Automotive Communication System- CAN & FlexRay protocols

Overview of Infotainment System & Key Features of Car Infotainment System

- Infotainment System is a media or service that delivers a combination of Information & Entertainment in the form of audio or video.

- In Vehicle Infotainment or IVI, is Integrated Infotainment Systems in Automobiles. Infotainment Head Unit has screen & user interfaces to control.

Different Car Infotainment Systems

- ❏ •Radio / Tuners
- ❏ •Multimedia
- ❏ •Phone Connectivity
- ❏ •Telematics
- ❏ •Navigation
- ❏ •Rear Seat Entertainment
- ❏ •Voice Recognition Systems

General Architecture of Car Infotainment Systems

HMMI is central interface to the user.

Control Display Data on Head Unit

Reach to all User Inputs via speech, keys or Touch Inputs

Specific to Application & HU Requirement

Middleware Layer is Abstraction to Lower Layers

Specific to OS & platform to HU

IO Interfaces, device drivers & protocol stack

Specific to the platform of the HU

HMI System
User Interface – Key / Touch

Application / Middleware Layer
Functional Logic / Networking / Navigation / Connectivity

| **OS Layer** |
|:--:|
| OS Core |

Hardware Layer
CPU / CAN / BootLoader

Introduction to CAN

- Multi – Master protocol

- Seamless Broadcasting

- Serial Communication Technology

- Priority based bit wise arbitration

- Originally developed by Robert Bosch for in vehicle automobile communication in 1980s

- CAN is widely recognized for reliable data exchange between ECU's

- Protocol in itself is robust in noisy environments & is cost effective

- It is a message based protocol, there are no defined addresses, just defined messages.
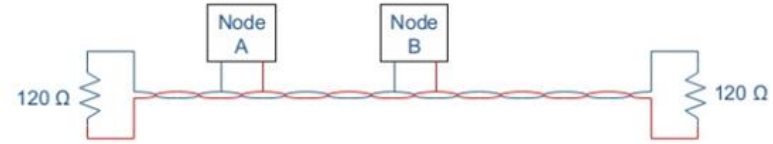
Before CAN

After CAN
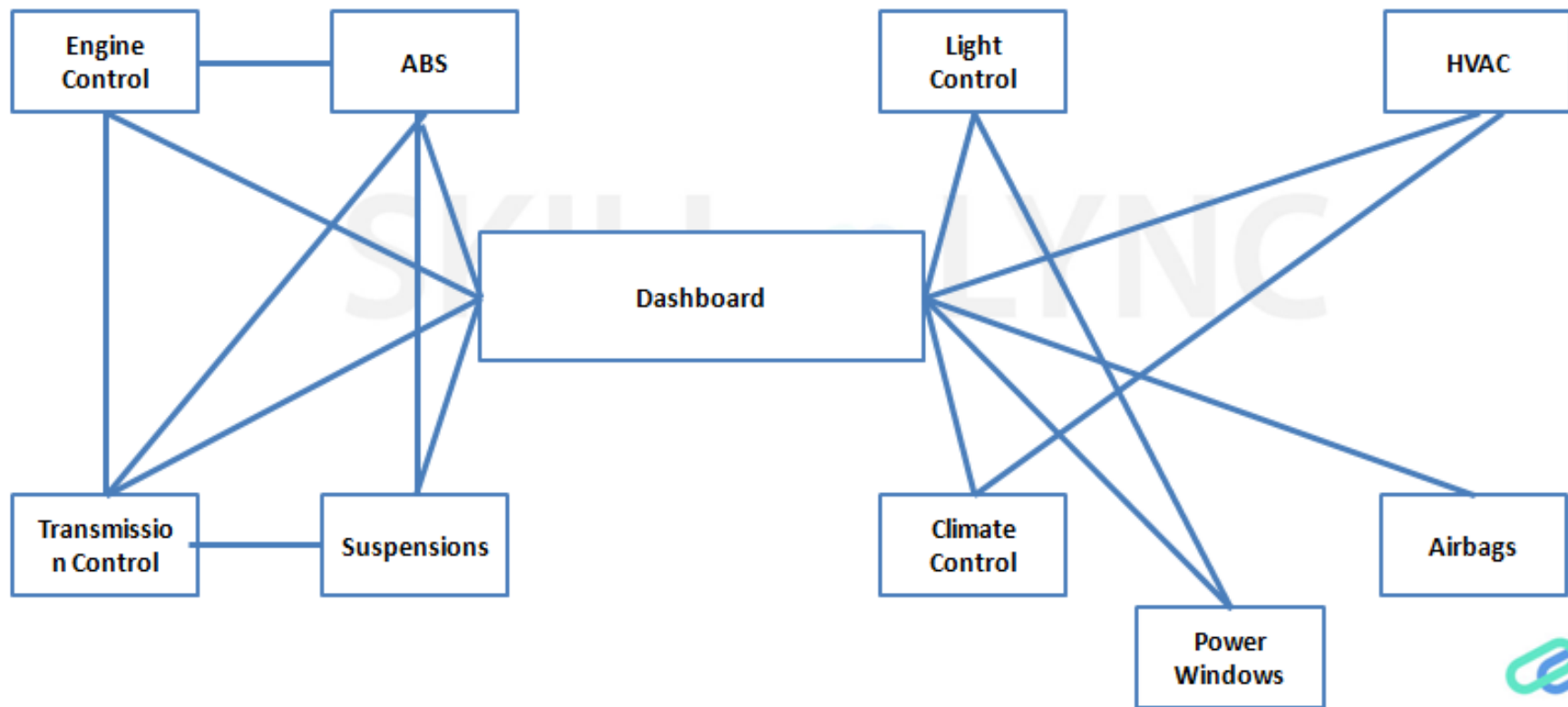
CAN Characteristics

•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

1M bit/sec	40 meters
500K bit/sec	100 meters
250K bit/sec	200 meters
125K bit/sec	500 meters

CAN Message Types & CAN Message Format
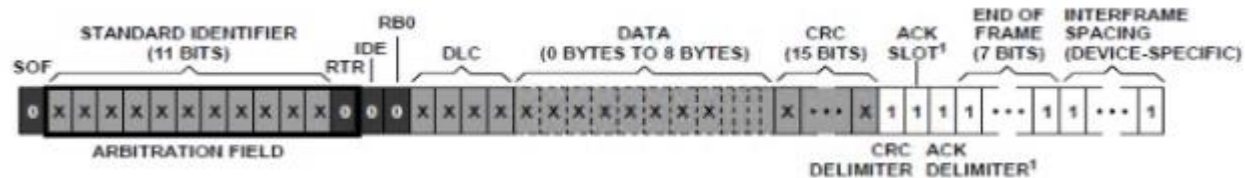
There are Four Message Types in CAN

Data Frame – Used to Transmit Data
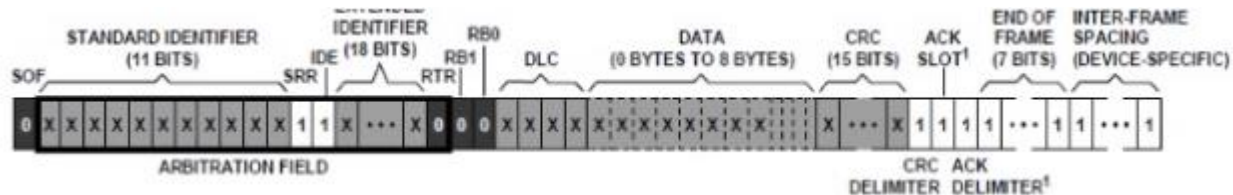
Remote Frame – Used to Request Data Transmission

Error Frame – Sent by a node that detects an error

Overload Frame – Sent by a node to request a delay in transmission

Standard Frame

Extended Frame

Introduction to FlexRay Protocol

❏ FlexRay is a Communication Protocol in Distributed Systems within automotive context.

❏ It was developed by FlexRay Consortium (BMW, Daimler Chrysler, Motorola, Philips) founded in 1999.

❏ Since it was developed, many well known OEM's & Tier – 1 Suppliers like Bosch, GM, etc have joined.

❏ The idea behind going for FlexRay is go get a fast, flexible & fault tolerant communication protocol.

❏ FlexRay was used for the first time in BMW X5 model in 2007.

FlexRay Protocol – Network Topology


Passive Bus Topology

Active Star Topology
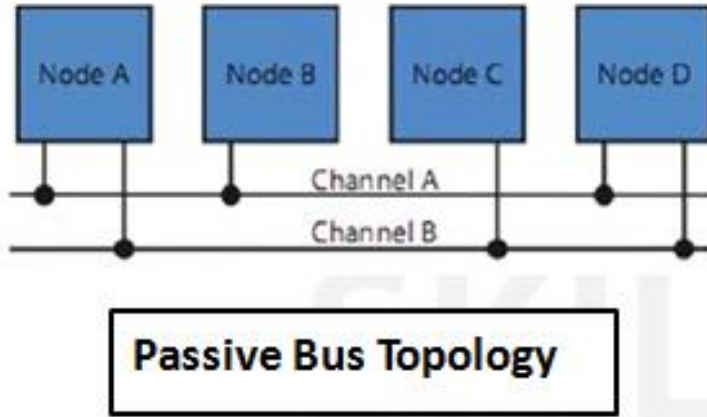
•Here, nodes are not directly interconnected but are connected via a common channel.

•No more than 22 nodes should be connected in a channel.
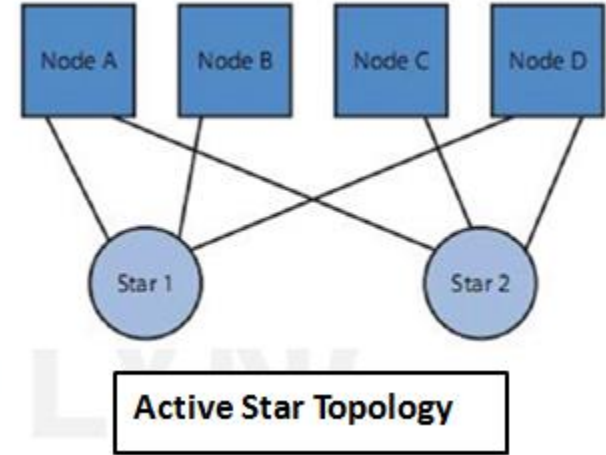
An alternative to passive connection, the FlexRay nodes may also be interconnected with the help of an active star coupler.
FlexRay nodes to be interconnected are physically arranged in the form of a star & an active star coupler is at center

FlexRay Communication Cycle

•FlexRay communication cycle is the fundamental element of the media access scheme within the FlexRay.

•The duration of a cycle is fixed when the network is designed, but is typically around 1 – 5 ms.

•The four main parts of a communication cycle are:
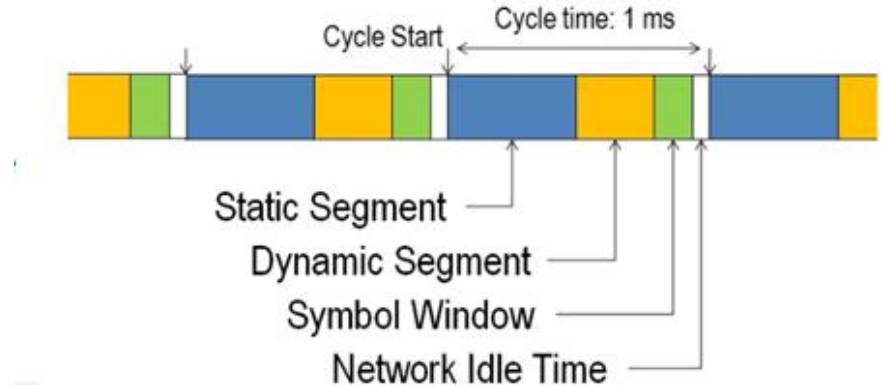
Static Segment – Reserved Slots for deterministic data that arrives at a fixed period.
Dynamic Segment – The Dynamic Segment behaves in a fashion similar to CAN & is used for wide variety of event based data.
Symbol Window – Typically used for network maintenance & signaling for starting the network.
Network Idle Time – An known quiet time used to maintain synchronization between node clocks.

CAN vs Flexray

	CAN	FlexRay
Cost/Node (in $)	3	6
Domains Applied	Chassis, PowerTrain	Chassis, PowerTrain
Message Transmission	Asynchronous	Synchronous & Asynchronous
Data Rate	1 Mbps	10 Mbps
Physical Layer	Dual – Wire	Dual – Wire (Optical Fibre)

Thanks