시스템 최신기술
(차량 제어 시스템 Week 1)

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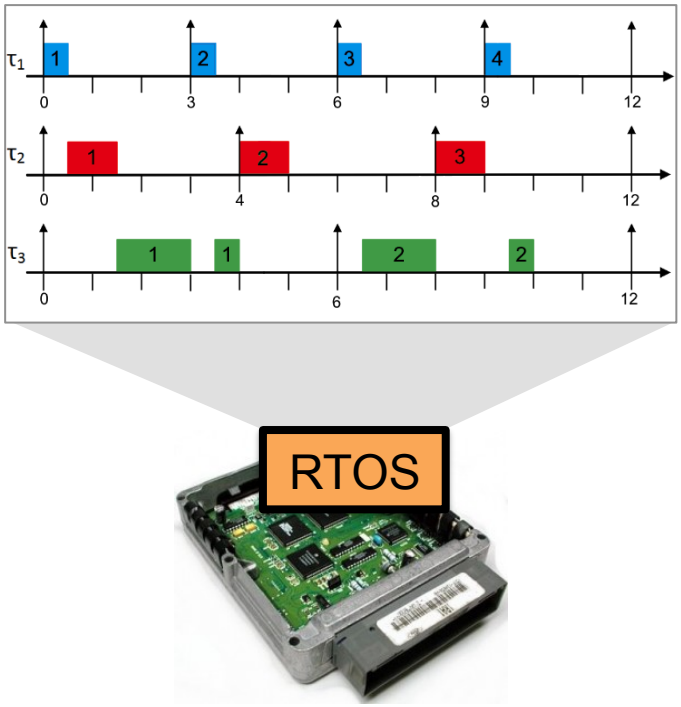
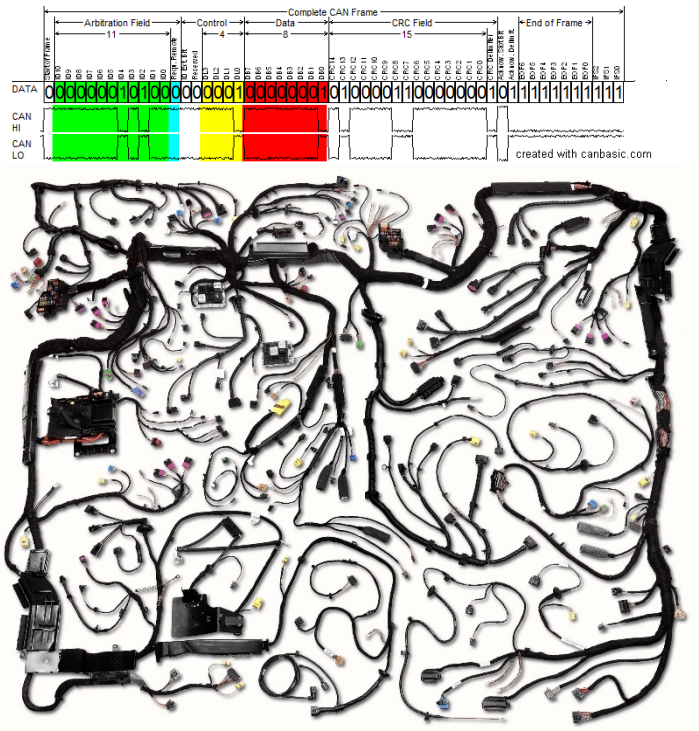
Kookmin University

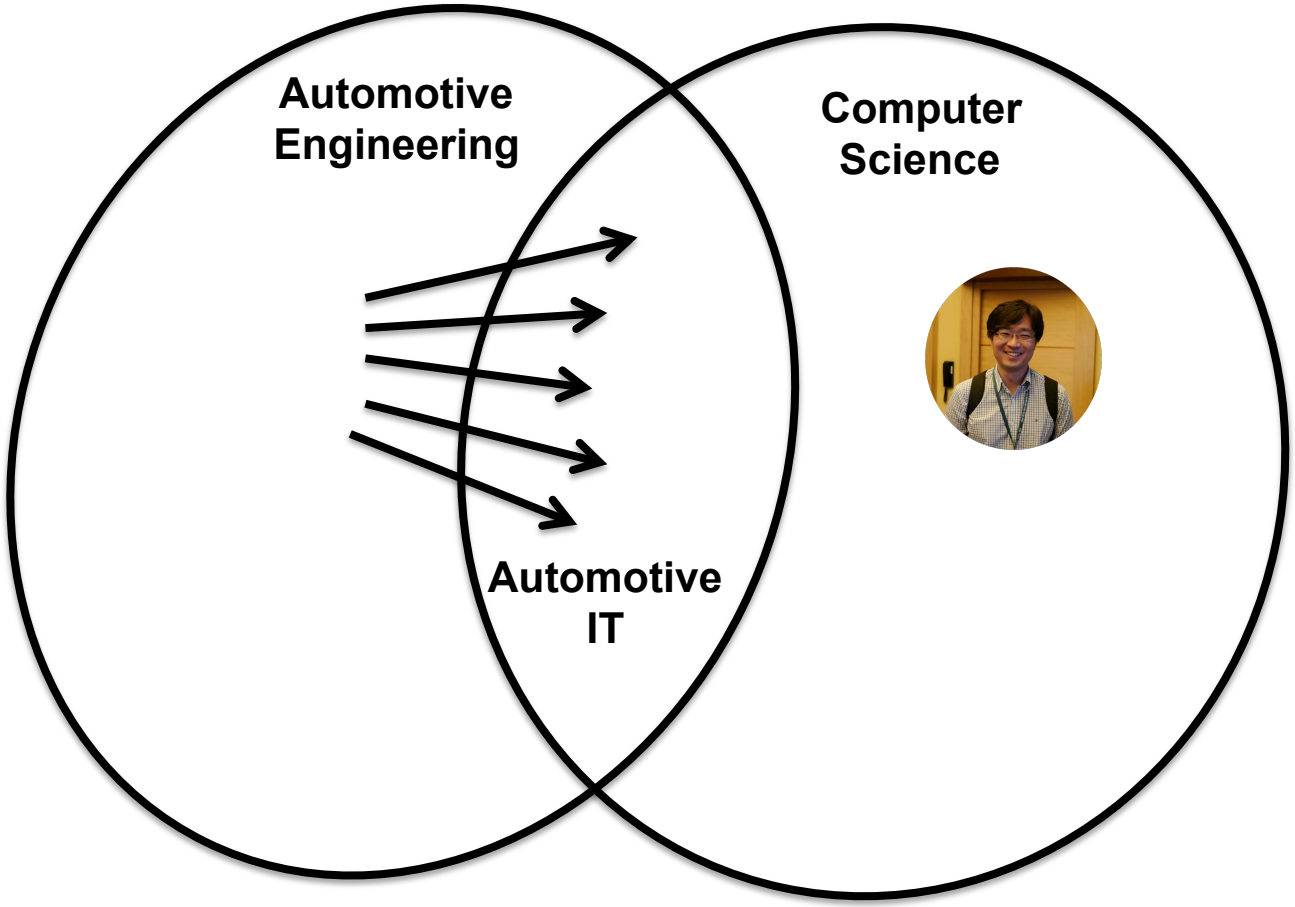
Introduction to Myself

- Prof. Jong-Chan Kim
- Office : 540
- E-mail : jongchank@kookmin.ac.kr
- Background : RTOS scheduling and real-time networks





Moving to a New Area



Vehicle as a Computer System

"Cars of the future will be computers on wheels" (USA Today)

Looks like a computer
with a handle

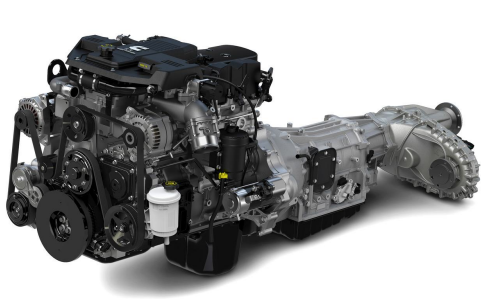
Infotainment System

Computer is driving,
not yourself

Vehicle Control System

Vehicle Control Domains

Powertrain Domain



- Engine
- Transmission

Chassis/Safety Domain

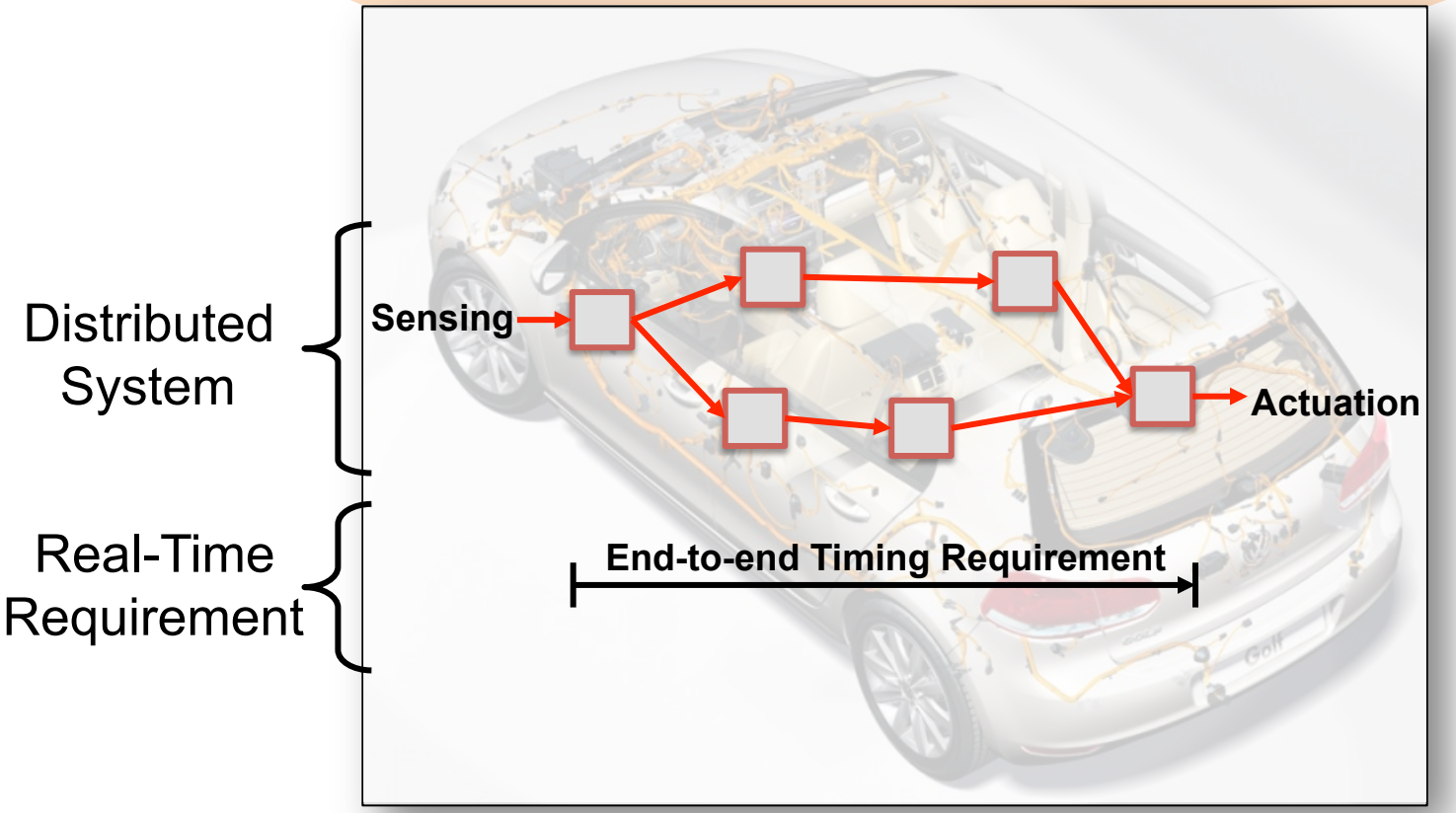
- Steering
- Braking
- Suspension

Body/Comfort Domain

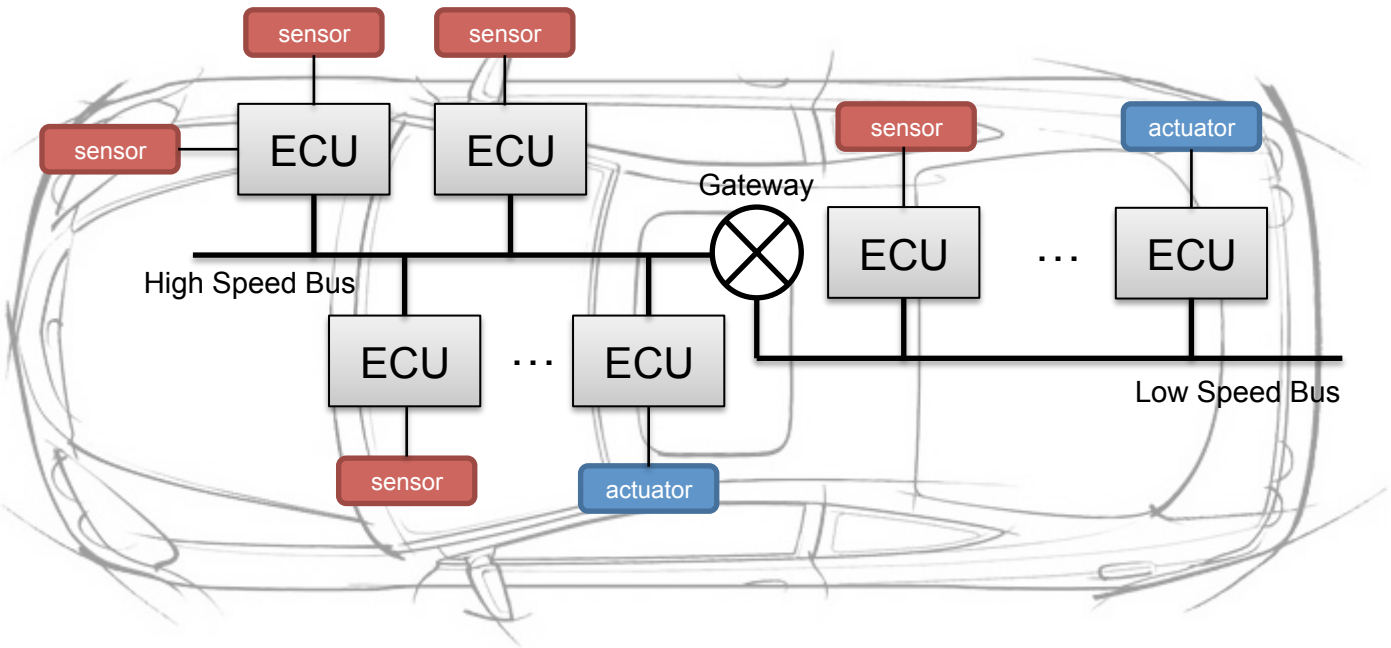
- Door
- Window
- Wiper

Vehicle Control System Characteristics

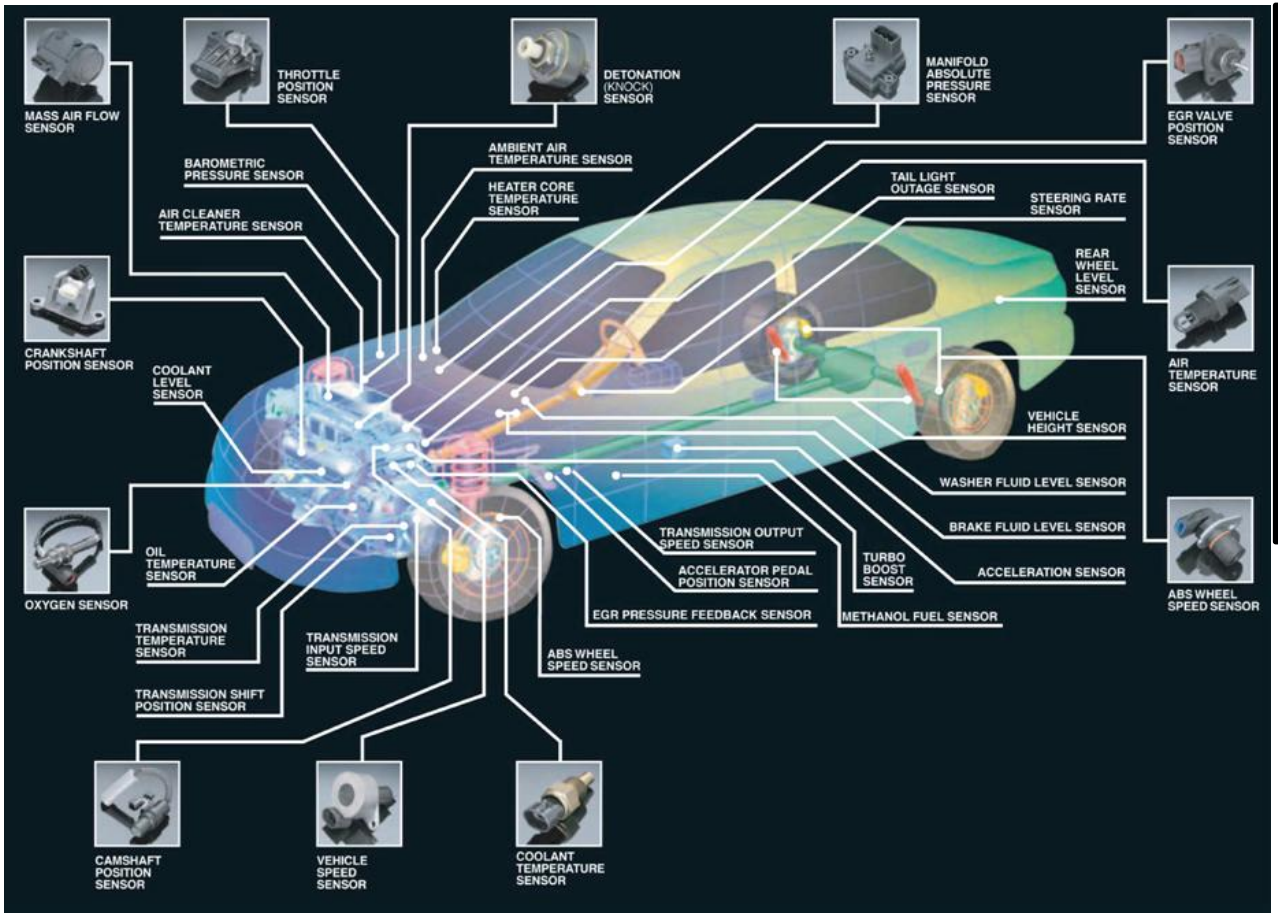
- More than 80 embedded computers (i.e., ECUs)
- More than 5 different types of network
- Various sensors and actuators



Simplified Picture



Sensors



- Throttle Position Sensor
- Mass Air Flow Sensor
- Vehicle Speed Sensor
- Oxygen Sensor
- Oil Temperature Sensor
- Crankshaft Position Sensor
- GPS
- Yaw Rate Sensor
- G Sensor
- …

From Kwik Kar USA – Auto Services

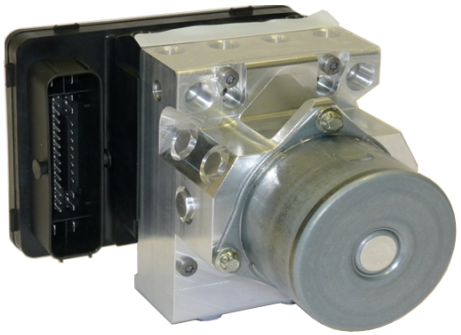
Actuators

Fuel Injector

Solenoid Valve

MDPS Motor

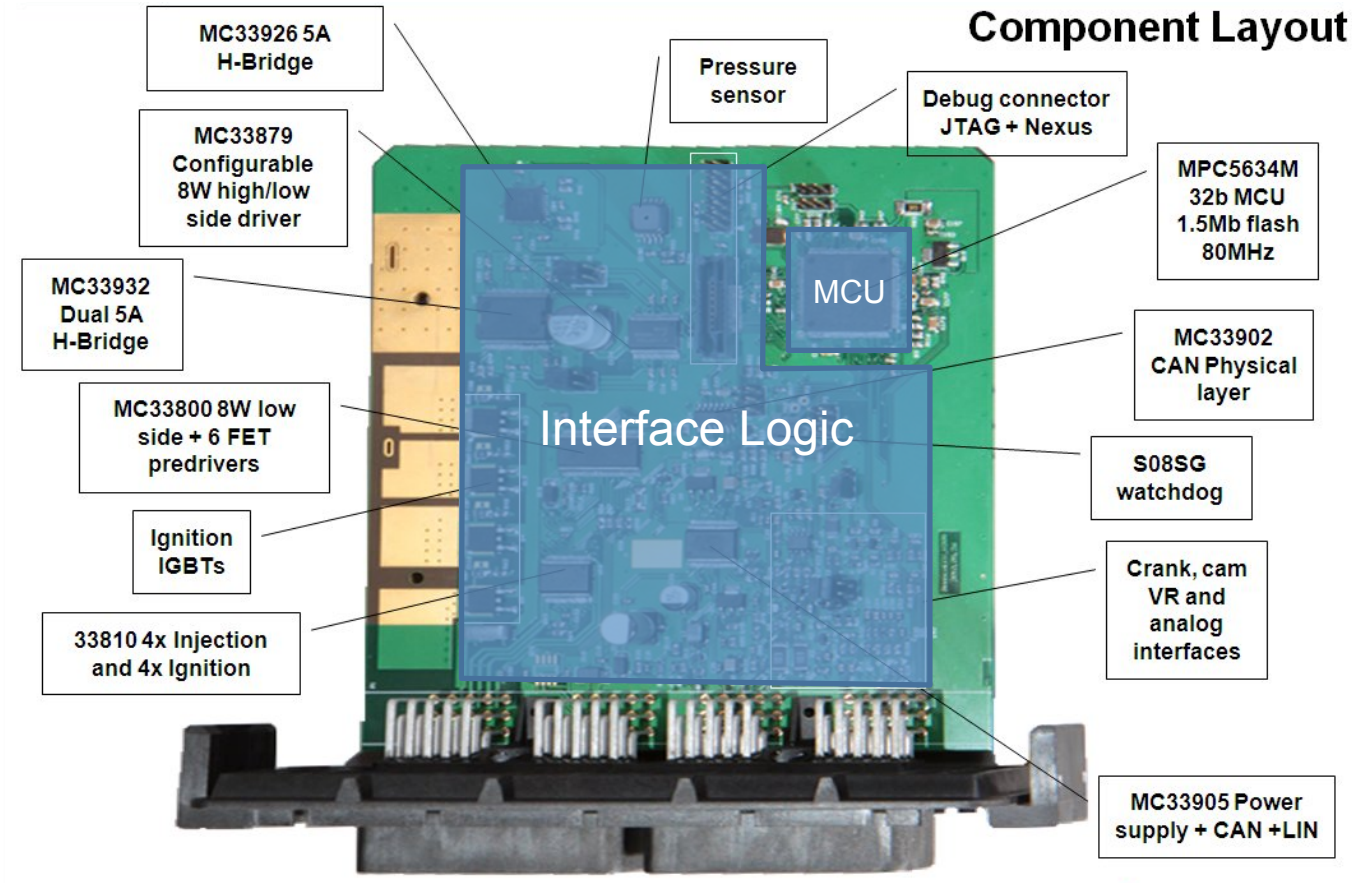
Spark Plug



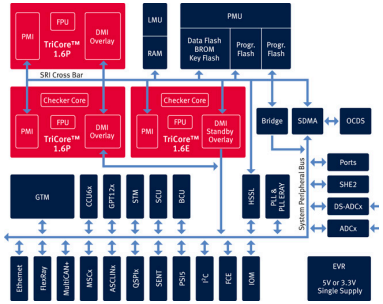
Brake

Active Suspension

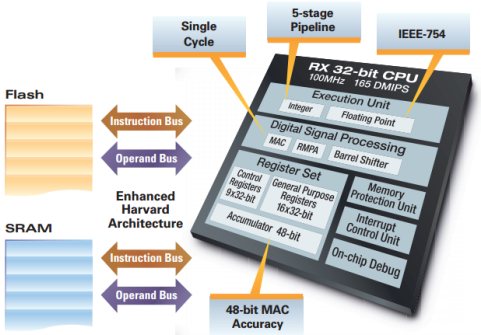
ECUs


Component Layout
MC33926 5A H-Bridge
MC33879 Configurable 8W high/low side driver
MC33932 Dual 5A H-Bridge
MC33800 8W low side + 6 FET predrivers
Ignition IGBTs
33810 4x Injection and 4x Ignition
Pressure sensor
Debug connector JTAG + Nexus
MPC5634M 32b MCU 1.5Mb flash 80MHz
MCU
MC33902 CAN Physical layer
Interface Logic
S08SG watchdog
Crank, cam VR and analog interfaces
MC33905 Power supply + CAN +LIN

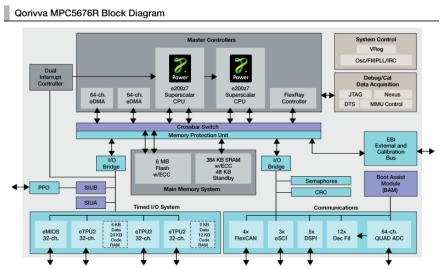
Automotive MCUs



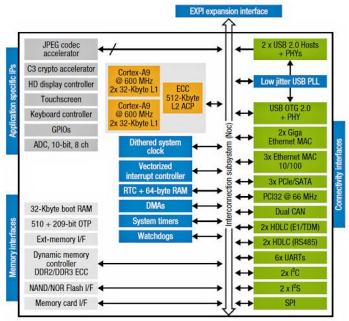
Infineon



Renesas



FreeScale

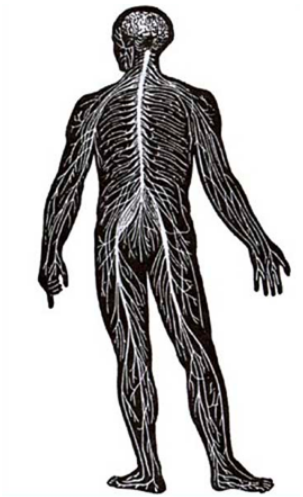


STMicro

In-Vehicle Networks

Like a human central nervous system that connects a brain, sensory organs, and locomotive organs

In-vehicle network



Central nervous system

Delivers signals (e.g., engine RPM, vehicle speed) throughout ECUs, sensors, and actuators in a vehicle

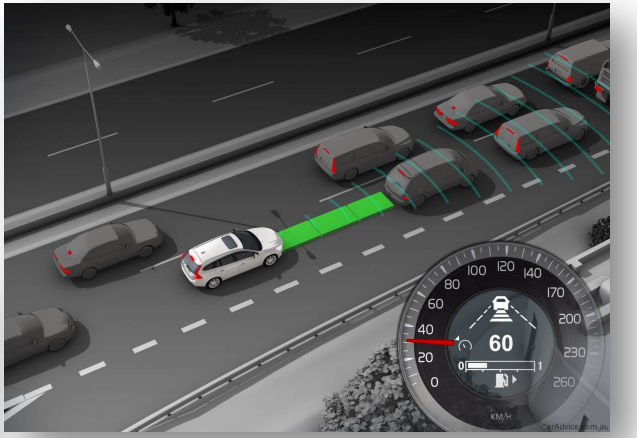
In-vehicle network standards : CAN, LIN, FlexRay, MOST, …

Today's most widely used in-vehicle network standard

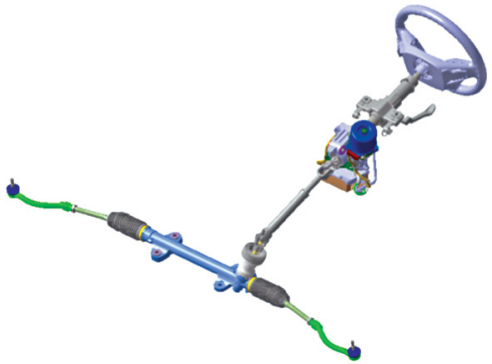
Various Vehicle Control Functions

ESC (Electronic Stability Control)

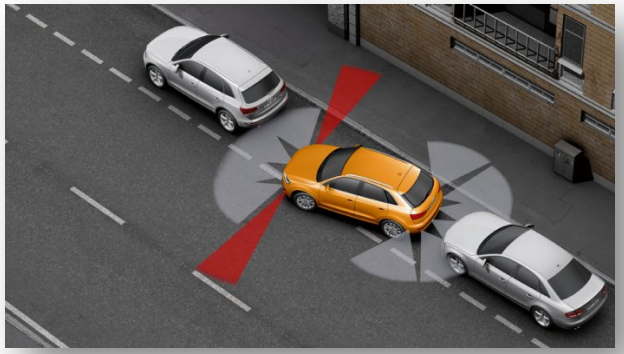
SCC (Smart Cruise Control)



MDPS (Motor Driven Power Steering)

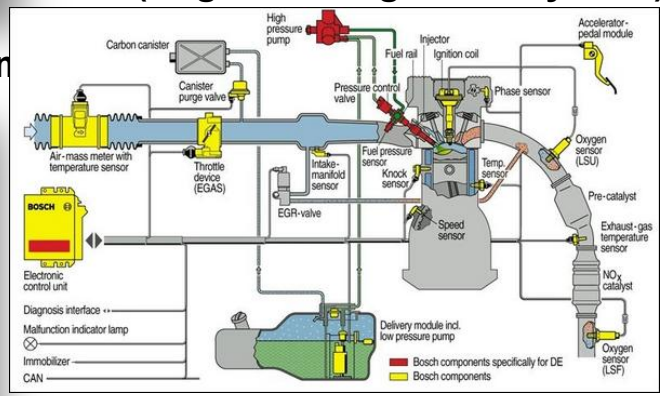


PAS (Parking Assist System)



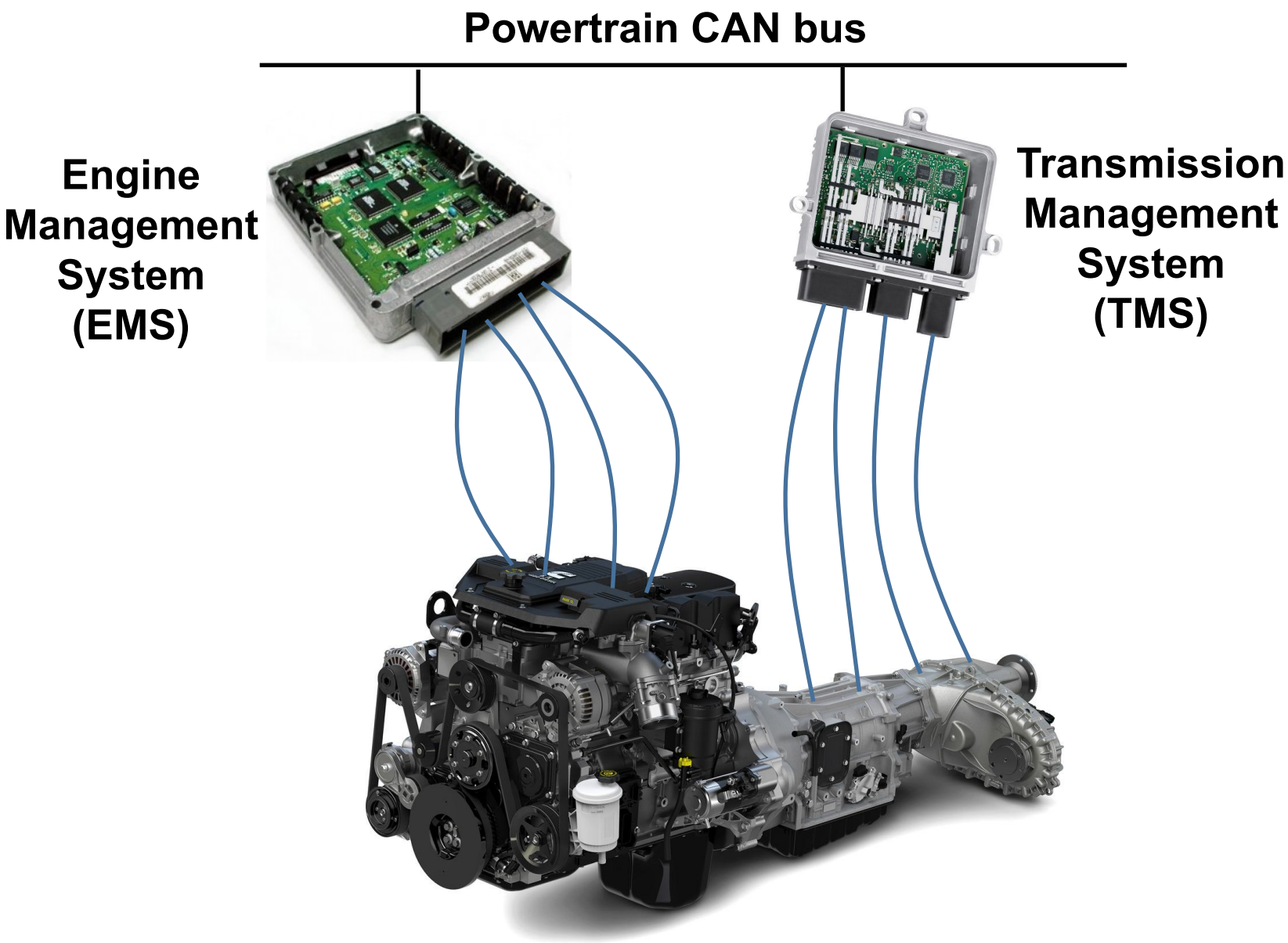
TMS (Transmission Management System)

EMS (Engine Management System)

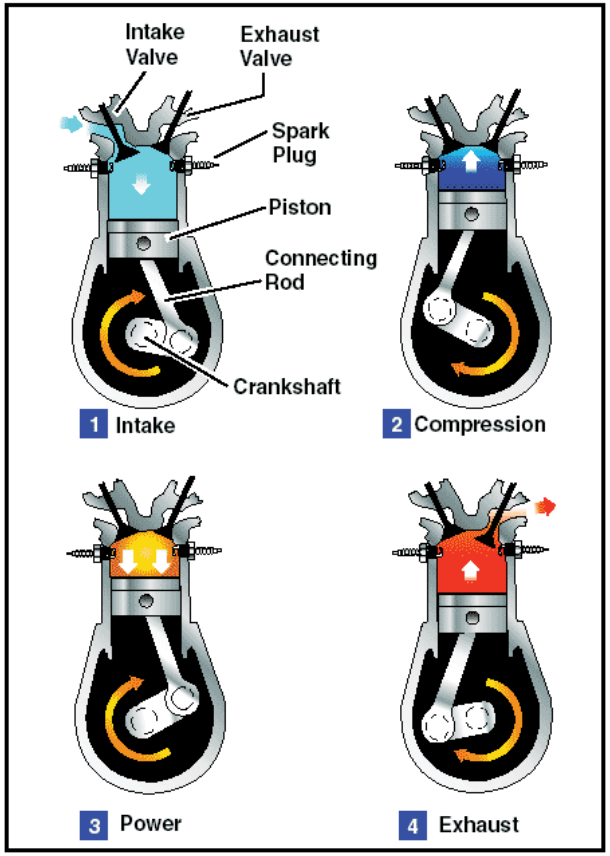


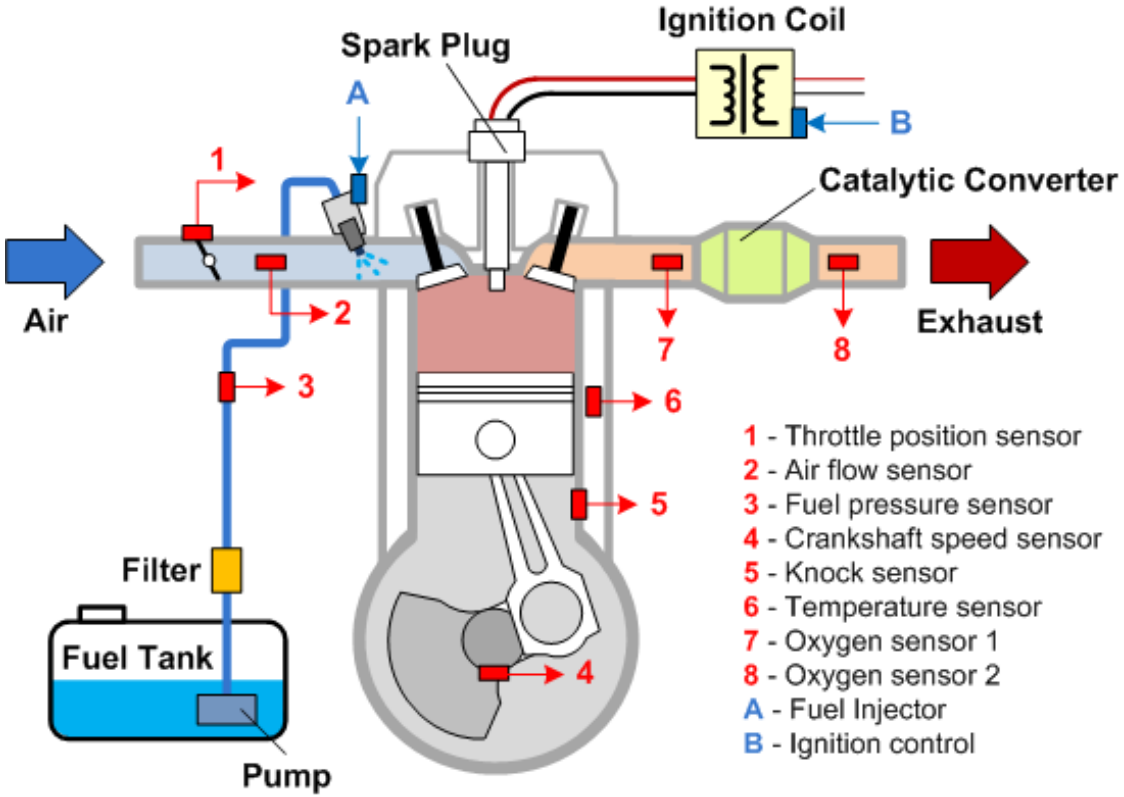
LKAS (Lane Keeping Assist System)

Powertrain Control Domain



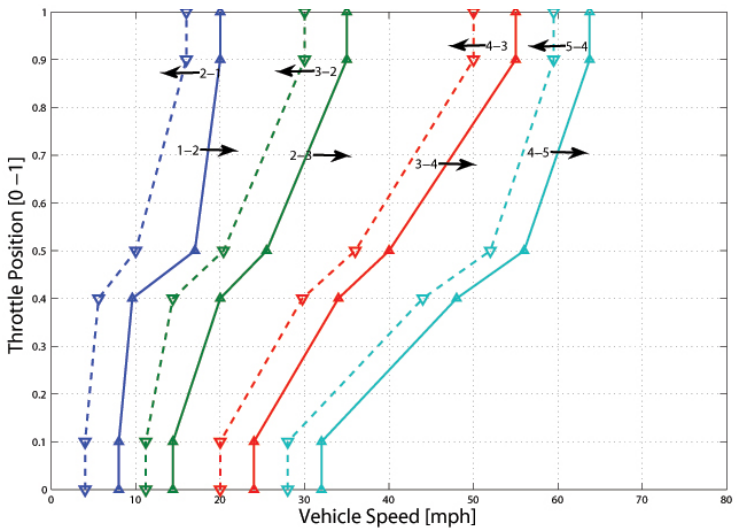
Engine Management System

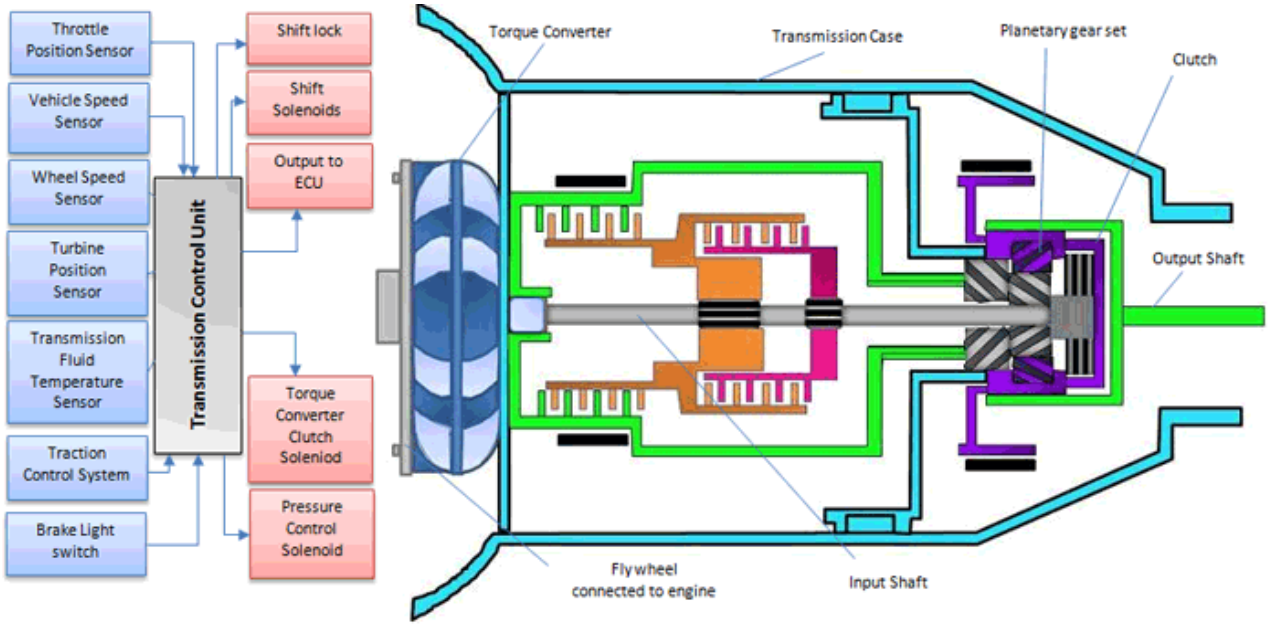




Transmission Management System

Gear Shifting Pattern





Chassis/Safety Control Domain

ADAS (Advanced Driver Assist System)

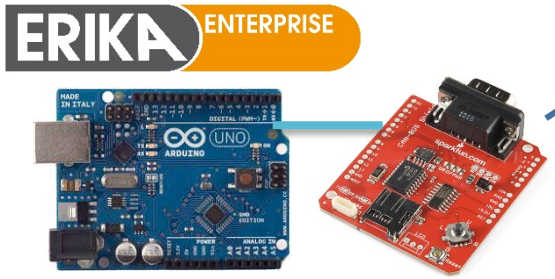
Lane Keeping Assist System

ADAS (Advanced Driver Assist System)

Smart Cruise Control

Project Environment

Erika Enterprise
OSEK RTOS



Arduino Uno CAN shield

차량 위치, 차속

조향각, 쓰로틀

CAN
Interface

오픈소스 동역학
시뮬레이터
on PC

Questions