TODAY'S
TOPIC

CONTENT

CAN PROTOCOL

What is CAN?

Controller Area Network

Why CAN?

The need for a centralized standard communication protocol came because of the increase in the number of electronic devices.

Feature?

Asyncronous serial communication protocol

Message-Oriented

Error Detection and Fault Confinement

High-Speed Communication

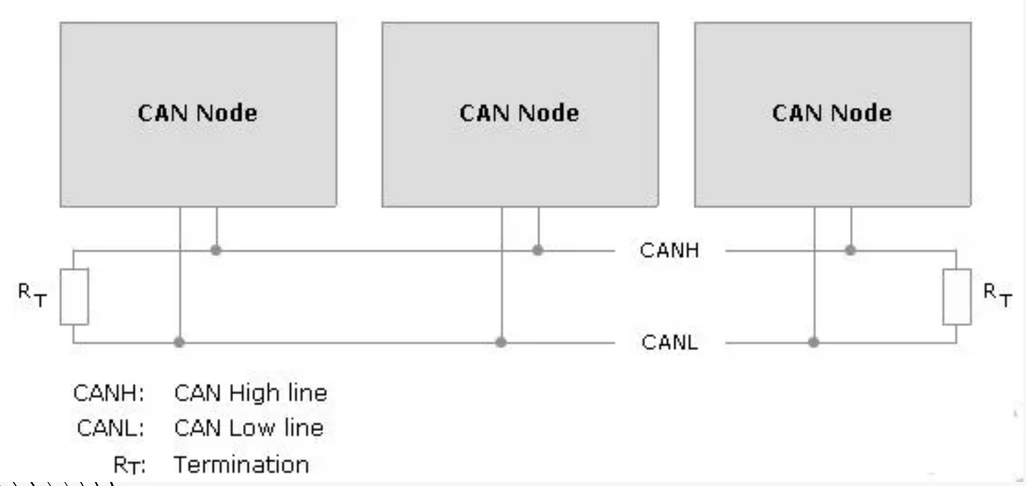
Max speed, 1Mbit/sec

Min speed, 125Kbit/sec

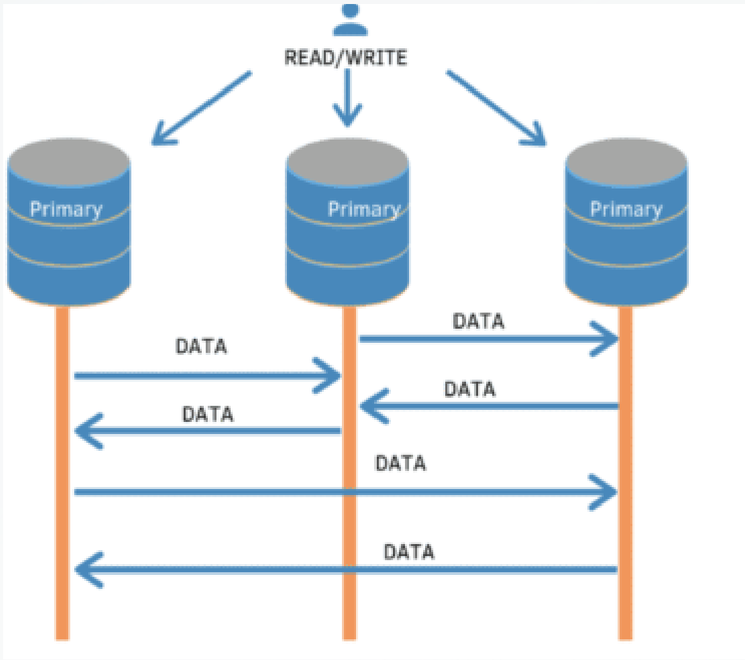
Broadcast, half-duplex

CAN PROTOCOL

Feature?(continued)



CAN nodes connected on the CAN bus in the BUS Topology.



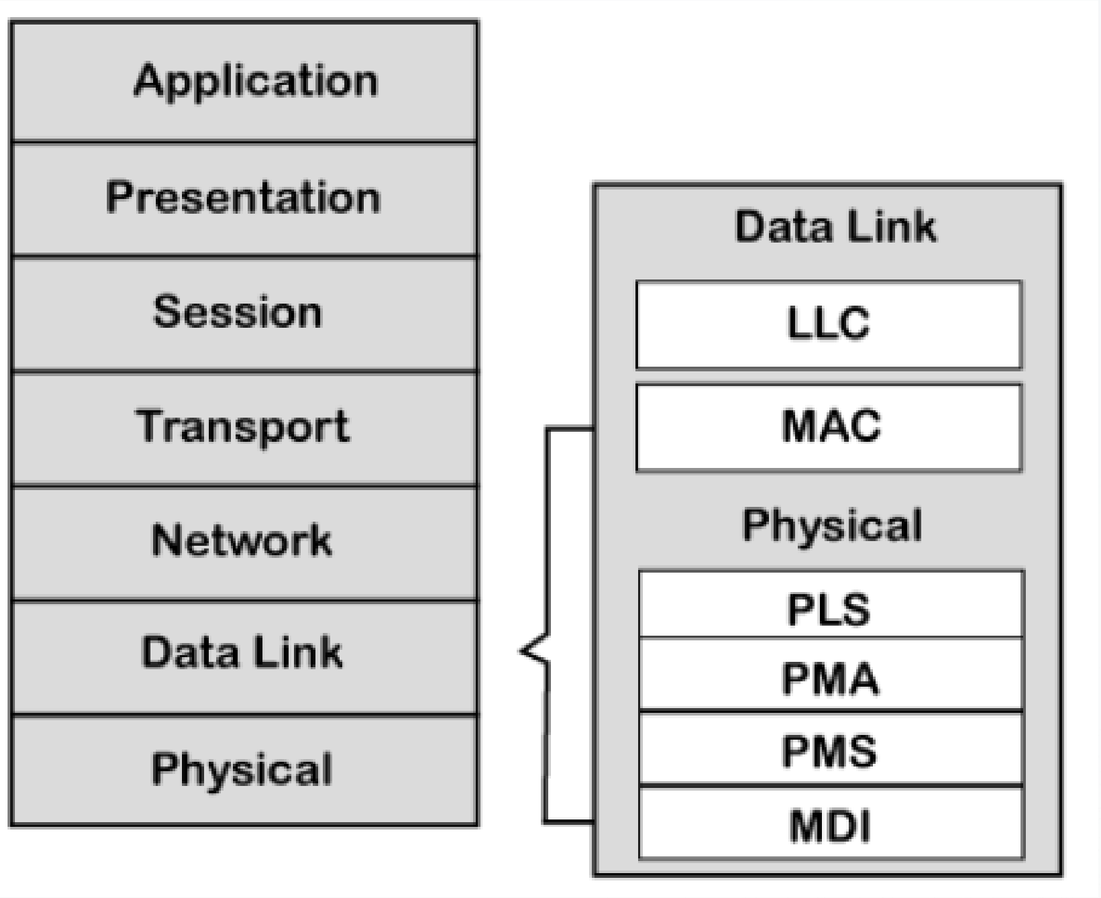
Multi-Master Architecture

CAN FRAME STRUCTURE

Can layered architecture?

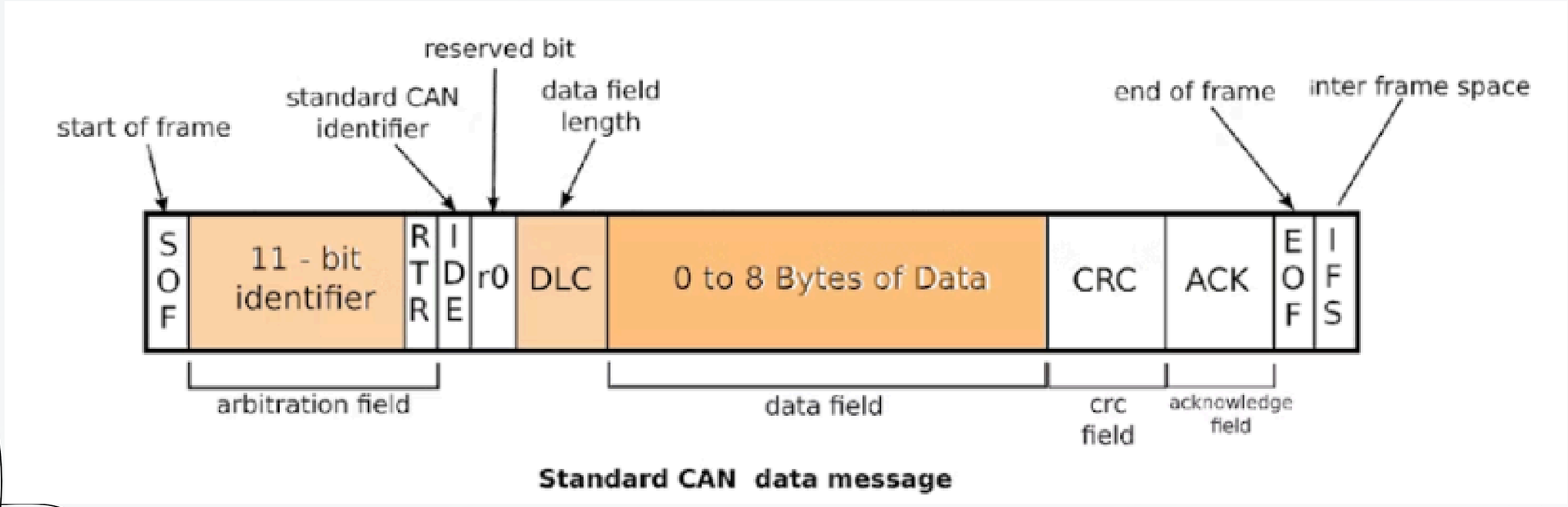
OSI model partitions the communication system into 7 different layers.

CAN layered architecture consists of two layers, i.e., data-link layer and physical layer.



CAN FRAME STRUCTURE

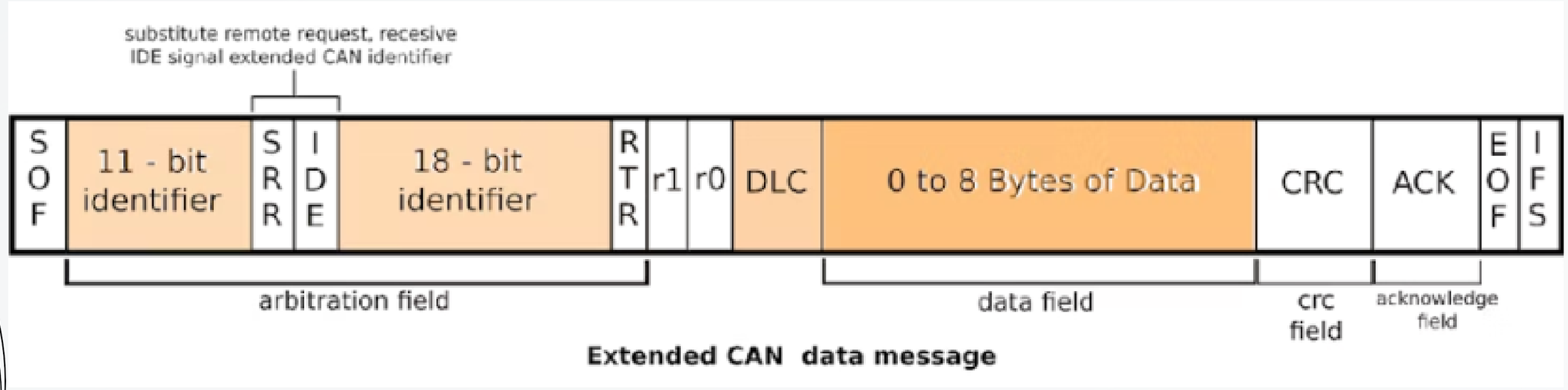
Can Framing?(standard)



Standard CAN data message

CAN FRAME STRUCTURE

Can Framing?(extended)



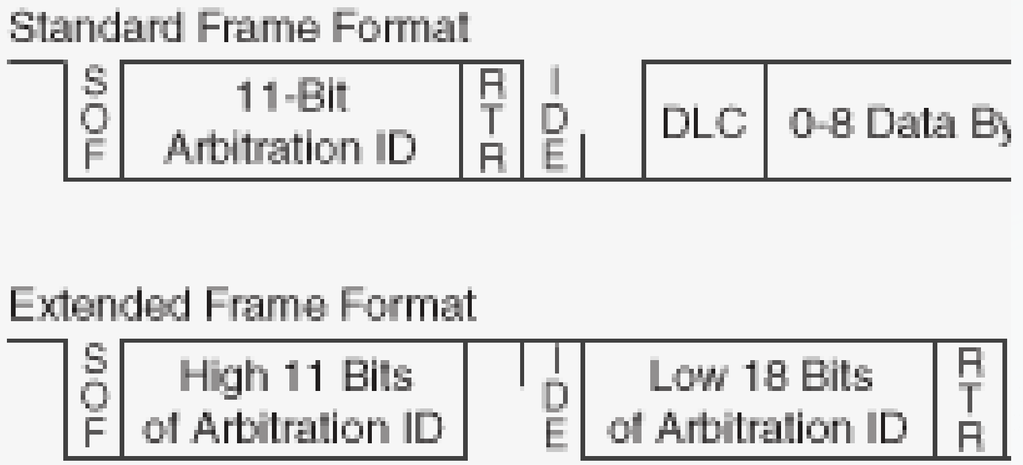
Extended CAN data message

CAN FRAME STRUCTURE

What’s the difference between standard and extendted data frame?

=The arbitration ID

In the standard frame format (also known as 2.0A), the length of the ID is 11 bits. In the extended frame format (also known as 2.0B), the length of the ID is 29 bits.



CAN FRAME STRUCTURE

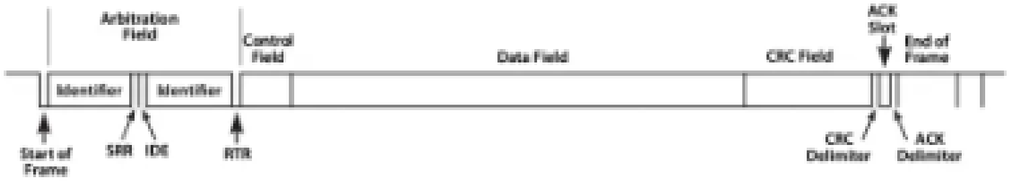
Type of CAN message?

1. Data Frame

All regular frames containing data are known as Data frames.

A data frame consists of 7 fields.

A CAN 2.0A ("standard CAN") Data Frame.



A CAN 2.0B ("extended CAN") Data Frame.

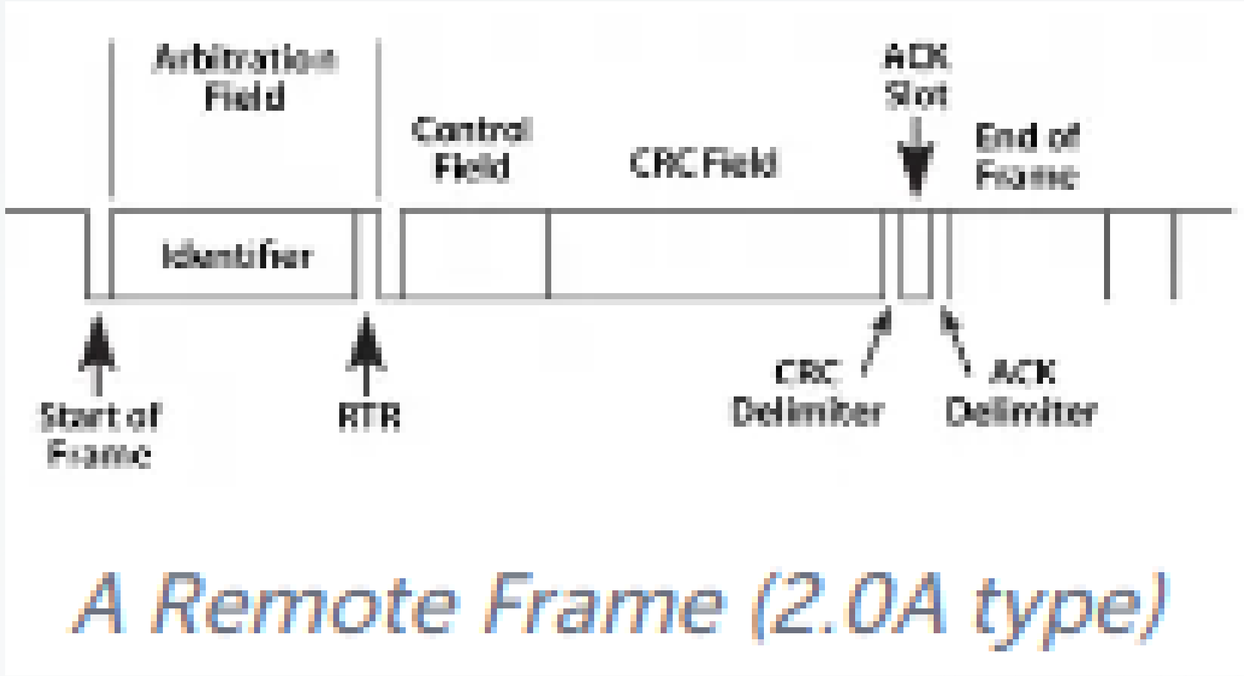
CAN FRAME STRUCTURE

Type of CAN message?

2. Remote frame

It is explicitly marked as a Remote Frame by setting the RTR bit as recessive.

There is no Data Field in the remote frame.

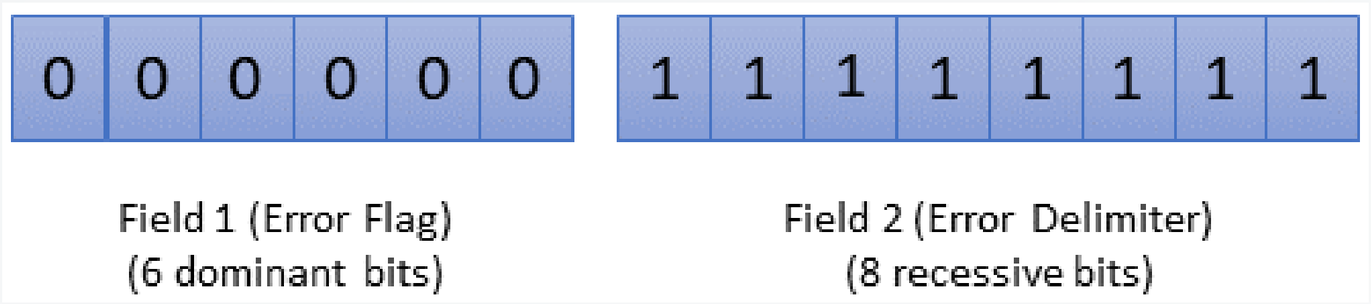


A Remote Frame (2.0A type)

CAN FRAME STRUCTURE

Type of CAN message?

3. Error Frame



Error frame consists of an error flag made up of six dominant bits and error flag delimiter made up of eight recessive bits (all 0's Active, all 1's Passive)

REC stands for Receive Error Counter and TEC is Transmit Error Counter.

When TEC/REC is greater than 255, the Bus is off

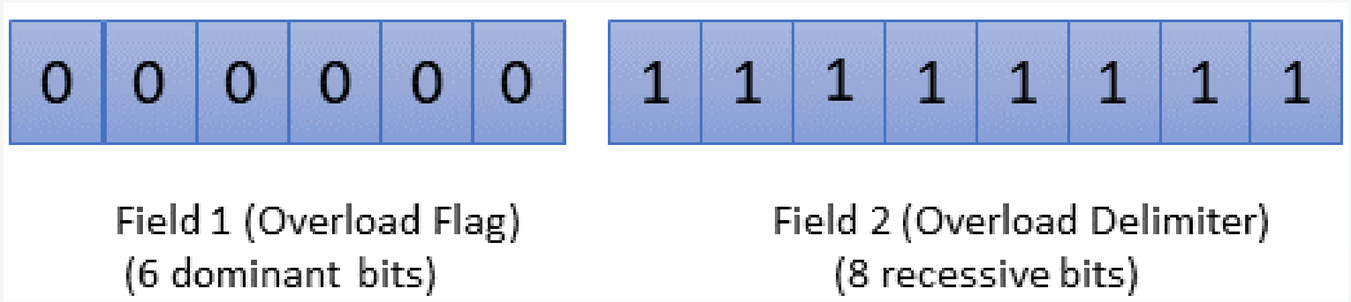
Passive error flags are set, when TEC or REC is greater than 127.

And, when TEC/REC < 128, then Active error flags are set

CAN FRAME STRUCTURE

Type of CAN message?

4. Overload frame



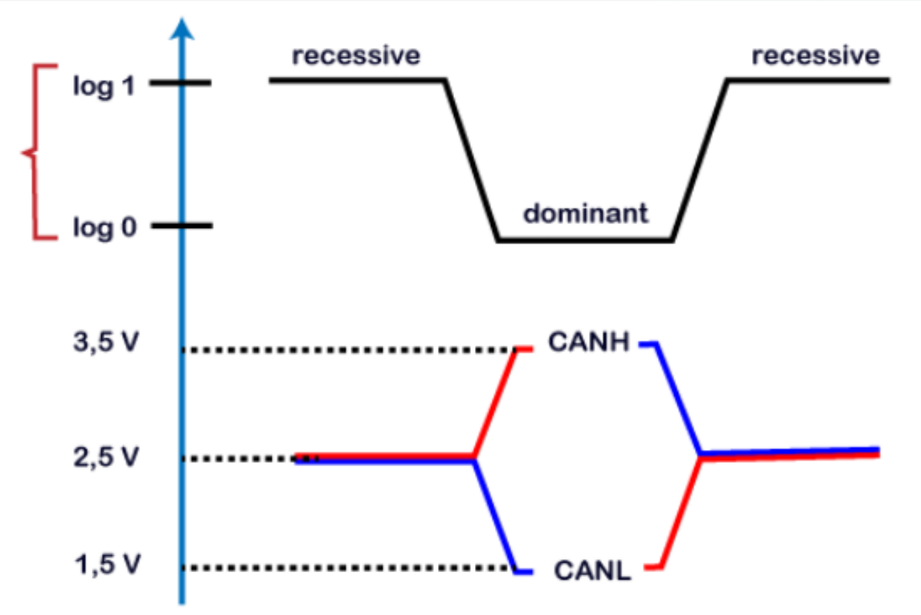
It sends this frame when it receives messages faster than it can process, providing extra time between successive Data or Remote frames.

Overload flag consisting of six dominant bits, overload delimiter consisting of eight recessive bits.

Unlike error frames, overload frames do not increment error counters.

CAN BUS ARBITRATION

CAN Characteristics?



Logic 1 is a recessive state. To transmit 1 on CAN bus, both CAN high and CAN low should be applied with 2.5V.

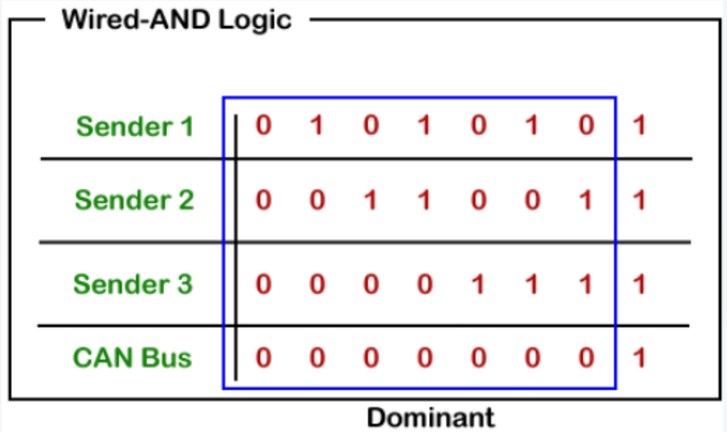
Logic 0 is a dominant state. To transmit 0 on CAN bus, CAN high should be applied at 3.5V and CAN low should be applied at 1.5V.

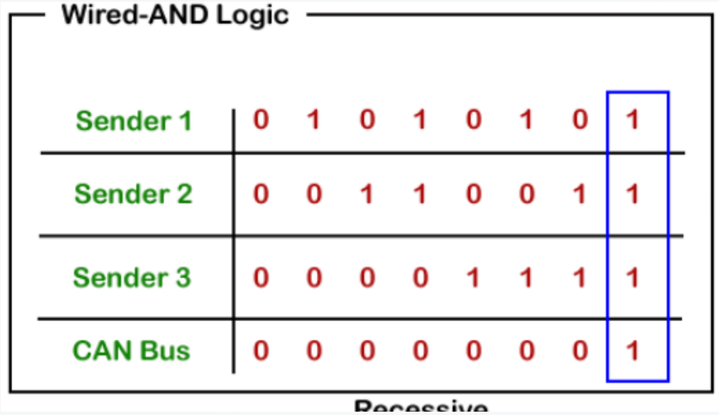
The ideal state of the bus is recessive.

If the node reaches the dominant state, it cannot move back to the recessive state by any other node.

CAN BUS ARBITRATION

CAN bus logic?





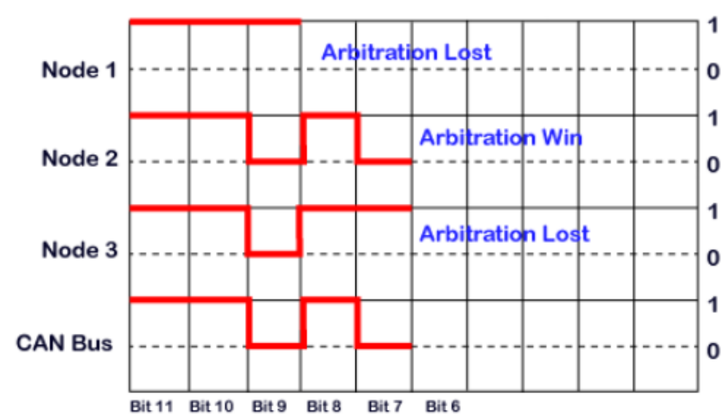
The dominant state overwrites the recessive state.

When the node sends the dominant and the recessive bit simultaneously, then the bus remains dominant.

The recessive level occurs only when all the nodes send the recessive bit.

CAN BUS ARBITRATION

CAN Arbitration Example?



CAN Node	Identifier (Hex)	Identifier (Binary)
1	0x7F3	11111110011
2	0x6B3	11010110011
3	0x6D9	11011011001

11th bit: remain recessive

10th bit: remain recessive

9th bit: node 1 has lost the arbitration, so it stops sending bits.

8th bit: remain recessive

7th bit: node 3 has lost the arbitration, so it stops sending the message while the node 2 has won the arbitration means that it will continue to hold the bus until the message is received.