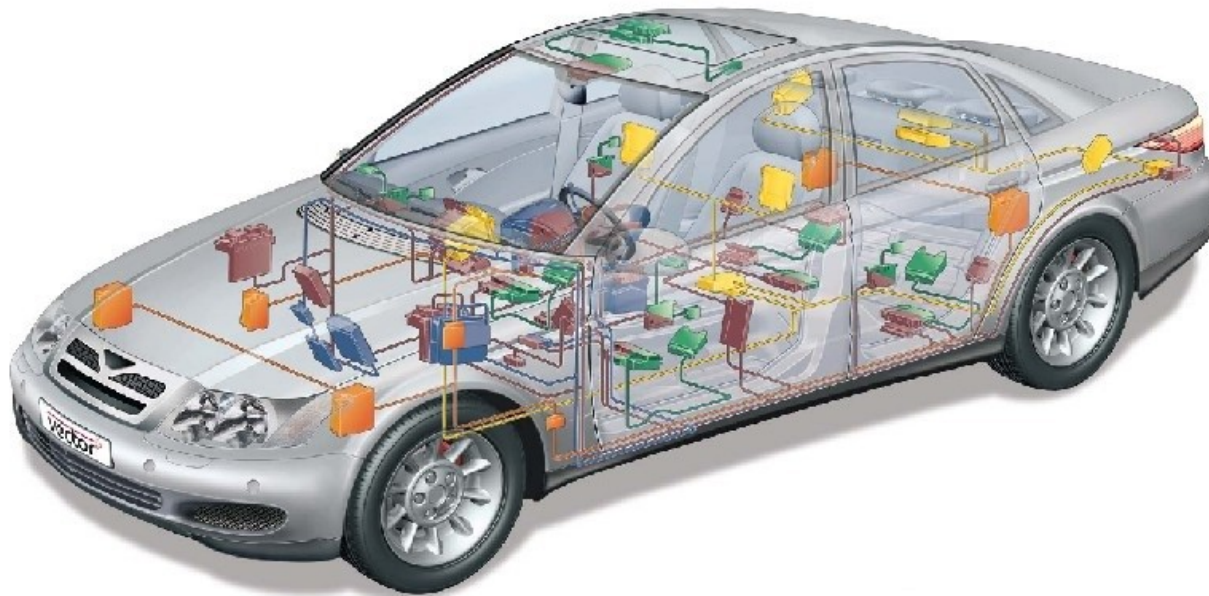


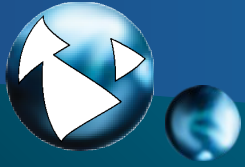


Seminar on



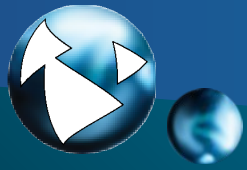
CAN Bus Protocol

By Abhinaw Tiwari
CSE-12010330



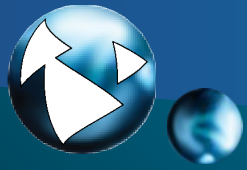
Contents

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- ❖ CAN Applications
- ❖ CAN Characteristics
- ❖ Message Types
- ❖ Arbitration
- ❖ CAN Data Protection
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- ❖ Disadvantages
- ❖ Conclusion



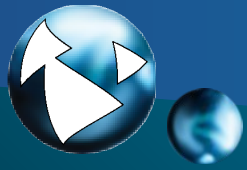
Introduction

- Multi-master protocol
- Broadcasting
- Serial communication technology
- Priority-based bit-wise arbitration



Introduction

- Originally developed by Robert Bosch for automobile in-vehicle network in the 1980s
- For reliable data exchange between ECUs
- Robust in noisy environments
- Cost effective

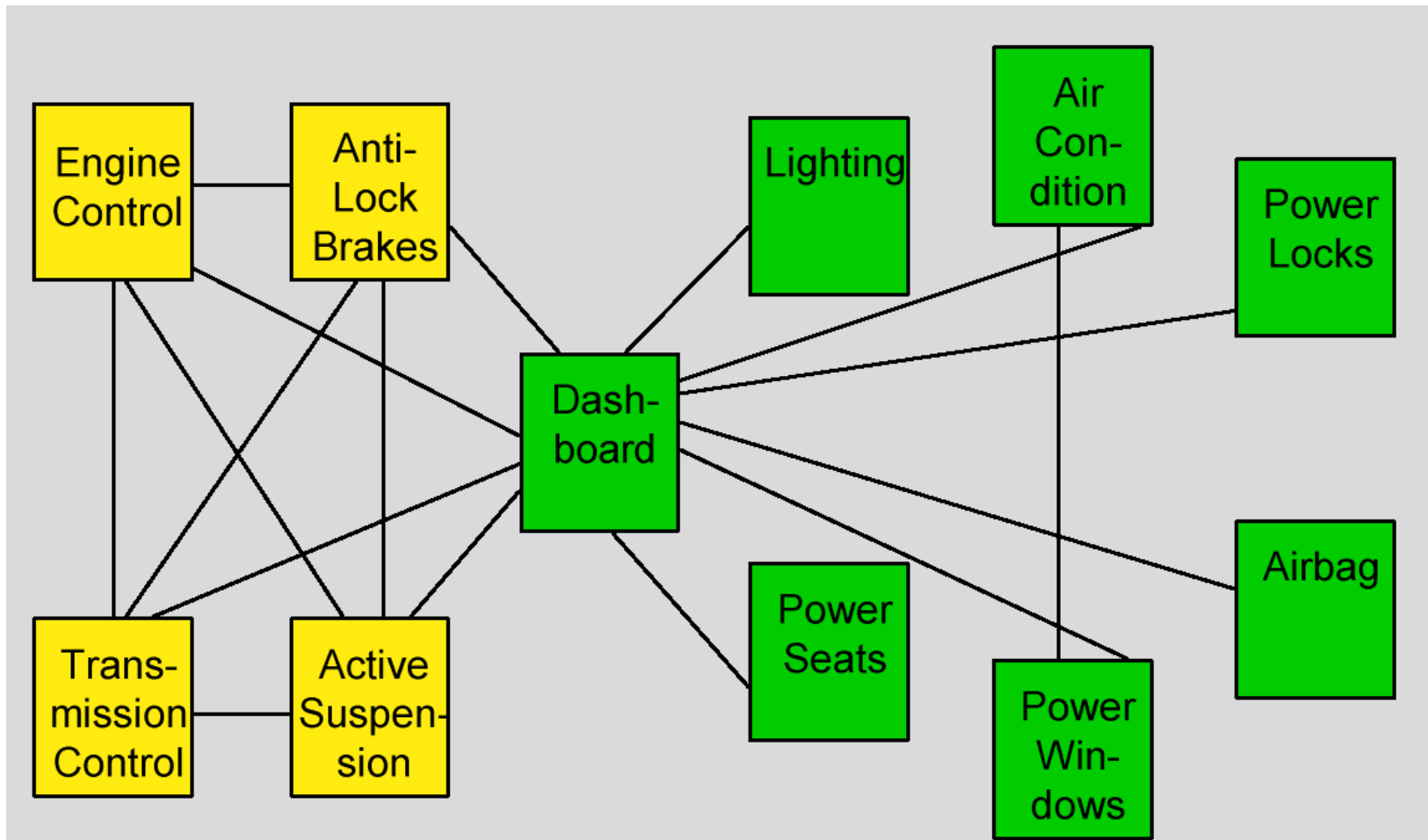


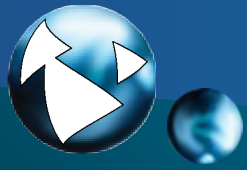
Introduction

- Compact and fast
- It is a message-based protocol.
- There are no defined addresses, just defined messages.

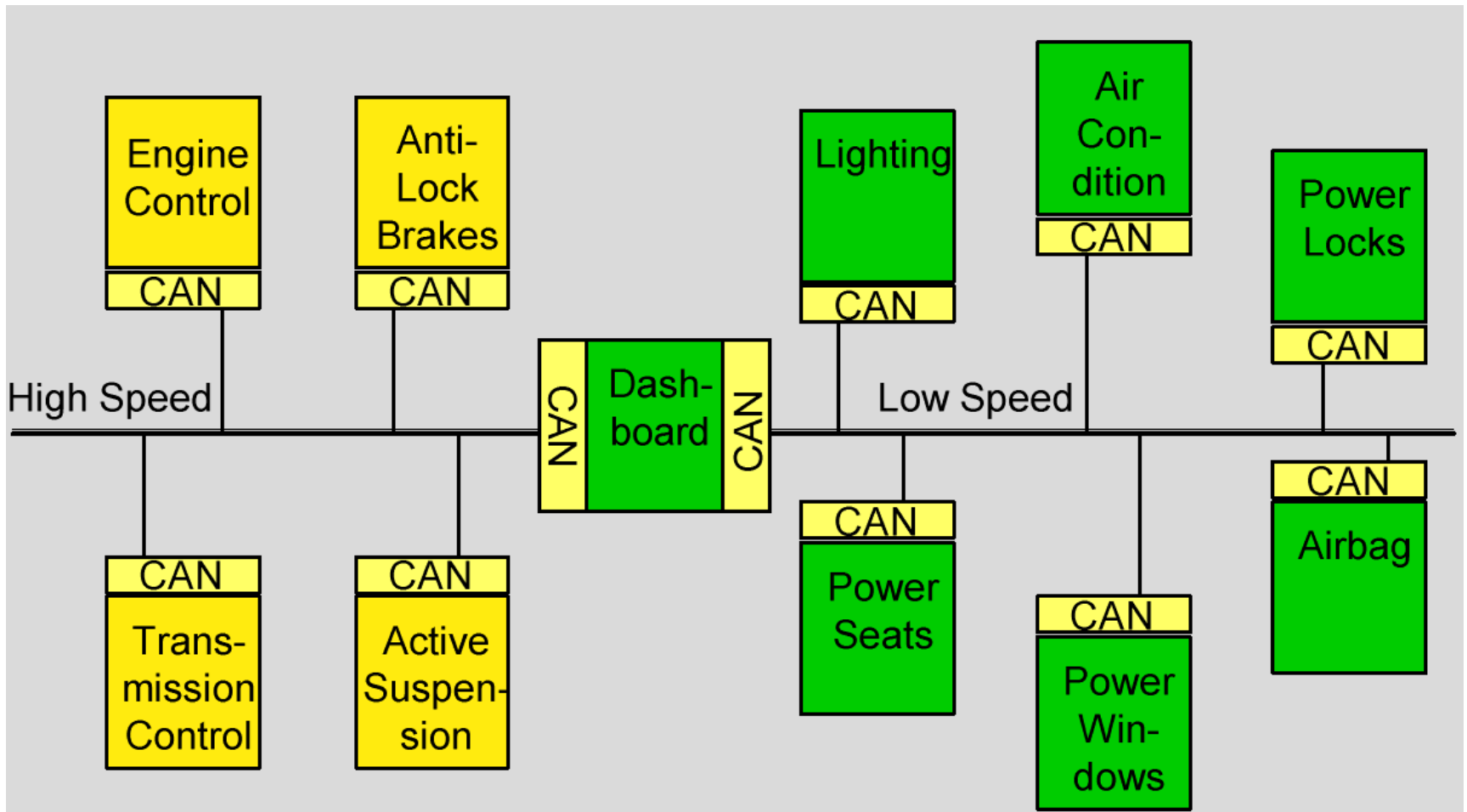


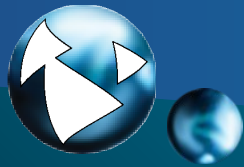
Before CAN



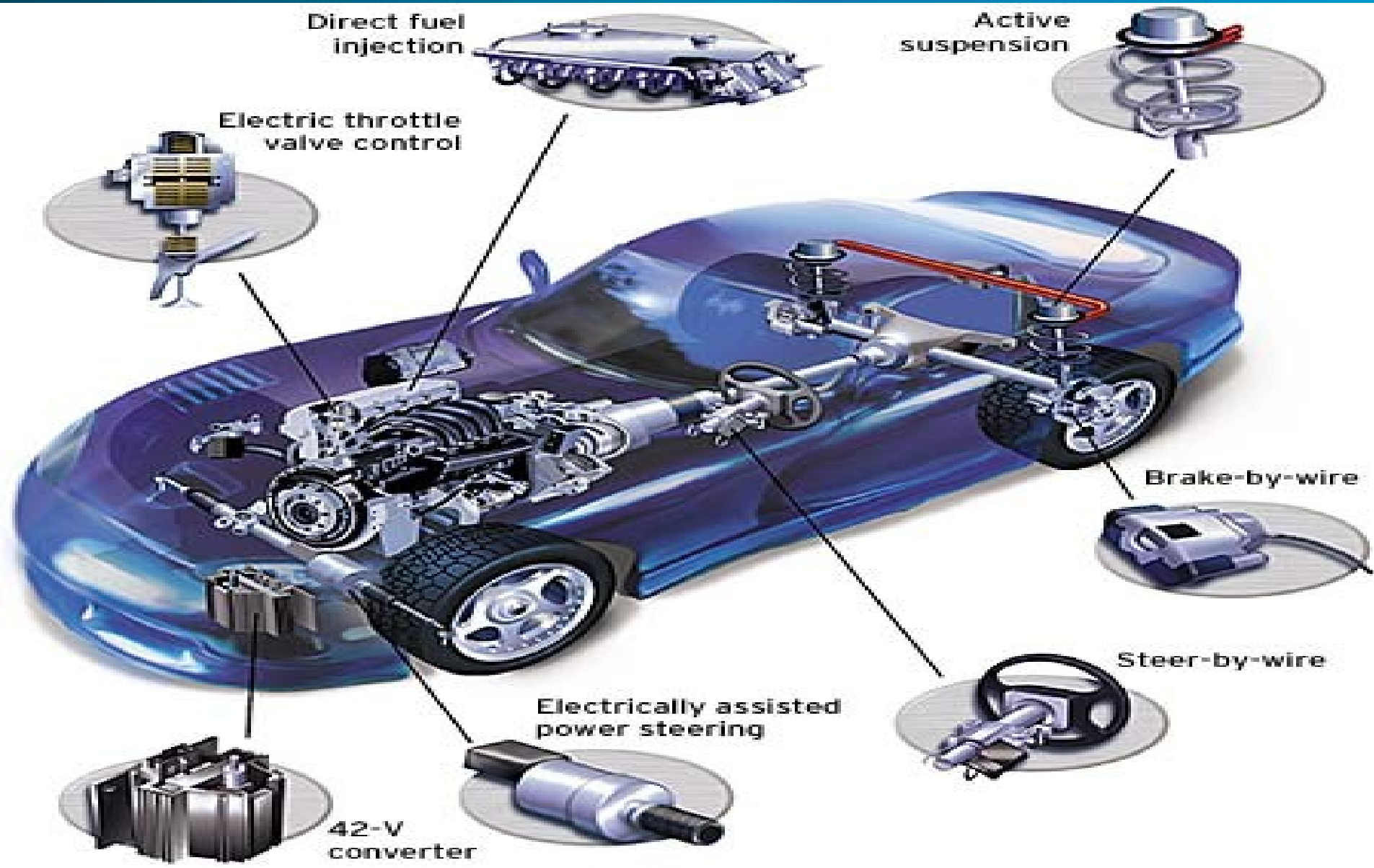


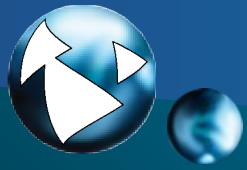
After CAN





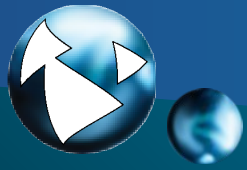
Real-world applications





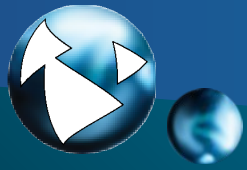
Real-world applications

- Automotive
- Military vehicles
- Industrial machinery
- Medical systems
- Agricultural machinery
- Marine control and navigation
- Elevator control systems



CAN Characteristics

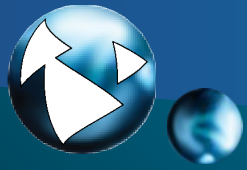
- All messages are broadcast
- Any node is allowed to broadcast a message
- Each message contains an ID that identifies the source or content of a message
- Each receiver decides to process or ignore each message



CAN Characteristics

Bit Rate / Bus Length

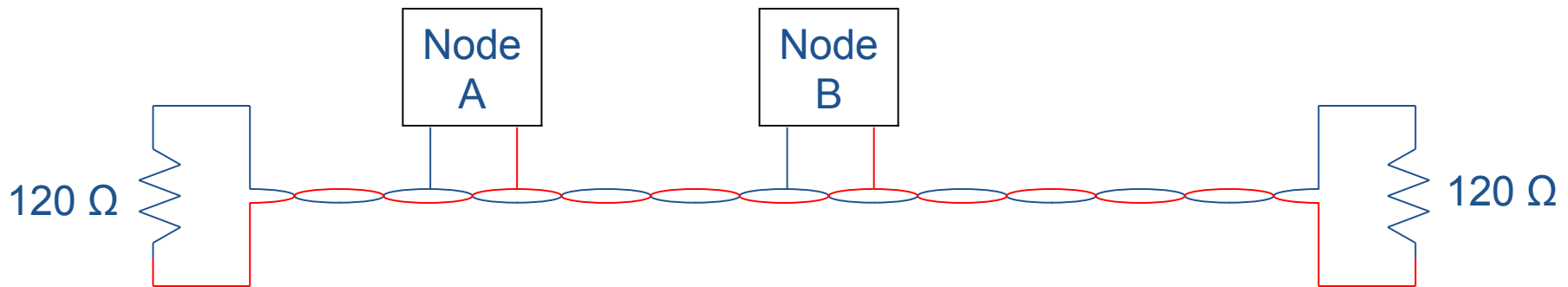
1M bit/sec	40 meters (131 feet)
500K bit/sec	100 meters (328 feet)
250K bit/sec	200 meters (656 feet)
125K bit/sec	500 meters (1640 feet)

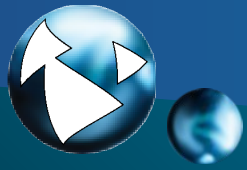


CAN Characteristics

Physical Medium

Single twisted pair wire terminated on each end

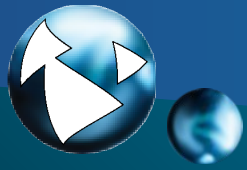




CAN Characteristics

Network Size

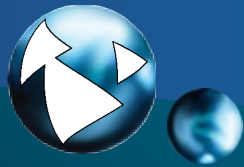
- The maximum number of nodes is not specified.
- Networks are limited by electrical loading, up to 64 nodes is normal



CAN Message Types

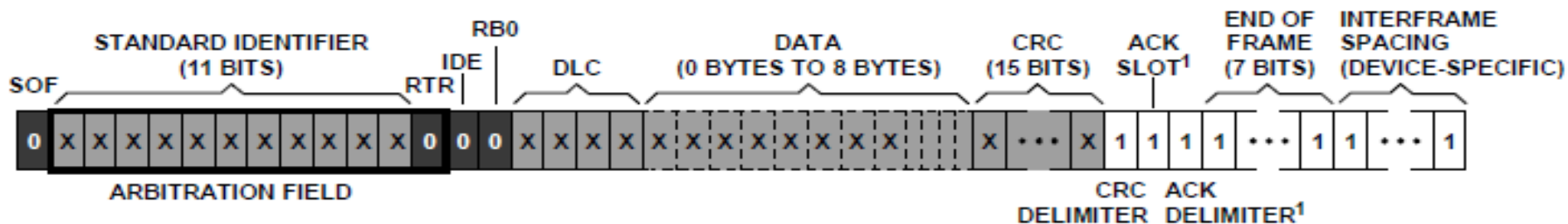
Four Message Types

- Data Frame
 - Used to transmit data
- Remote Frame
 - Used to request data transmission
- Error Frame
 - Sent by a node that detects an error
- Overload Frame
 - Sent by a node to request a delay in transmission

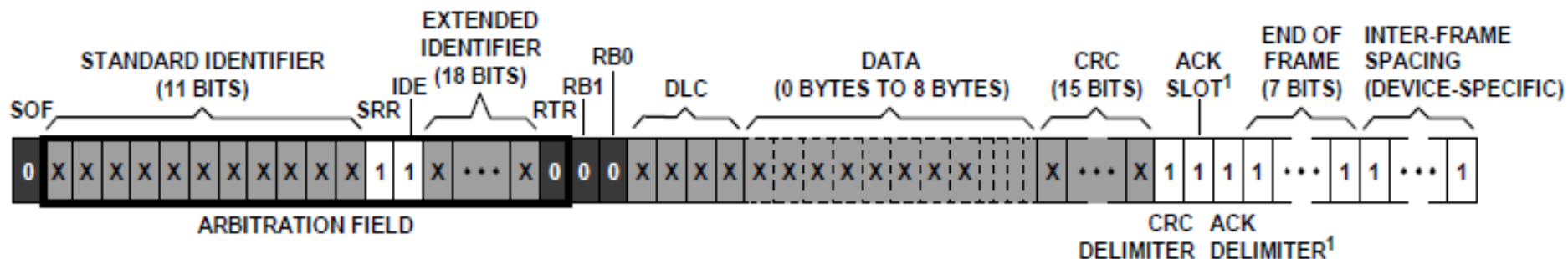


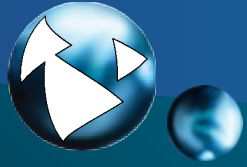
CAN Message Format

- Standard Data Frame



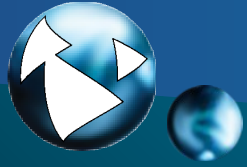
- Extended Data Frame





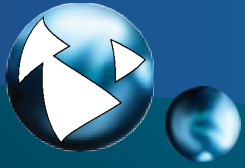
CAN Arbitration

- CSMA/CA
- All nodes must wait for an idle bus condition .
- If two nodes begin transmitting simultaneously, they then participate in an arbitration process.



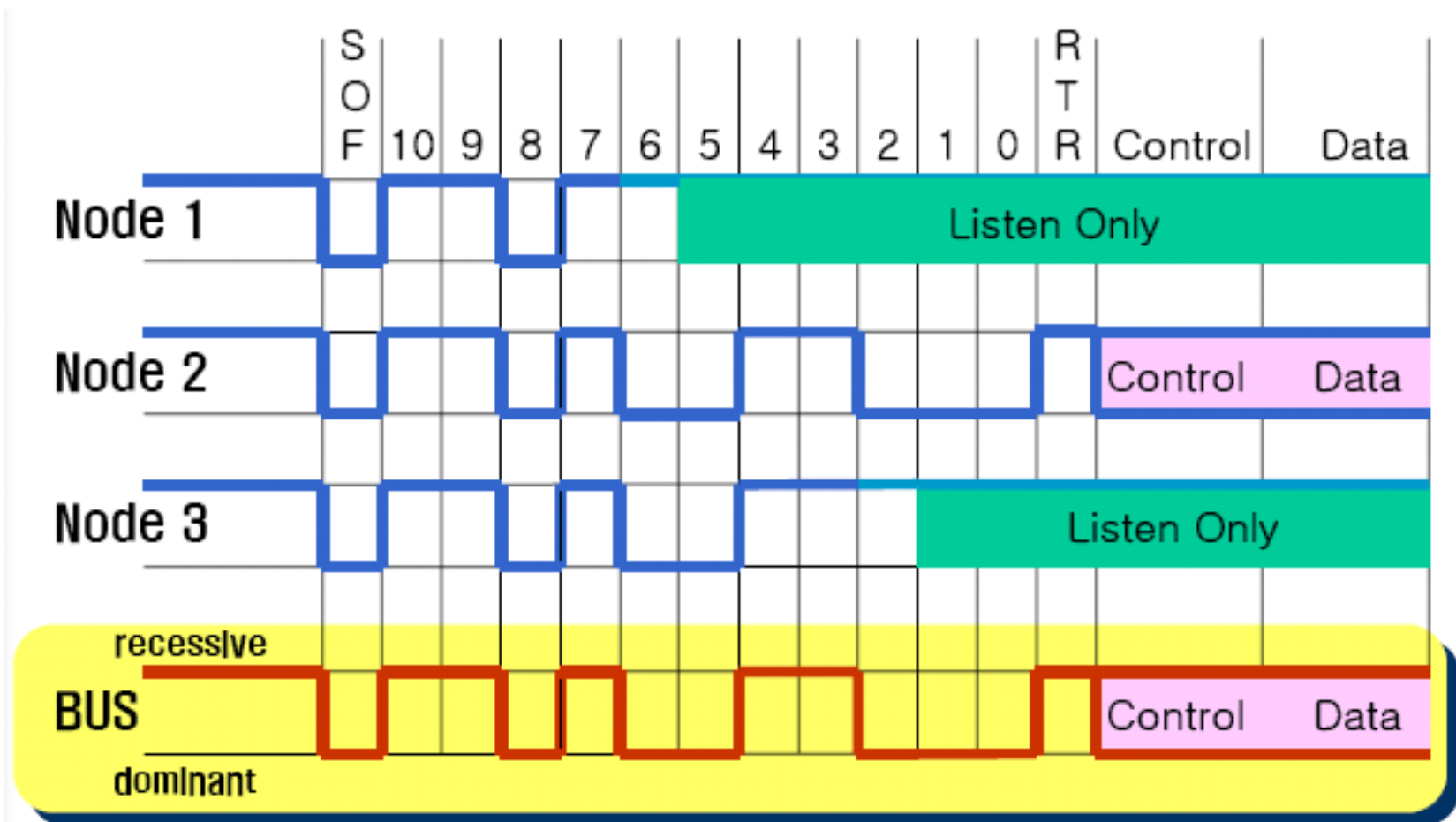
CAN Arbitration

- Wired-AND mechanism
- The node with the lower ID number wins the arbitration and continues transmitting its message.
- The loser of the arbitration backs off and re-tries.



CAN Arbitration

CSMA/CA & Wired-AND Logic





CAN Data Protection

CAN Data Protection- Error Detection

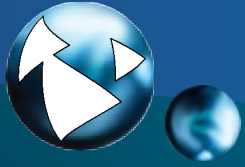
- Bit Monitoring
 - ❖ Sender Task
 - ❖ Compares every bit placed on the CAN bus with the actual bus level
 - ❖ Discrepancy indicates a bit monitoring error and results in error handling



CAN Data Protection

CAN Data Protection- Error Detection

- Stuff Check
 - ❖ Receiver Task
 - ❖ Compares arriving bit stream for a sequence of six homogeneous bits.
 - ❖ Detection of a sixth homogeneous bit indicates bit stuffing error and results in error handling



CAN Data Protection

CAN Data Protection- Error Detection

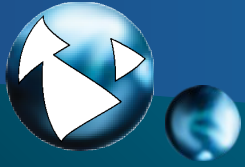
- Form Check
 - ❖ Receiver Task
 - ❖ Comparison of the arriving bit stream with the message format
 - ❖ Detection of a dominant delimiter bit (CRC delimiter, ACK delimiter) or a dominant bit within EOF indicates a format error and results in error handling



CAN Data Protection

CAN Data Protection- Error Detection

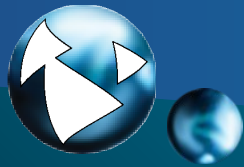
- Cyclic Redundancy Check
 - ❖ Receiver Task
 - ❖ Utilizes the arriving bit stream and generator polynomial for the Cyclic Redundancy Check defined in ISO 11898-1
 - ❖ Detection of a CRC error results in error handling



CAN Data Protection

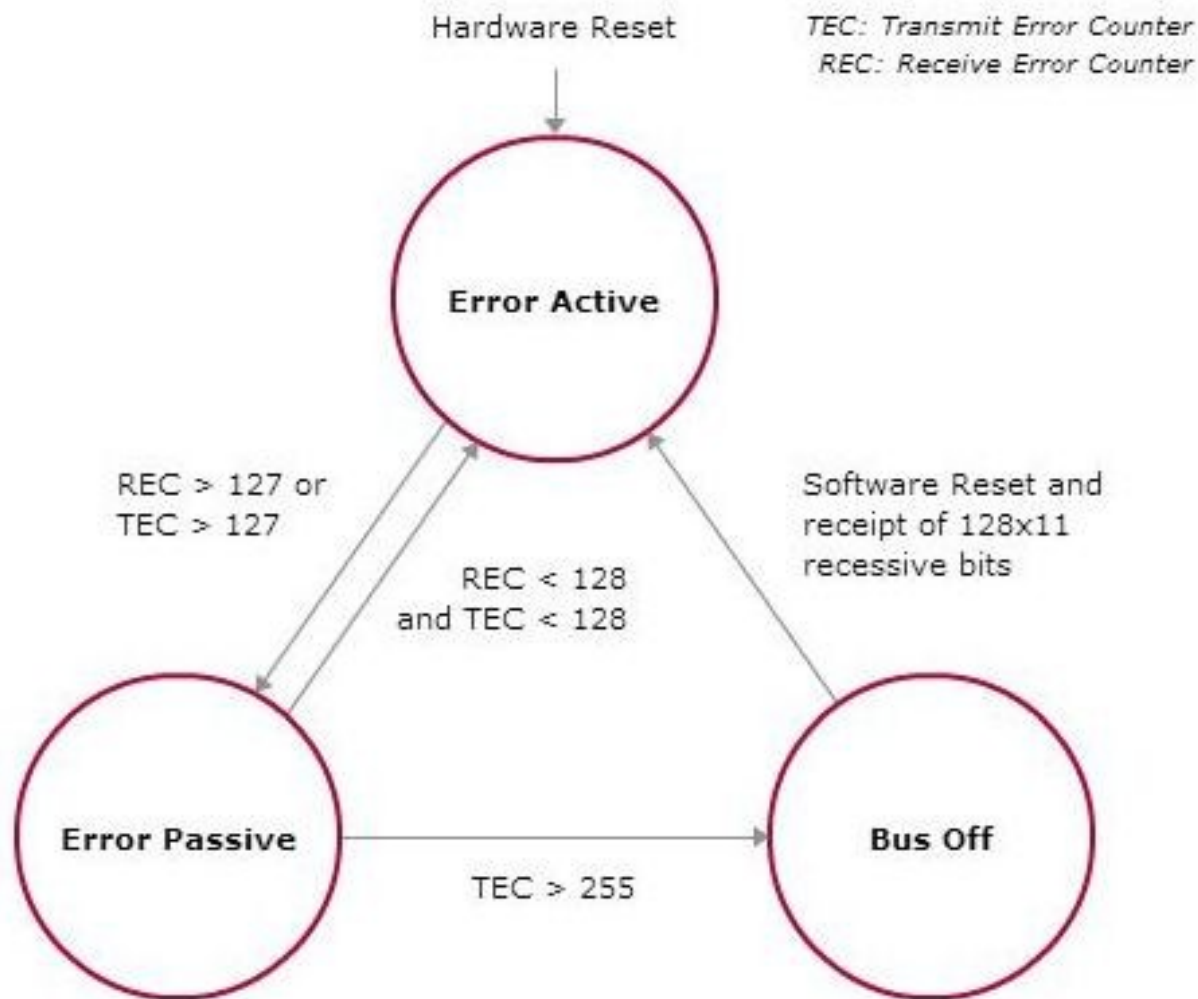
CAN Data Protection- Error Detection

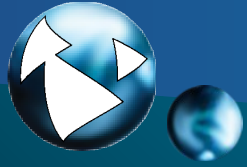
- ACK Check
 - ❖ Sender Task
 - ❖ Acknowledge error (ACK error) is detected if the recessive level placed by the sender is not overwritten
 - ❖ Detection of an ACK error results in error handling



CAN Data Protection

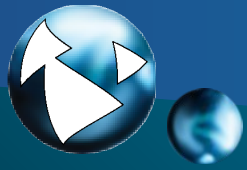
Error Tracking





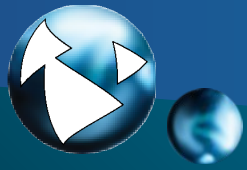
CAN Advantages

- High performance under light loads
- Low cost
- Reliable
- Robust



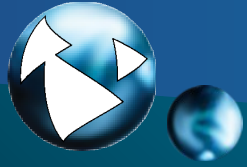
CAN Disadvantages

- Unfair access: Node with high priority can hog the network
- Starvation for some particular nodes



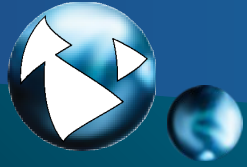
Conclusion

- CAN is ideally suited in applications requiring a large number of short messages with high reliability in rugged operating environments.
- Because CAN is message-based and not address-based, it is especially well-suited when data is needed by more than one location and system-wide data consistency is mandatory.



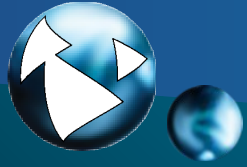
References

1. <https://elearning.vector.com>
2. <https://slideshare.net>



CAN Bus Protocol

Q & A



CAN Bus Protocol

Thank you!