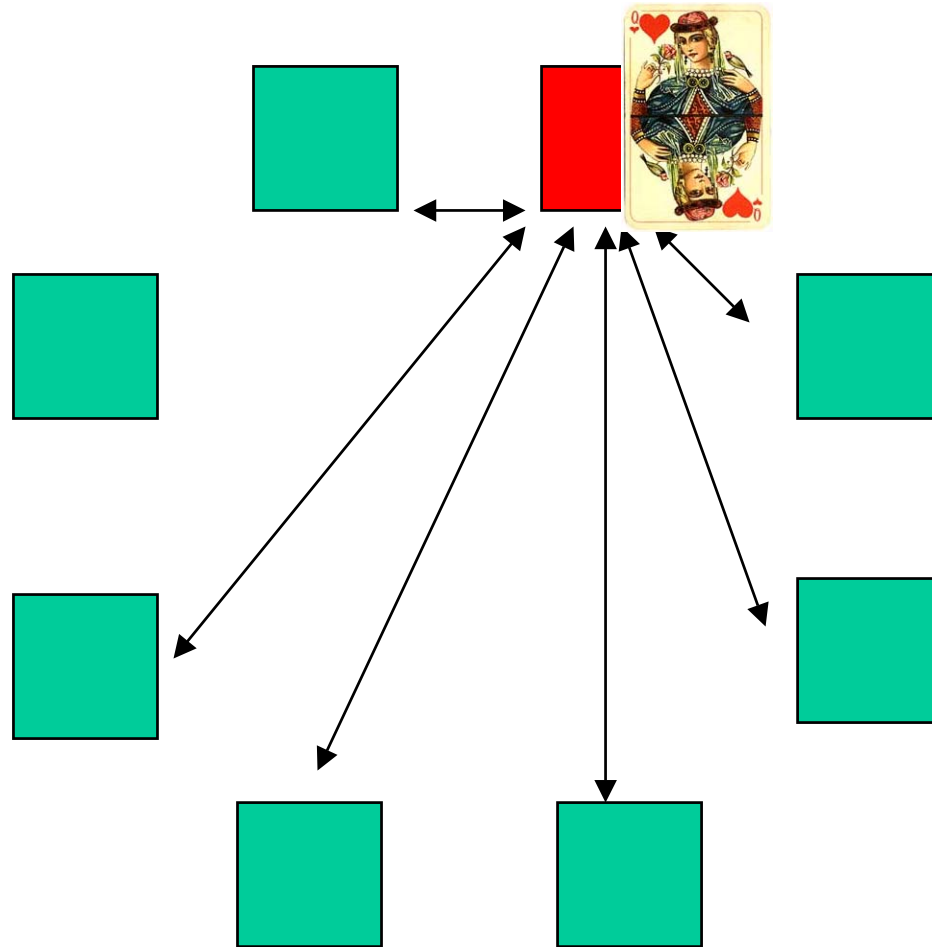
# Medium Access Control: Token Passing

The node that holds the token controls the network traffic



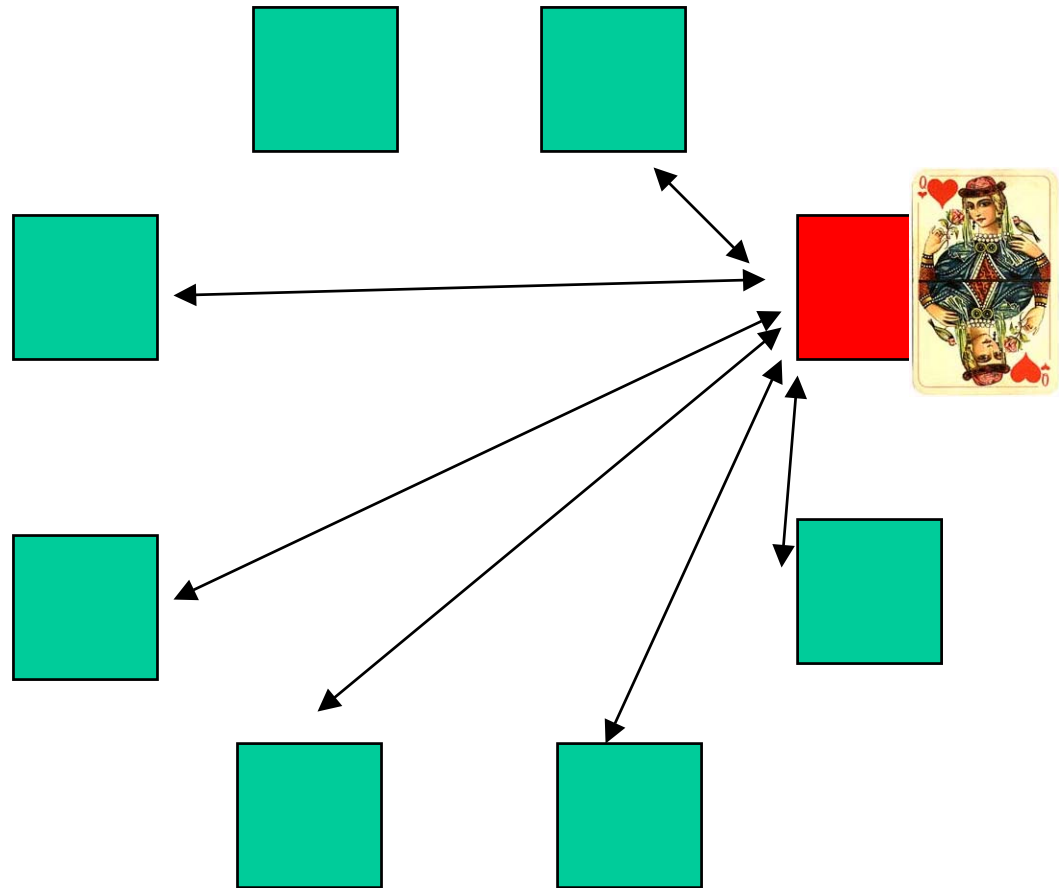
# Medium Access Control: Token Passing

The node that holds the token controls the network traffic



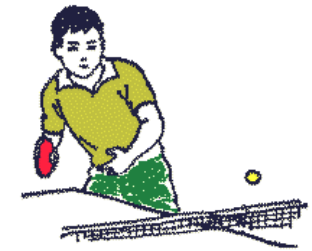
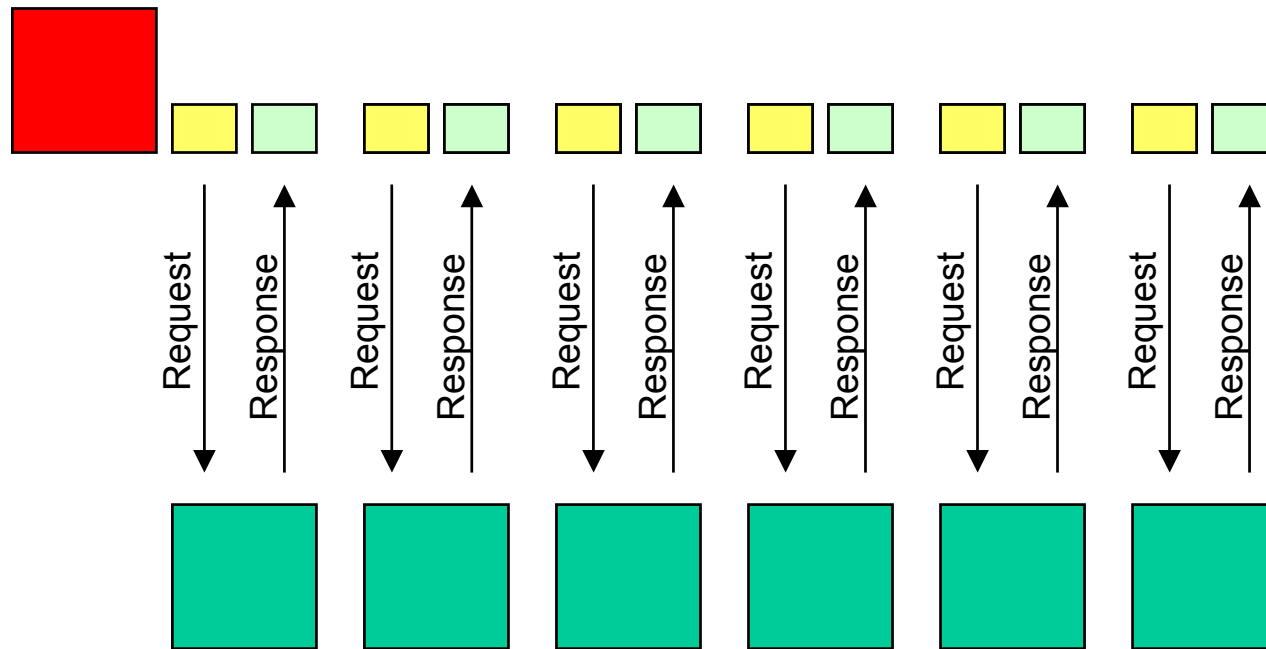
# Medium Access Control: Token Passing

The node that holds the token controls the network traffic



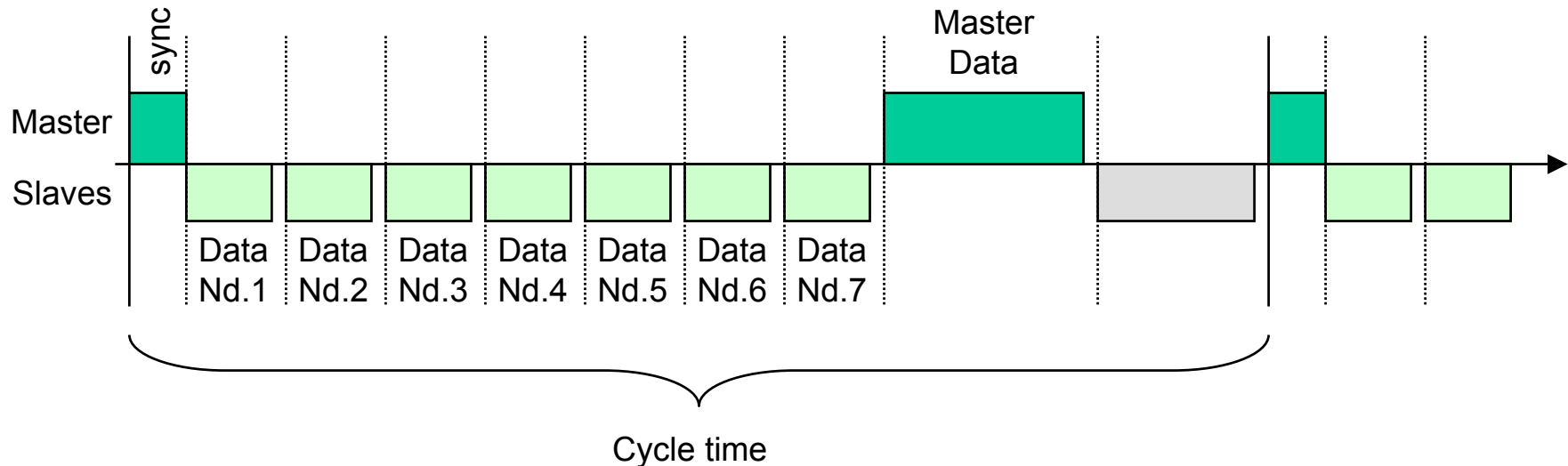
# Medium Access Control: Polling

One master node polls the slave nodes



# Medium Access Control: Time Slicing

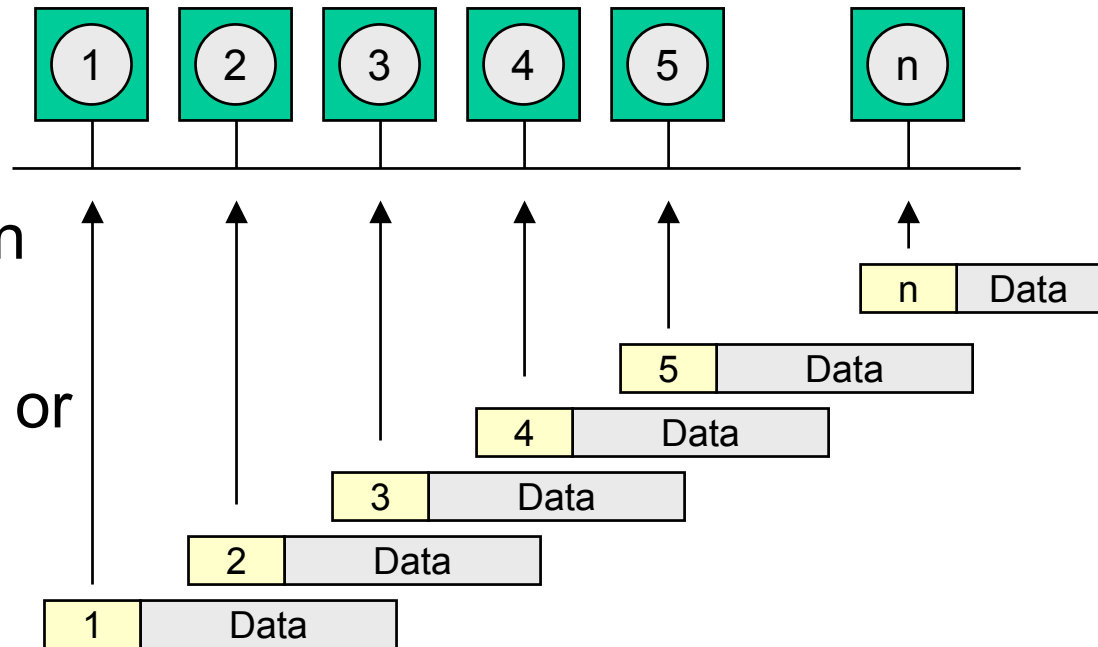
All nodes are synchronized and send within their time slice



# Addressing

## Node-Addressing

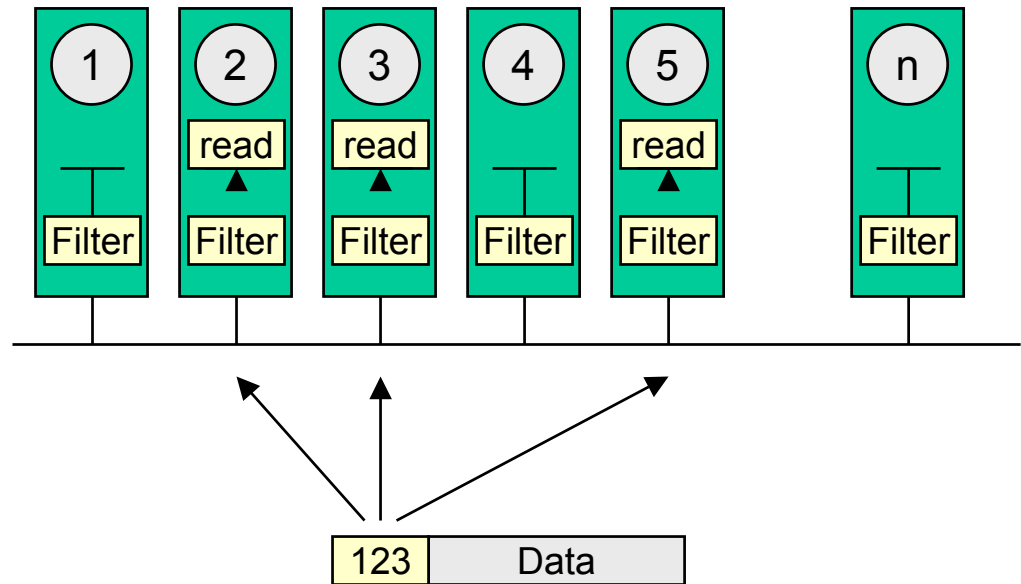
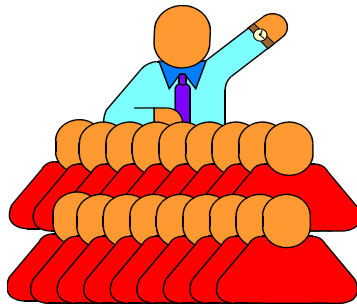
- Node processes Data with its destination address
- Peer to Peer, Multicast or Broadcast possible



# Addressing

## Telegram-Addressing

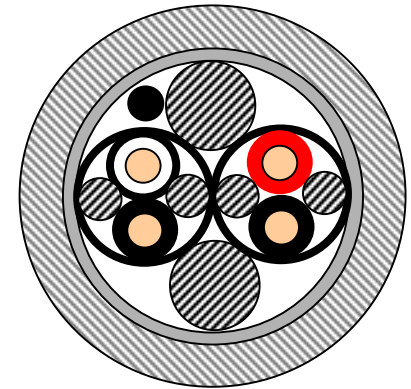
- Node processes Daten with the Ident-Number that he is interested in.
- Requires Broadcast



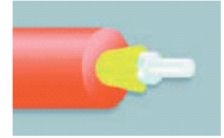
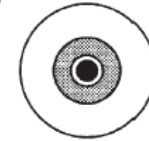
# Transmission Media (Examples)

## Copper:

- RS 485, 2/3/5-Wire  
(Profibus, -DP, Interbus-S, LON, Bitbus...)
- ISO 11898, 2-Wire (+ GND)  
(CAN "High Speed,,)
- Power Supply Line  
(AS-Interface, LON, Interbus-Loop)
- Unshielded Twisted Pair (UTP)  
(Ethernet 10BaseT)
- Koax-Wire  
(Arcnet, Ethernet 10Base5, 10Base2)



# Transmission Media (Examples)



## Fiber Optics:

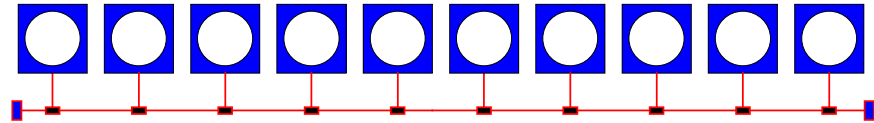
- Plastic Optical Fiber (POF) + HCS (hard clad silica)  
(Beckhoff-Lightbus, Sercos, Interbus-S, Profibus)
- Glass Fibre (Single Mode + Multi Mode)

Type	Peak Wave Length	Damping	Max Length
POF	640...675nm	~2000 dB/km	40m
HCS	640..675nm	~7 dB/km	300m
Multi Mode	790..910nm	~3dB/km	1700m
Single Mode	1260..1380nm	~0,4 dB/km	10000m

# Topology

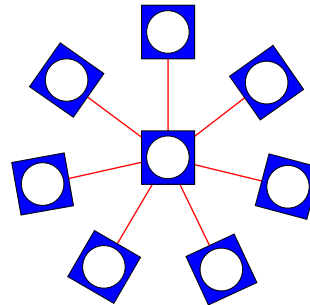
## Bus / Line

- (electrical)



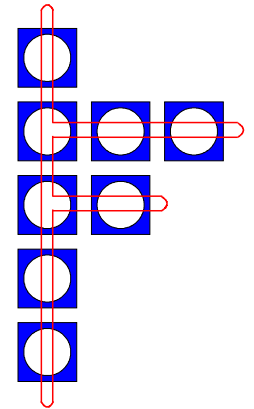
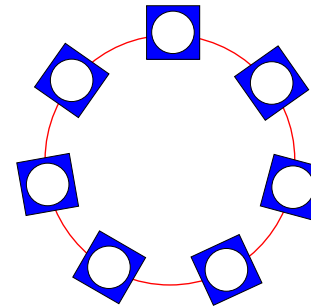
## Star

- (electrical and optical)



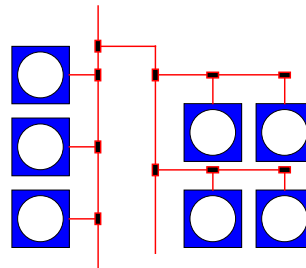
## Ring

- (electrical and optical)
- With special types



## Tree

- (electrical)



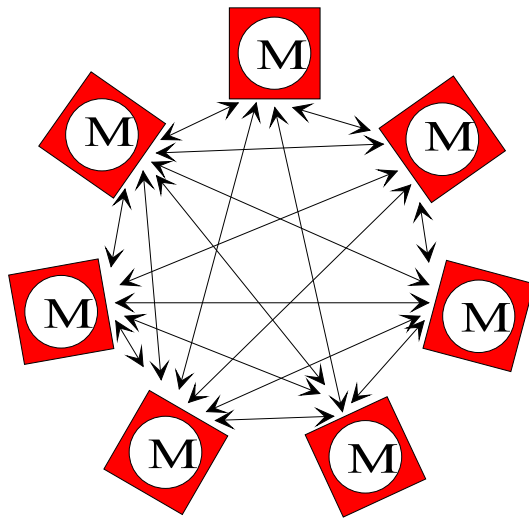
# Node Hierarchy

## Definitions:

Master: Node that controls the bus access and bus communication

Slave: Can only communicate with Master

## Multi-Master System



## Master-Slave-System

