

Controller Area Network (CAN - ISO 11898) Protocol

Ws CAN Protocol?

CAN is a serial communication technology used especially for reliable data exchange between electronic control units (ECUs) in the automobile without using any host computer.

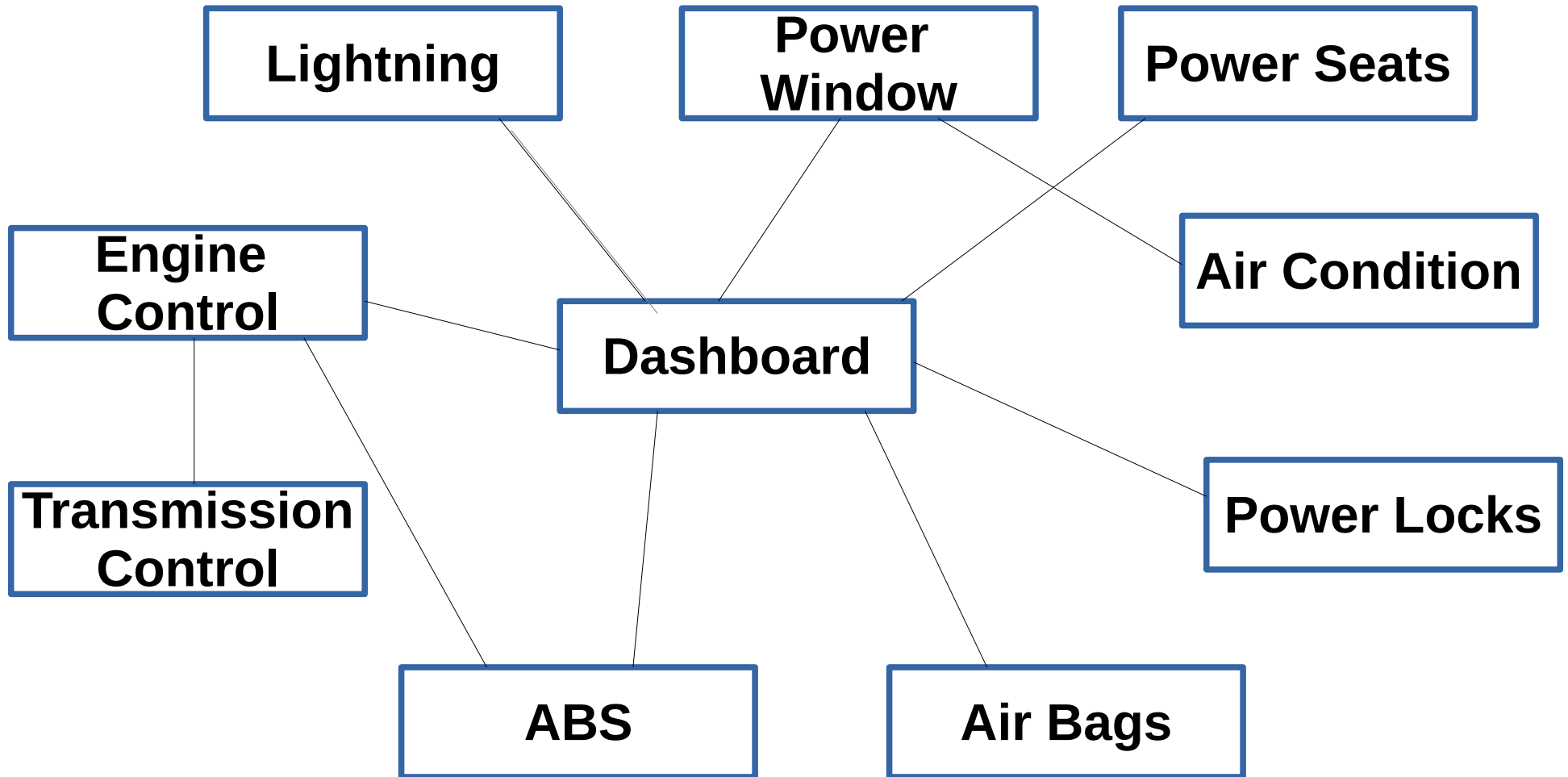
CAN is a Message based Protocol.

Why CAN Protocol?

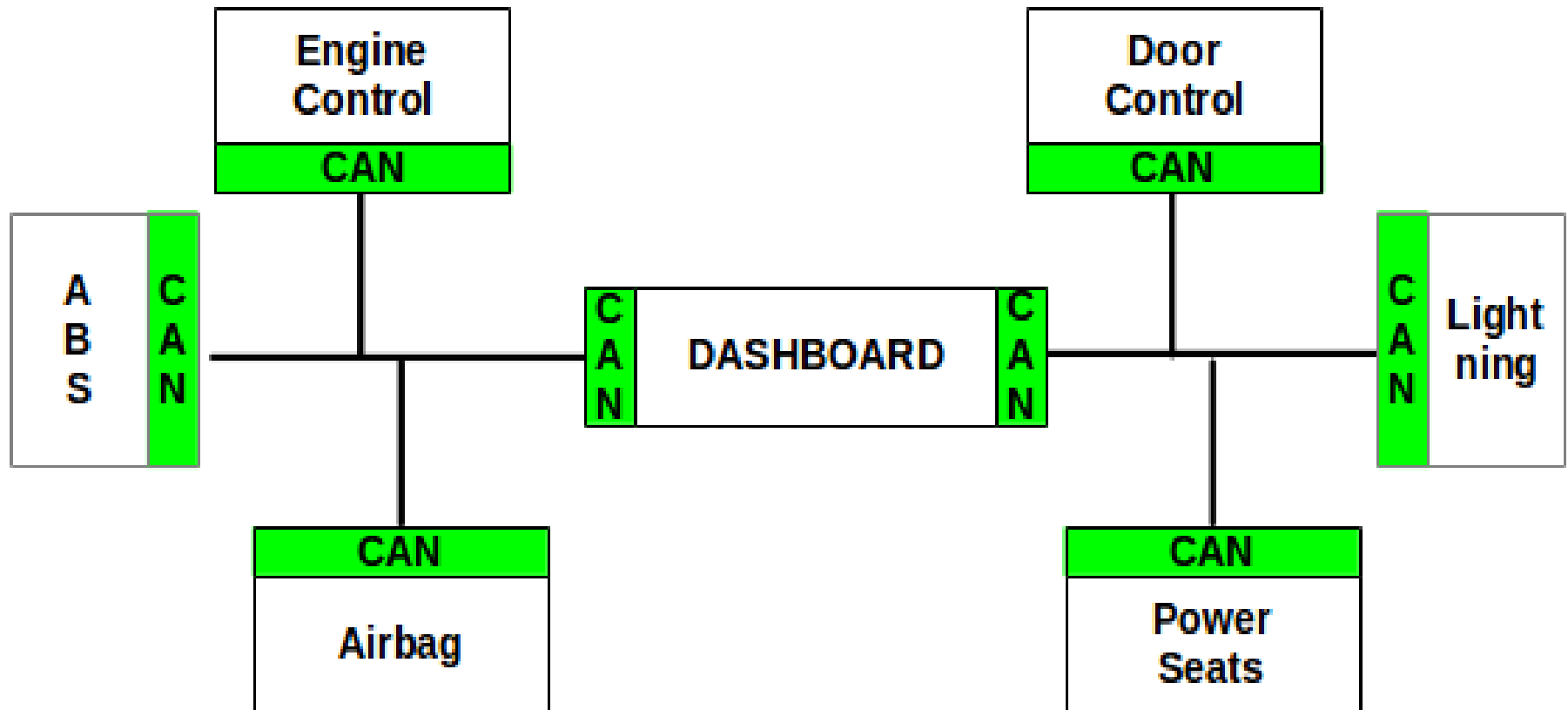
- CAN was first created for automotive use, so its most common application is “In-Vehicle Electronic Networking”.
- Purpose to replace complex wiring harness with two-wire-bus.

- An idea initiated by Robert Bosch GmbH in 1983 to improve the quality of automobiles thereby making them more reliable, safe and fuel efficient.
- Controller Area Network (CAN) is a serial network that was originally designed for the automotive industry, but has also become a popular bus in industrial automation as well as other applications.

Before CAN



After CAN



OBD

- CAN is one of five protocols used in the on-board diagnostics (OBD) vehicle diagnostics standard.

Features of CAN Bus

1. The CAN protocol was developed by Robert BOSCH & introduced in 1986.

2. It is two wired Protocol.

- CANH (CAN High)
- CANL (CAN Low)

3. CAN protocol is -

- Broadcast,
- Multi-master (priority based bus access),
- Half Duplex,
- Asynchronous serial communication protocol.

4. CAN Speed & Distance

- 1Mbps at network length below 40Meter's.
- Decreasing the bit rate below, longer network distance.
 - Eg: 500Meters at 125Kbps (Kilobit per second).

Bus Length vs Signaling Rate

Table 1. Suggested Cable Length vs Signaling Rate

Bus Length (m)	Signaling Rate (Mbps)
40	1
100	0.5
200	0.25
500	0.10
1000	0.05

5. Max Nodes on CAN Bus

- Practically up to 30 nodes.

(When more than the 30 nodes are used on a bus, it is recommended that a transceiver with a high bus-input impedance).

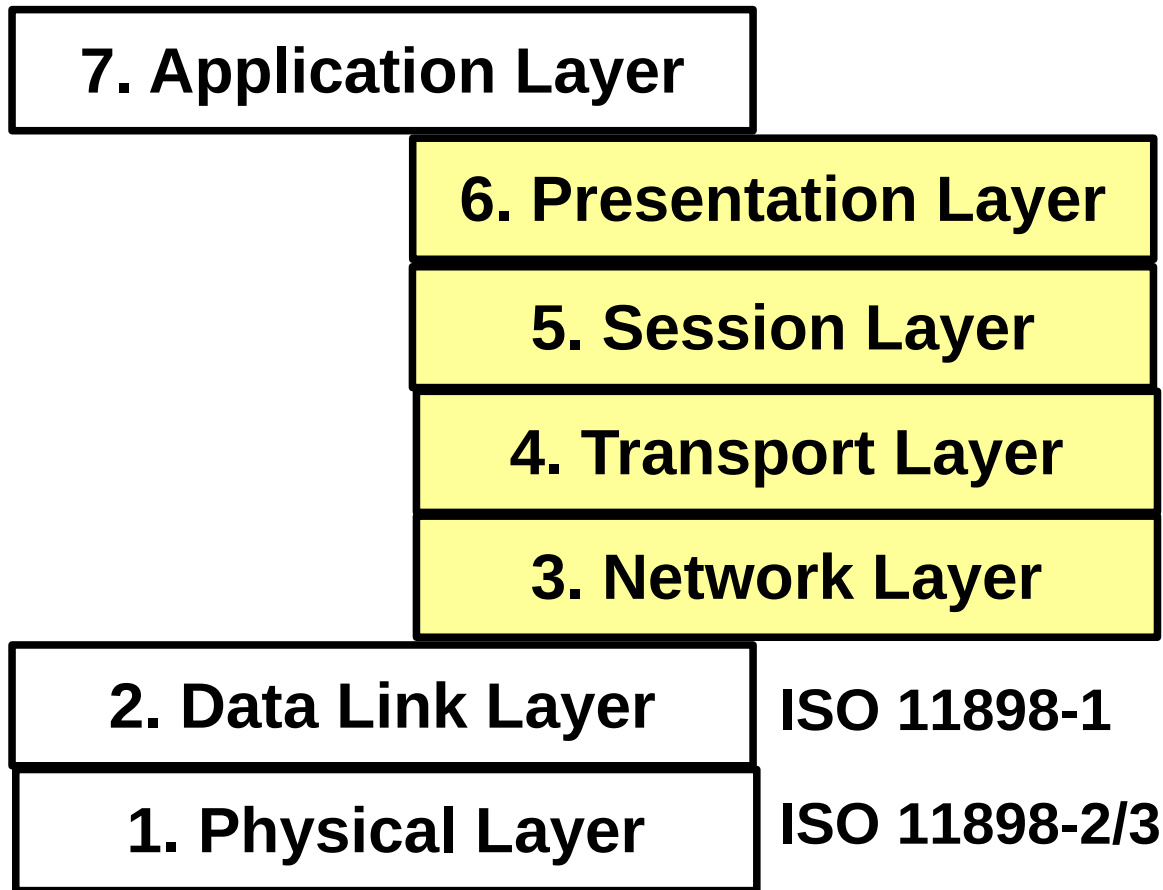
6. CAN is available in two versions

- Standard CAN (Version 2.0A).
11 bit identifier.
- Extended CAN (Version 2.0B).
29 bit identifier.

7.To achive Design transparency and implementation flexibility CAN has been subdivided into different layers.

- Data Link Layer (ISO 11898-1)
- Physical layer (ISO 11898-2/3)

7 Layers of OSI Model



8. CAN standard supports several topologies.
Commonly used topology is Line / Bus
Topology

9. Low-Cost, Lightweight Network.

10. Standard CAN protocol supports 8 bytes while CAN FD protocol supports 64 bytes in the data field part.

11. Supports remote data request

12. Supports non-destructive contention-based arbitration.

13. Supports auto retransmission of frames that have lost arbitration or have been destroyed by errors during transmission.

14. The protocol supports different error detection capabilities such as bit error, ack error, form error, CRC error and stuff error.

15. Every message has a priority, so if two nodes try to send messages simultaneously, the one with the higher priority gets transmitted and the one with the lower priority gets postponed.

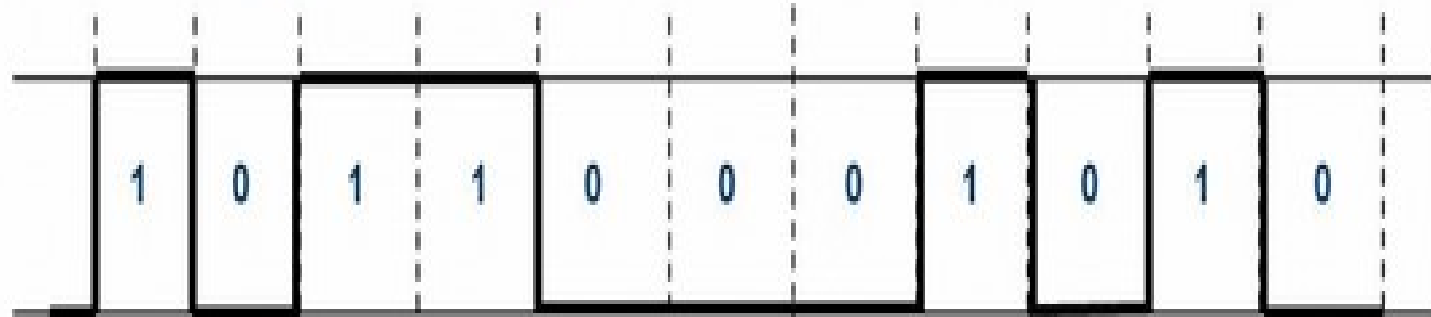
16. CAN Data Format

- The message is transmitted serially onto the bus using a non-return-to-zero (NRZ) format.
- As the name suggests, there is no transition between same polarity bits.

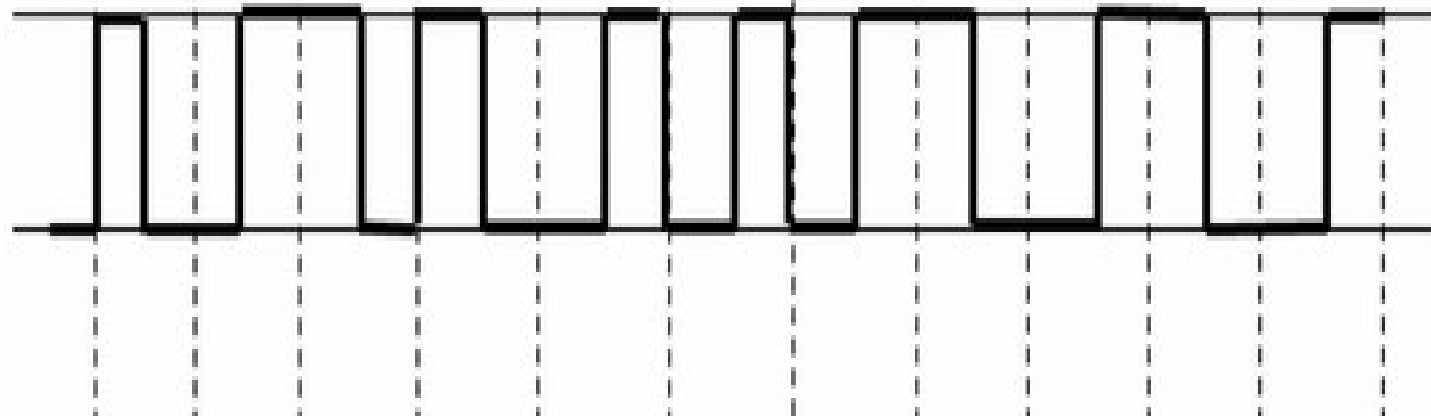
NRZ vs Manchester Data Format

Digital Bit Representations

NRZ



Manchester



Applications of CAN protocol

- Passenger vehicles, trucks, buses (gasoline vehicles and electric vehicles)
- Electronic equipment for aviation and navigation
- Industrial automation and mechanical control
- Elevators, escalators
- Building automation
- Medical instruments and equipment

Thank You