TYPE OF FRAMES IN CAN

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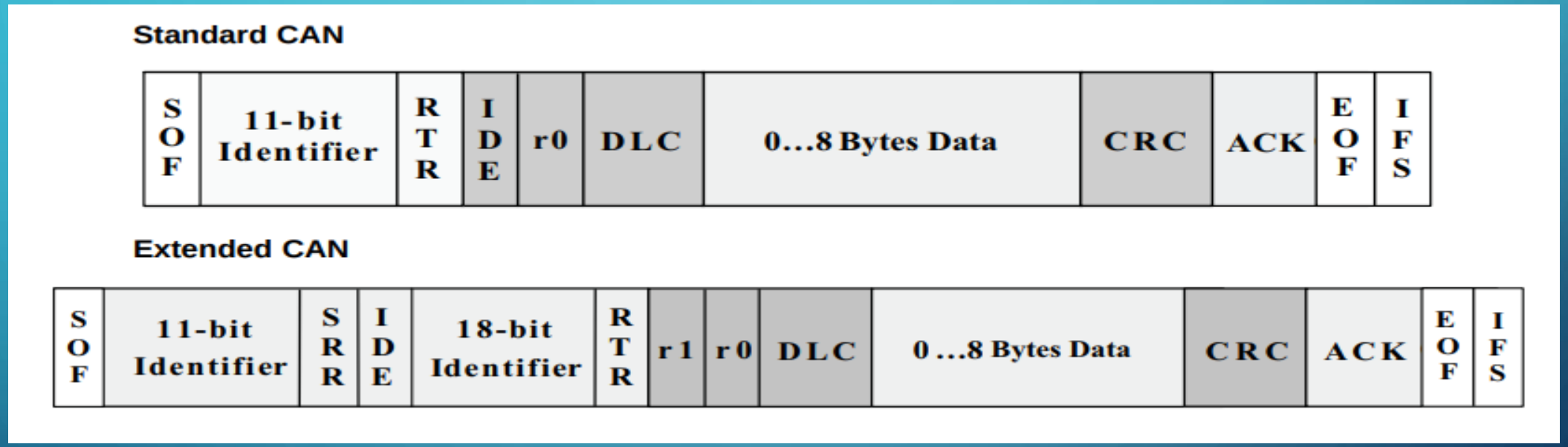
- FRAME TYPE BASED ON PURPOSE IN CAN
  - Data frame
  - Remote frame
  - Error frame
  - Overload frame
- FRAME TYPE BASED ON ARBITATION FIELD :
  - Standard
  - Extended
- FRAME TYPE BASED ON DATA RATE
  - Classical (0 to 8 bytes of Data)
  - CAN Flexible Data rate (0 to 64 bytes of Data)

DATA FRAME

- A frame containing node data for transmission.
- The data frame in the CAN protocol is used to send/broadcast the data in the CAN network so that others can receive whoever all are available in the CAN network according to their requirement.
- The data frame having consisted of 7 fields that are taking care of secure data transfer from transmitter to receiver successfully.
- The CAN data frame is composed of seven fields: Start of frame (SOF), arbitration, control, data, cyclical redundancy check (CRC), acknowledge (ACK) and end of frame (EOF). The SOF field consists of one dominant bit.

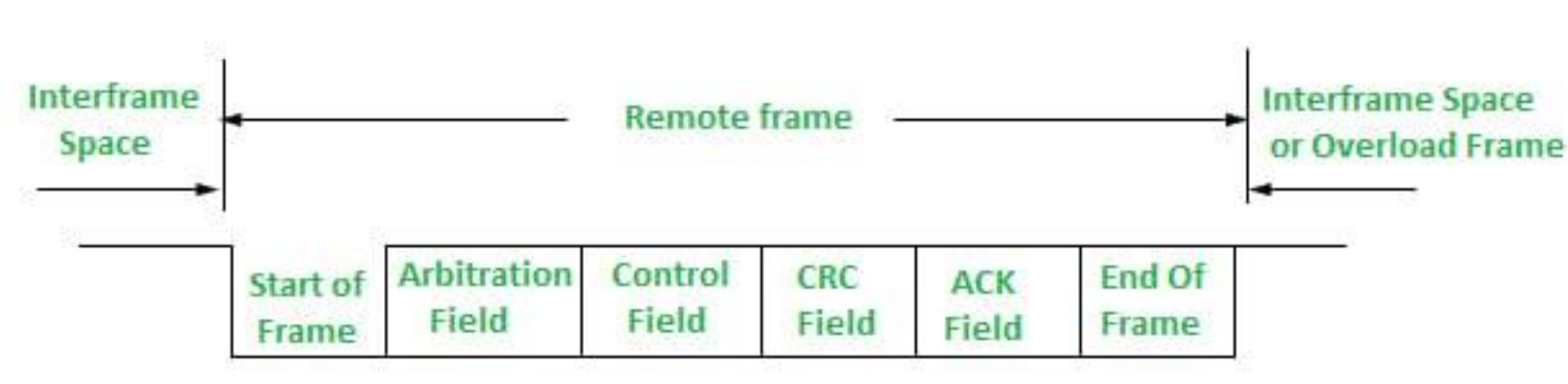
DATA FRAME


Standard CAN
SOF
11-bit Identifier
RTR
IDE
r0
DLC
0...8 Bytes Data
CRC
ACK
EOF
IFS
Extended CAN
SOF
11-bit Identifier
SRR
IDE
18-bit Identifier
RTR
r1
r0
DLC
0 ...8 Bytes Data
CRC
ACK
EOF
IFS

REMOTE FRAME

- A frame requesting the transmission of a specific identifier.
- The sender-receiver means when an ECU needs any data like the vehicle speed in another ECU, receiver will send a remote frame to transmitter through the CAN bus.
- A Remote frame is composed of six different bit fields: Start of the frame, Arbitration field, Control field, CRC field, ACK field, End of the frame.
- If RTR bit is recessive(1) - Remote the frame.
- If RTR bit is dominant(0) - Data the frame.

REMOTE FRAME



ERROR FRAME

- The error frame consists of two different fields. The first field is given by the superposition of ERROR FLAGS (6-12 dominant/recessive bits) contributed from different stations. The following second field is the ERROR DELIMITER (8 recessive bits).
- There are two types of error flags
- Active Error Flag six dominant bits - Transmitted by anode detecting an error on the network that is in error state "error active“ .
- Passive Error Flag six recessive bits - Transmitted by a node detecting an active error frame on the network that is in error state "error passive“ .

ERROR FRAME

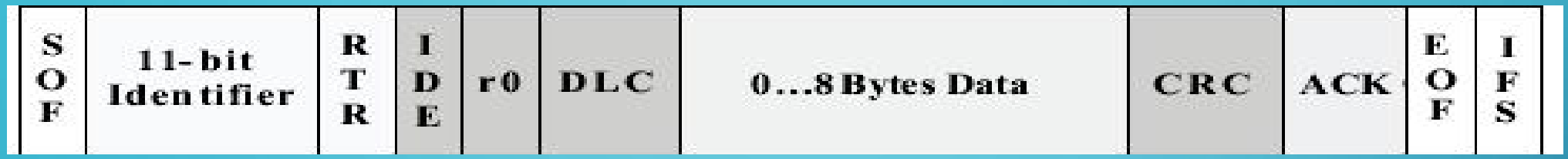
There are two error counters in CAN

- 1. Transmit error counter (TEC)
- 2. Receive error counter (REC)
- When TEC or REC is greater than 127 and less than 255, a Passive Error frame will be transmitted on the bus. • When TEC and REC is less than 128, an Active Error frame will be transmitted on the bus.
- When TEC is greater than 255, then the node enters into Bus Off state, where no frames will be transmitted.

OVERLOAD FRAME

- The overload frame contains the two bit fields Overload Flag and Overload Delimiter. There are two kinds of overload conditions that can lead to the transmission of an overload flag
- The internal conditions of a receiver, which requires a delay of the next data frame or remote frame.
- Overload Flag consists of six dominant bits. The overall form corresponds to that of the active error flag. The overload flag's form destroys the fixed form of the intermission field. As a consequence, all other stations also detect an overload condition and on their part start transmission of an overload flag. Overload Delimiter consists of eight recessive bits.

STANDARD CAN FRAME



- SOF : Start of Frame bit. It marks start of message. It is used to synchronize nodes on the CAN bus.
- Identifier : It is 11 bit (binary) in size. It establishes priority of message. Lower the value, higher is the priority.
- RTR : It stands for Remote Transmission Request bit. This field is dominant when node requires information from another remote node. All the nodes receive request and all the nodes receive reply. Specific node processes the request based on identifier and transmits the reply.

STANDARD CAN FRAME

- IDE : Stands for Identifier Extension bit. It indicates standard CAN frame is being transmitted with no extension.
- r0 : It is reserved for future use.
- DLC : Stands for Data length code. It is 4 bits in size. It indicates number of bytes to be transmitted over the CAN bus.
- Data field : It contains 0-8 bytes (64 bits) of application data.
- CRC : There is an algorithm, it takes entrie CRC field and polynomia value with constant. It is used for error detection. It is 16 bits in size. It holds checksum for application data preceding to it.

STANDARD CAN FRAME

- ACK : It is 2 bits in size. It contains first bit as ack bit and second bit as delimiter. Each node uses this to show integrity of its data. Node receiving correct message overwrites this bit in original received message with dominate bit as mentioned above to indicate error free message has been transmitted. The node receiving erroneous message leaves this bit as recessive. Moreover it discards the message and hence prompts the sending node to re-transmit the message after re-arbitration process.
- EOF : Stands for End of Frame. It is 7 bits in size. It marks end of CAN frame or message.
- IFS : stands for Interframe space. It is 7 bits in size. It contains time required by controller to move correctly received frame to its proper position in message buffer area.

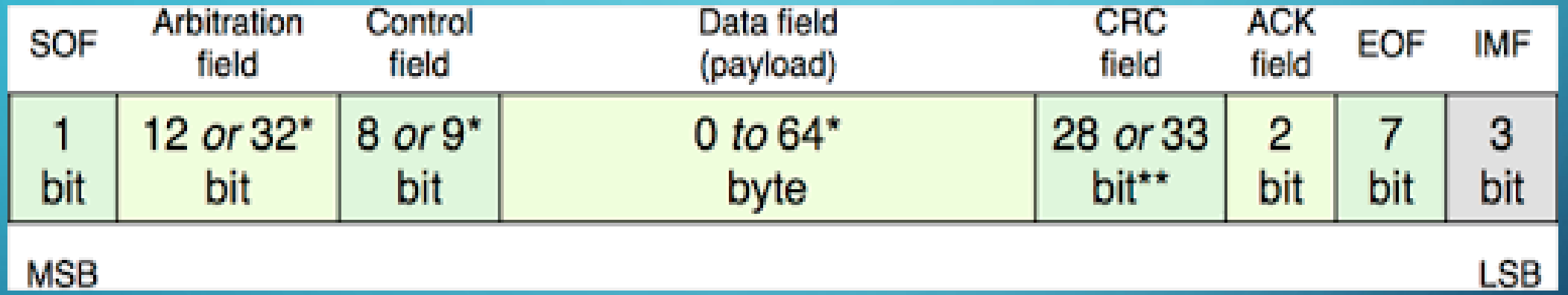
EXTENDED CAN FRAME

- Identifier : It is 29 bit (11+18) in size. It establishes priority of message. Lower the value, higher is the priority.
- SRR : It stands for Substitute Remote Request. This bit replaces RTR bit of standard CAN message location as placeholder in this extended CAN format.
- IDE : It functions as recessive bit in identifier extension. It indicates that more identifier bits are followed. 18 bit extension follows IDE.
- r1 : It is additional reserved bit for future use.

Classical CAN Frame vs Flexible Data CAN Frame

Features	Classical CAN	CAN FD
Payloads	Supports upto 8 bytes of payload /frame	Supports upto 64 bytes of payload /frame
Data Rate	Maximum of 1 Mb/s speed at 40 meter bus length	The standard permits speeds upto 5 Mb/s
Latency	Takes significantly more time to send the data	Able to send the message at less time as the data is transmitted at a higher bit rate
Bit rate dependency	Propagation delay is common in CAN bus standard due to the transceivers and cable length.	There is no such dependence of bit rate on signal propagation delay due to the difference in the message frame format.
Compatibility Factor	A Classical CAN controller is not compatible with CAN FD	CAN FD is backward compatible with Classical CAN which means that both CAN and CAN FD nodes can be used together

FLEXIBLE DATA **CAN FRAME**



CAN Message Transmission

1. Initialize the microcontroller.
2. Initialize the CAN Transceiver by clearing the RB2 pin and setting the RB3 pin.
3. Initialize the CAN control register (CANCON) for requesting the configuration mode.
4. Using CAN status register (CANSTAT) check CAN module is in configuration mode. If it is not in configuration mode then check continuously until it enters into configuration mode.
5. After CAN module enters into configuration mode, set the baud rate using CAN baud rate control registers.
6. Initialize the CAN module i/o control register (CIOCON).
7. Initialize the CAN control register (CANCON) for requesting the normal mode.
8. Check if TXREQ bit is cleared and if it is normal mode and transmit buffer n.
9. Initialize the transmit buffer registers with Message ID, Data Length Code.
10. Configure transmitter buffer control register (TXBnCON) .
11. Call the delay function (1000ms).
12. Repeat the steps from step 8 to step 11 continuously.

THANK YOU ☺