

EMBEDDED ACADEMY

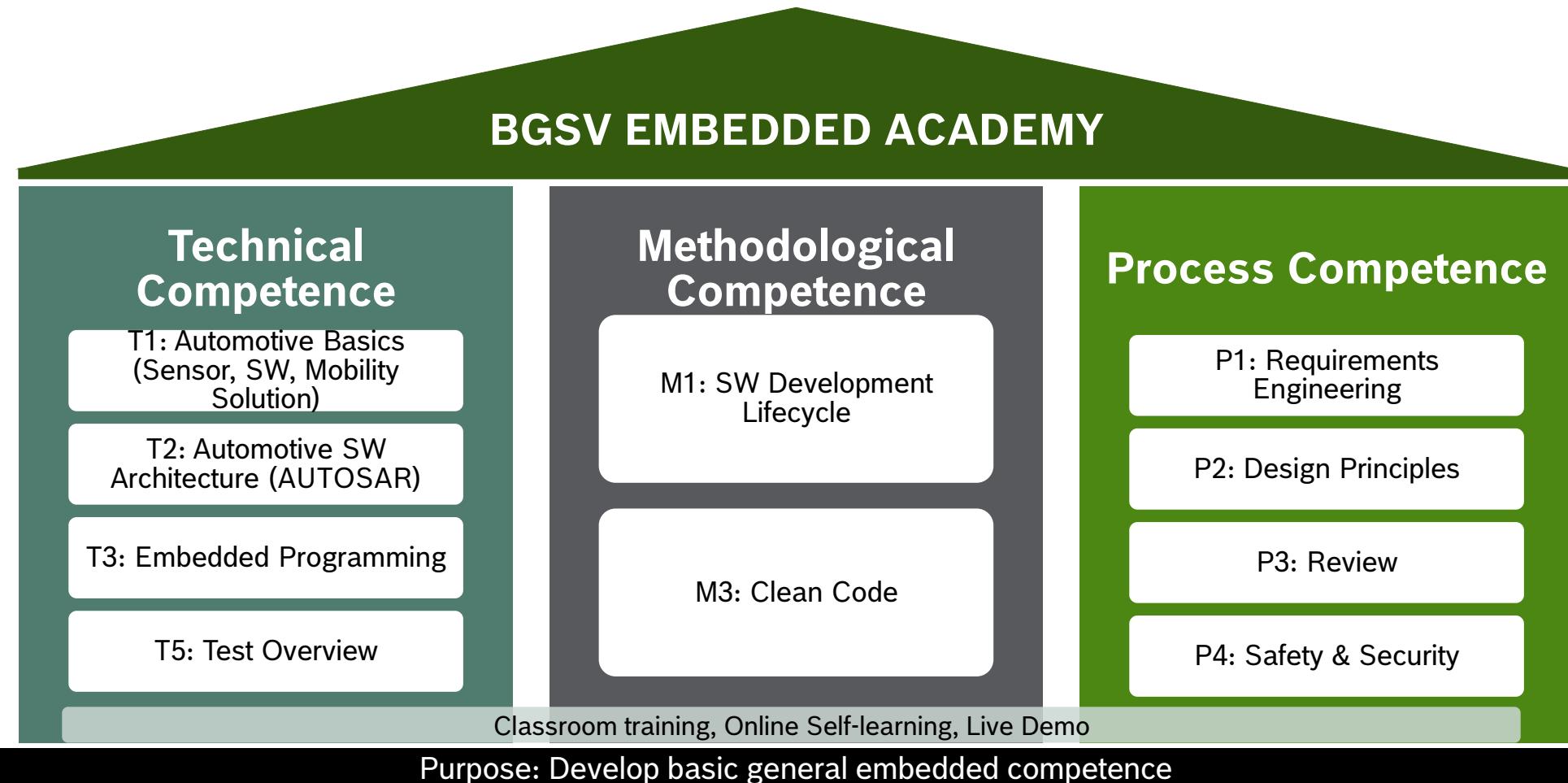
★ PEDAL TO THE MEDAL ★



 BOSCH

BGSV Embedded Academy (BEA)

Focused Program to Develop Embedded Competence



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T1

AUTOMOTIVE BASICS

Agenda

No	Part	Duration
1	2 WP introduction	0.25h
2	Automotive introduction	0.25h
3	Power Train	1.50h
4	Steering, Body	0.50h
5	Braking System	1.00h
6	Safety	0.25h
7	Car Multimedia	0.75h
8	ADAS	0.75h

2WP INTRODUCTION

Two-Wheeler & Powersports (2WP) business unit responsible for wide range of vehicles

Two-wheeler



Powersports



Three-wheeler



Two-Wheeler & Powersports (2WP) System portfolio

**Motorcycle
ABS** **01**



**Motorcycle
stability
control (MSC)** **02**



**Advanced rider
assistance
systems (ARAS)** **03**



**Help Connect
(Smartphone base
emergency call)** **04**



**Instrument &
infotainment
systems** **05**



**Engine
management
systems** **06**



**Electrification
systems** **07**



**Electronic
stability program
(ESP®)** **08**



**Semi-active
damping
control system** **09**



Two-Wheeler & Powersports (2WP) technology overview

Bosch provides the comprehensive systems, services and solutions

Assistance systems							
Powertrain systems & electrification							 Central drive unit
							
Connectivity systems							*Licensing only *B2X: bike-to-vehicle communication

Two-Wheeler & Powersports (2WP) technology fields

High-performance bikes

Powertrain systems and electrification

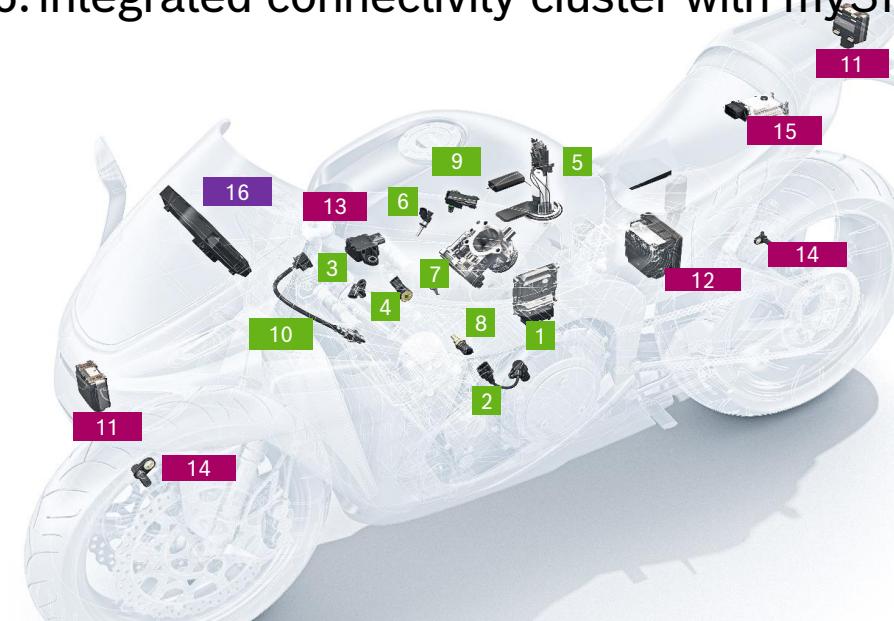
1. Engine control unit
2. Crankshaft speed sensor
3. Camshaft speed sensor
4. Knock sensor
5. Fuel supply module
6. Fuel injector
7. Electronic throttle body assembly
8. Temperature sensor
9. Temperature and manifold air pressure sensor
10. Lambda sensor

Assistance systems

11. Mid-range radar sensors (front/rear)
12. MSC unit
13. Inertial measurement unit (crash detection)
14. Wheel-speed sensor
15. Semi-active damping control unit

Connectivity systems

16. Integrated connectivity cluster with mySPIN



Two-Wheeler & Powersports (2WP) technology fields

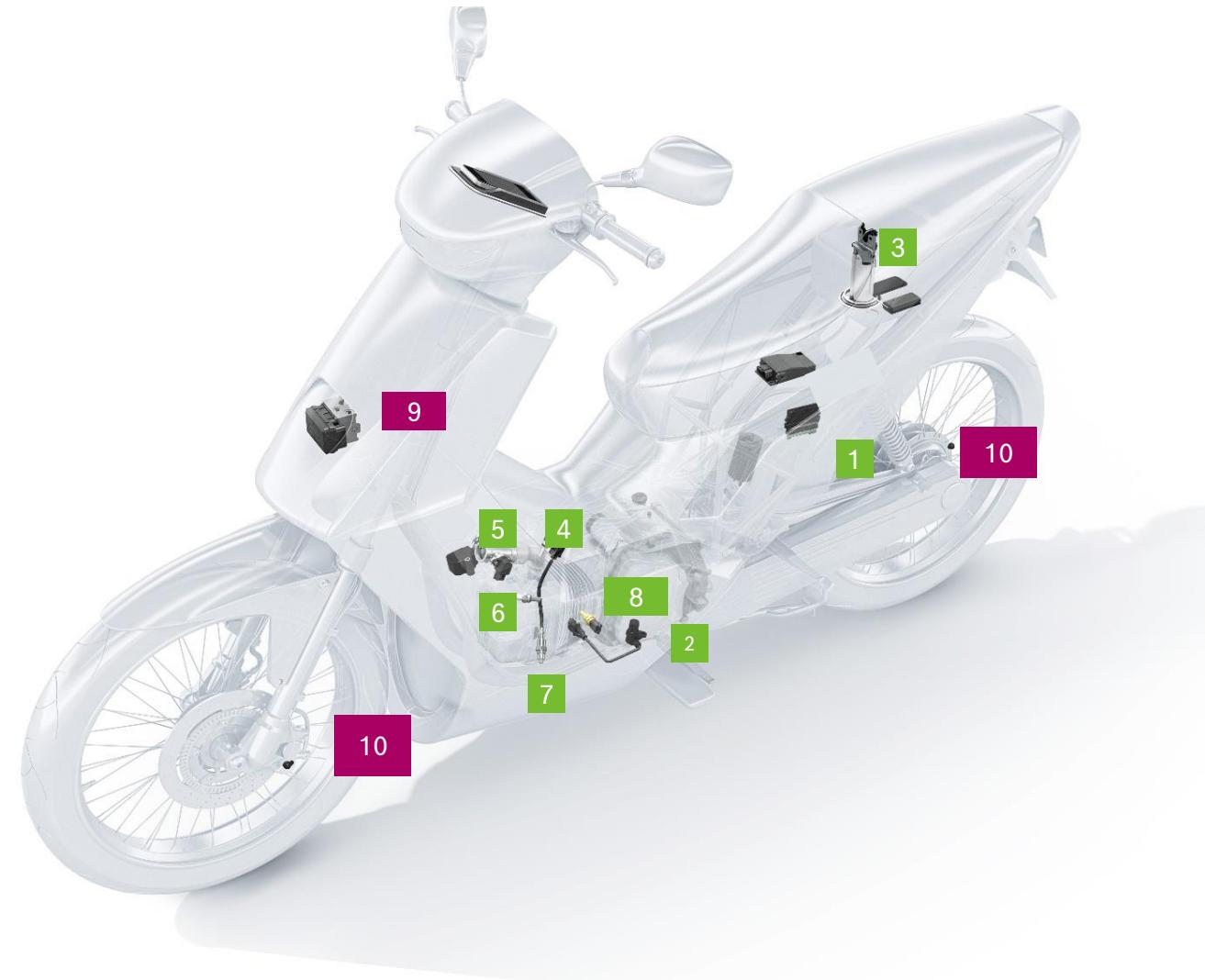
Small bikes

Powertrain systems and electrification

1. Engine control unit
2. Crankshaft speed sensor
3. Fuel supply module
4. Fuel injector
5. Mechanical throttle body assembly
(licensing only)
6. Throttle position sensor
7. Lambda sensor
8. Temperature sensor

Assistance systems

9. ABS unit
10. Wheel-speed sensor



2WP Assistance systems and function overview

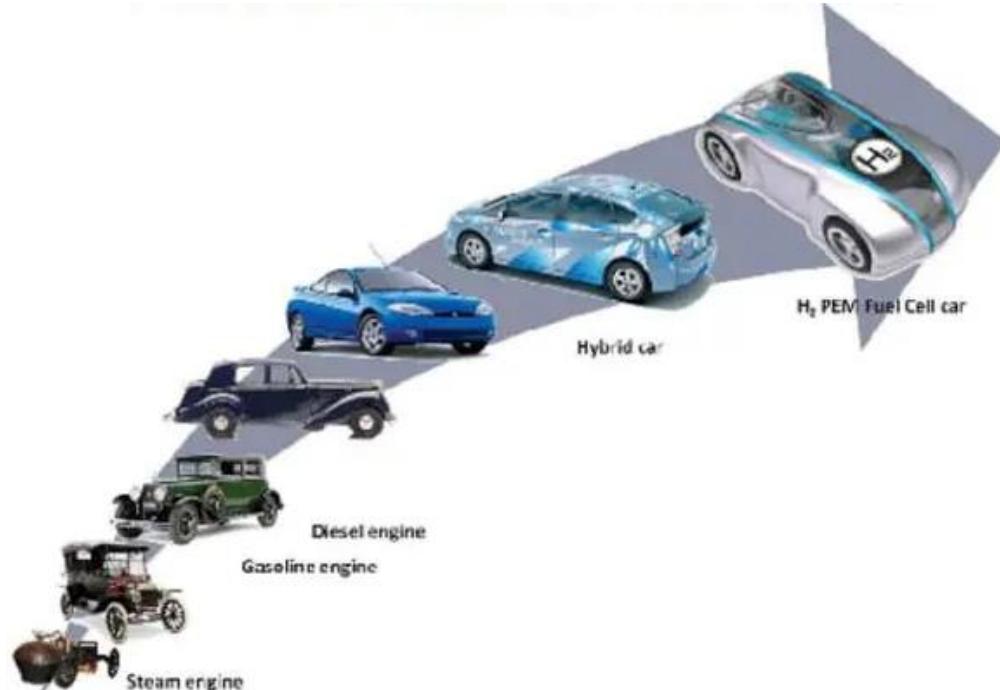
ABS, MSC, Value-added functions, ARAS

Predictive safety and comfort	ARAS	Blind spot detection	Forward collision warning	Adaptive cruise control (ACC)
Vehicle stability	Value-added function of MSC	Electronic combined brake system	Hill hold control	Vehicle hold control
		Slope dependent	Launch control	
		Wheelie control	Rear-wheel slide	
		Cornering traction control	Cornering drag torque control	
		Off-road control*	Rear-wheel lift-up control*	
	MSC	Cornering brake control		
	ABS	Brake control		

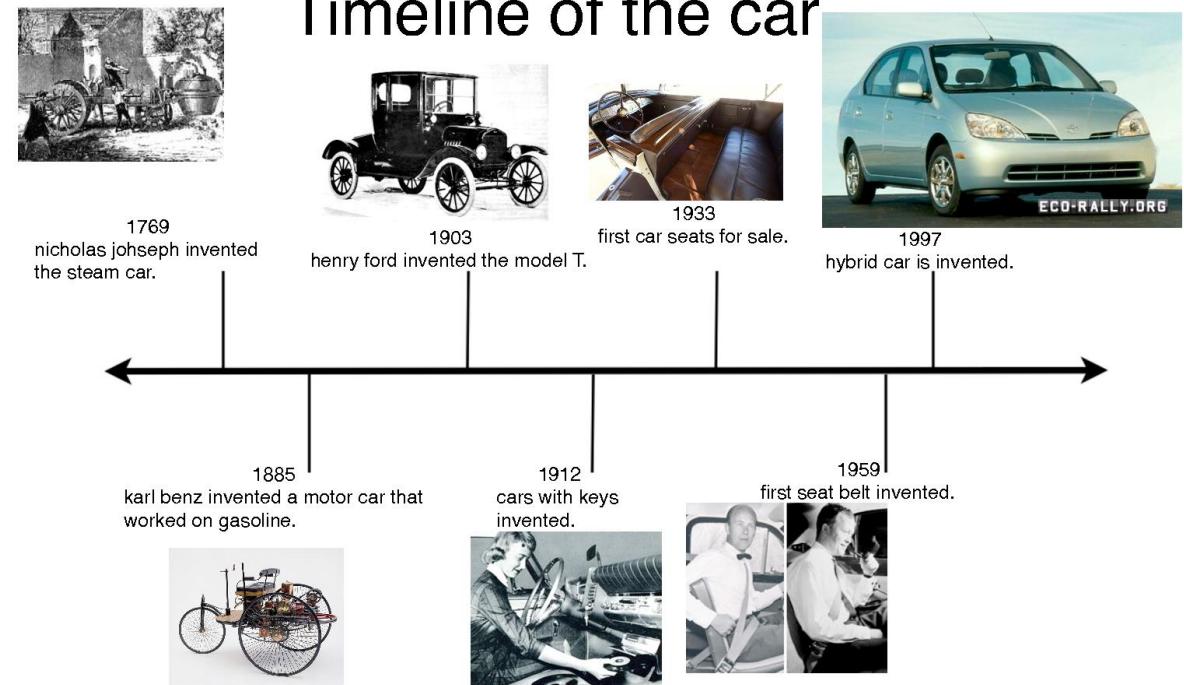
AUTOMOTIVE INTRODUCTION

Automotive Basics

A Quick history of the automobile



Timeline of the car



Automotive Basics

Types of vehicle

+ Passenger car (PC)



+ Commercial vehicle (CV)

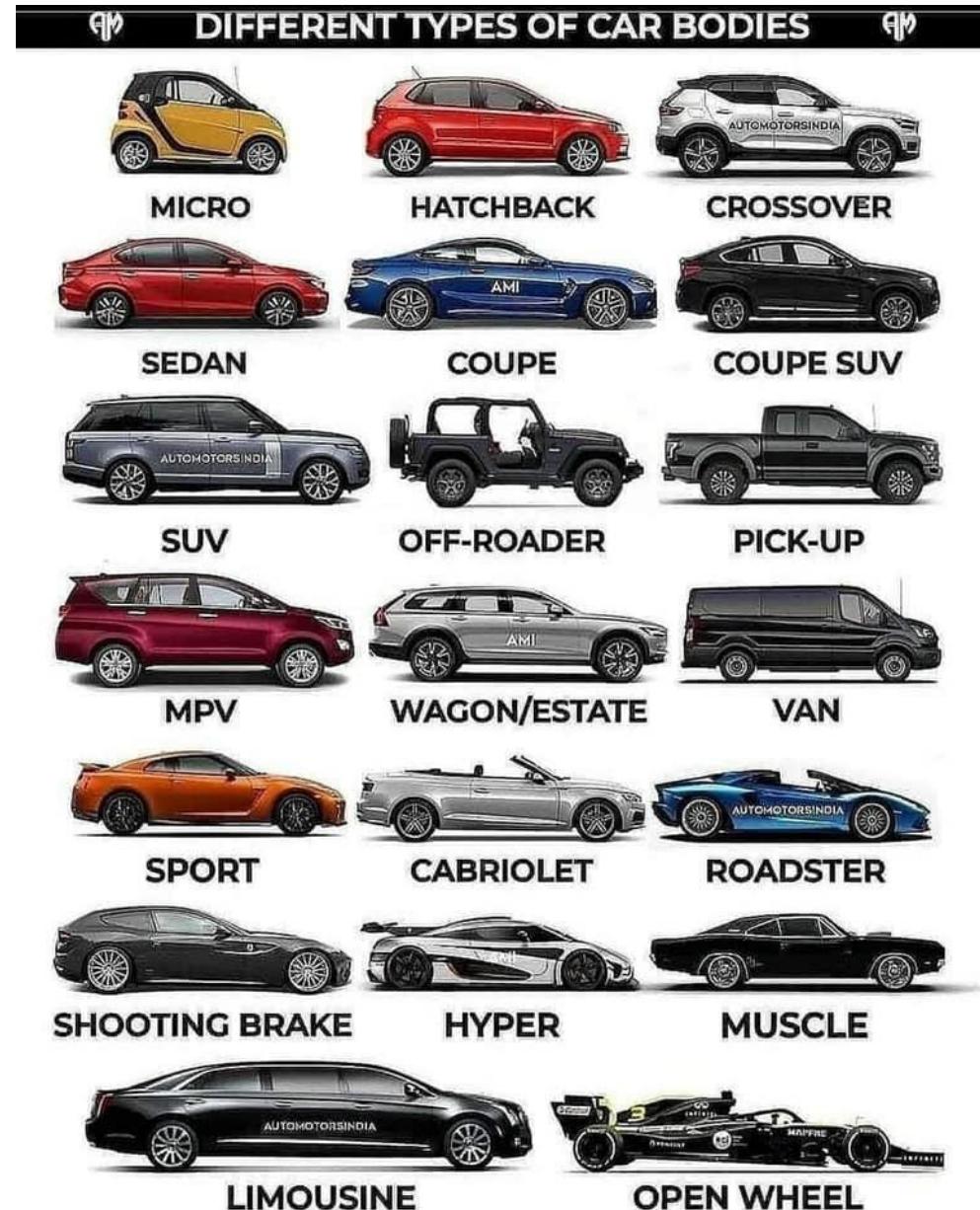
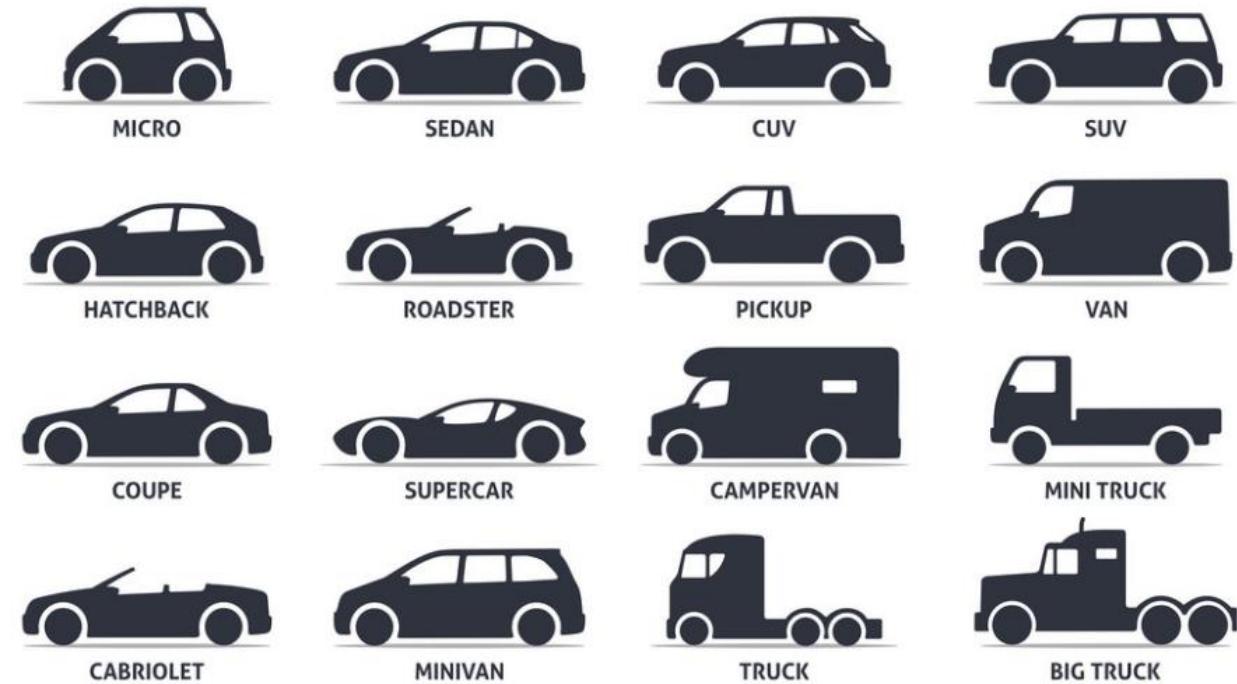


+ Off-highway vehicle (OHV)



Automotive Basics

Types of vehicle



Automotive Basics

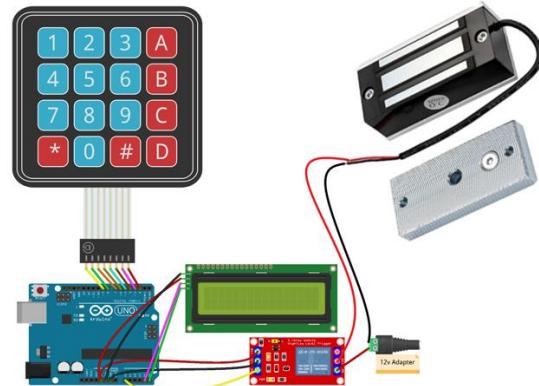
Quick overview about Mechatronics system



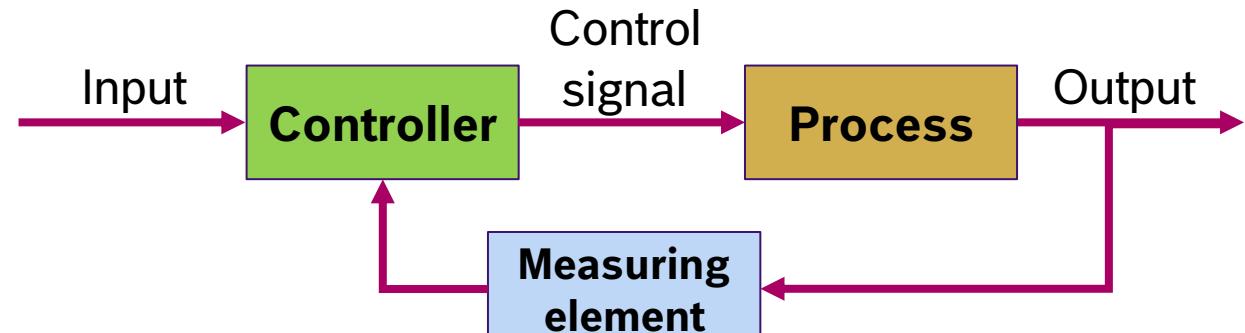
CIRCUITS DIY
PROJECTS | TUTORIALS | CIRCUITS | DATASHEETS

Door Lock System

Arduino Tutorial



Open loop system



Closed loop system



BOSCH

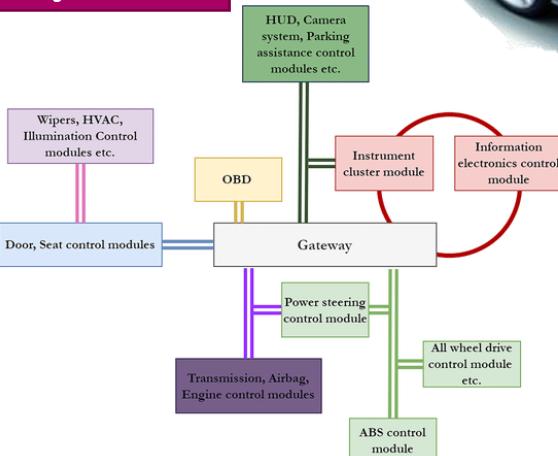
Bosch
Global
Software
Technologies
alt_future

Vehicle System Overview

Audi Q7
quattro Antriebsstrang
quattro drivetrain
05/07



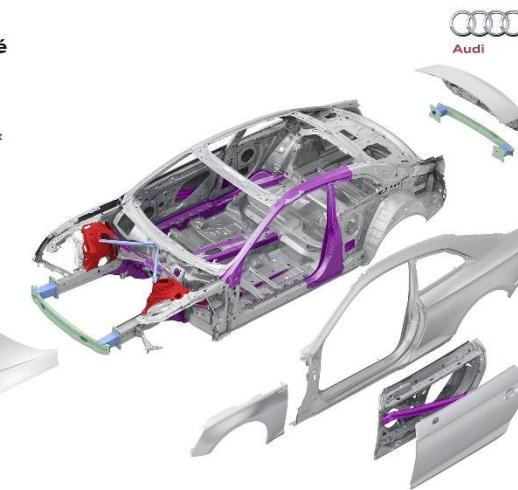
Electrical/Electronics systems



- MOST
- FlexRay
- LIN
- Diagnostic CAN
- Convenience CAN (Comfort CAN)
- Powertrain CAN
- Display and control CAN

Vehicle Frame & Body

Audi A5 Coupé
Karosserie mit Anbauteilen
Structure with hang on parts
06/16



Chassis systems



And so on...



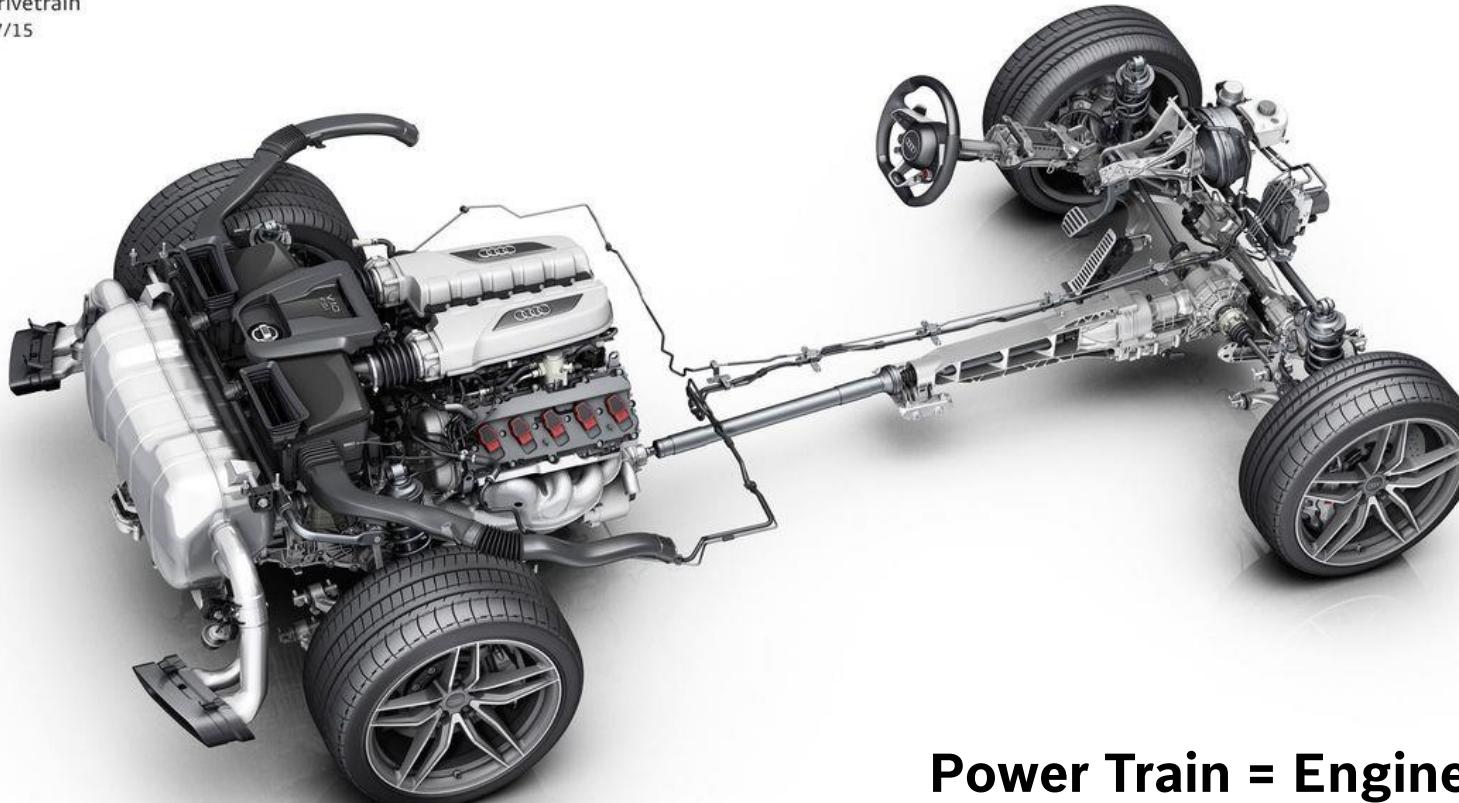
Car Multimedia

POWER TRAIN

Power Train

Audi R8 V10 plus

Antriebsstrang
Drivetrain
07/15



Power Train = Engine + Drive Train

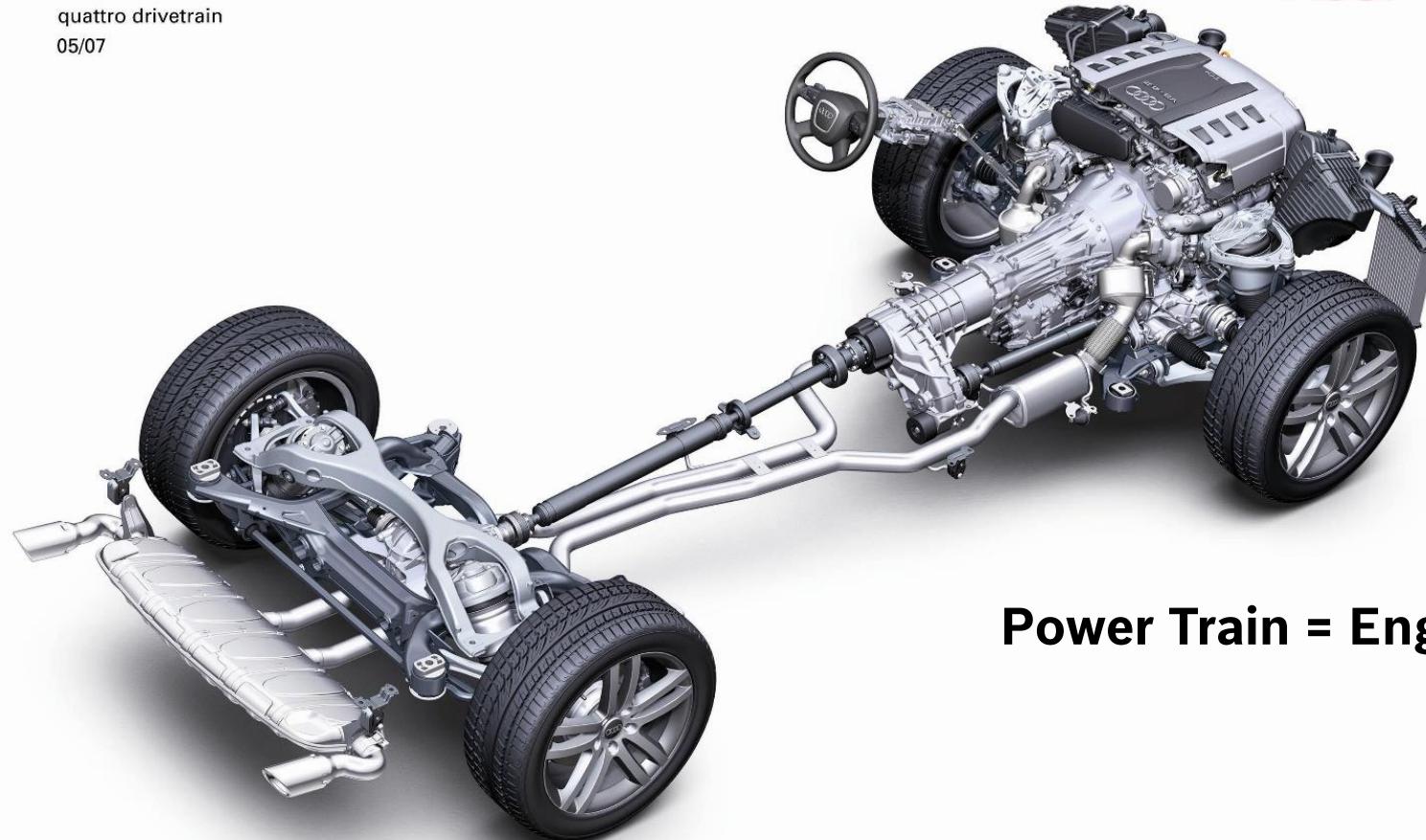
Power Train

Audi Q7

quattro Antriebsstrang

quattro drivetrain

05/07



Power Train = Engine + Drive Train

Engine

Internal Combustion Engine

Functionality:

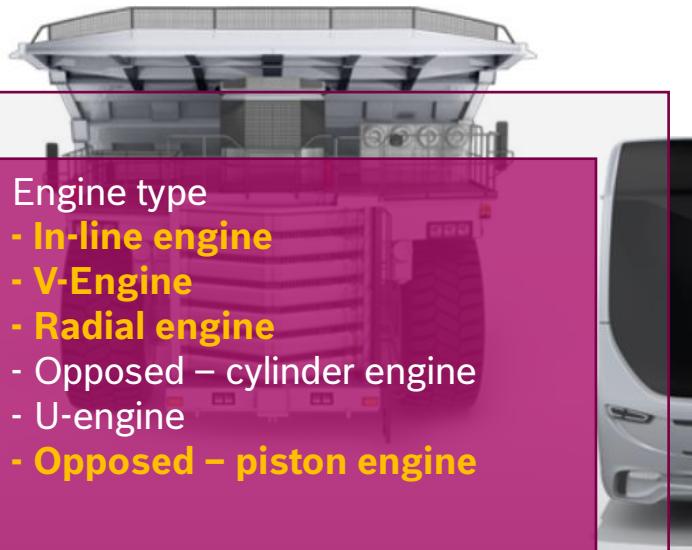
- The main power supply for car.
- It converts fuel to torque to drive a car

Classify:

- External - combustion engine
- **Internal - combustion engine**

- Operation concept
- 2 strokes engine
 - **4 strokes engine**
 - Stirling engine
 - Wankel rotary engine
 - Gas turbine
 - etc.

- Fuel Injection - type
- **Indirect injection engine**
 - **Direct injection engine**

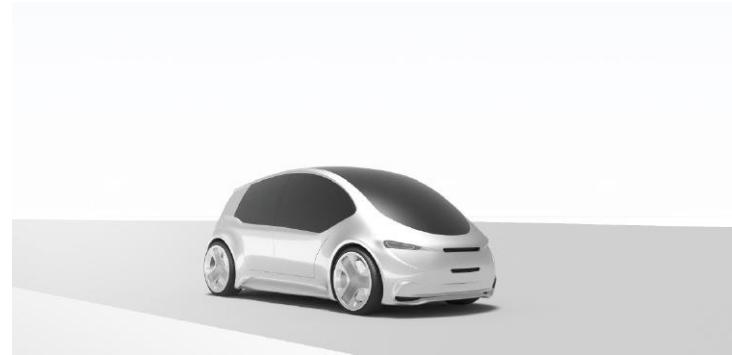


Engine type

- **In-line engine**
- **V-Engine**
- **Radial engine**
- Opposed – cylinder engine
- U-engine
- **Opposed – piston engine**

Fuel used

- **Gasoline engine**
- **Diesel engine**
- LPG
- Hybrid



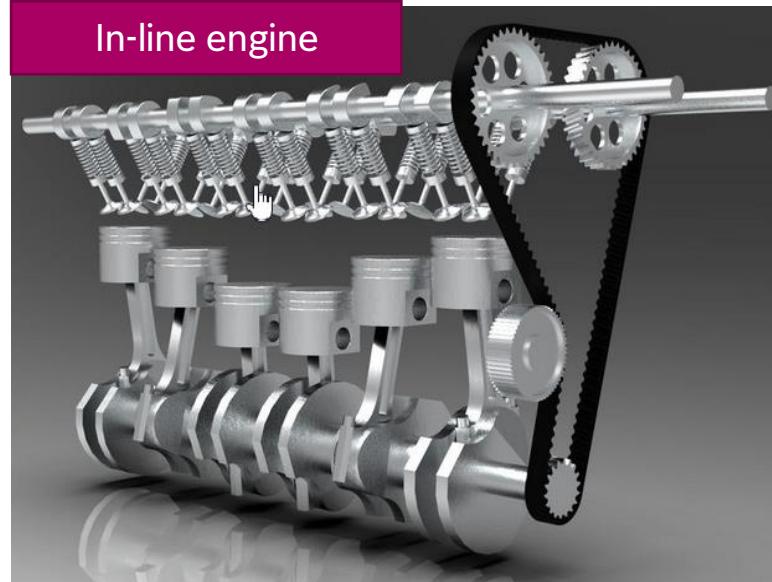
Engine

Most popular engine types

V-engine



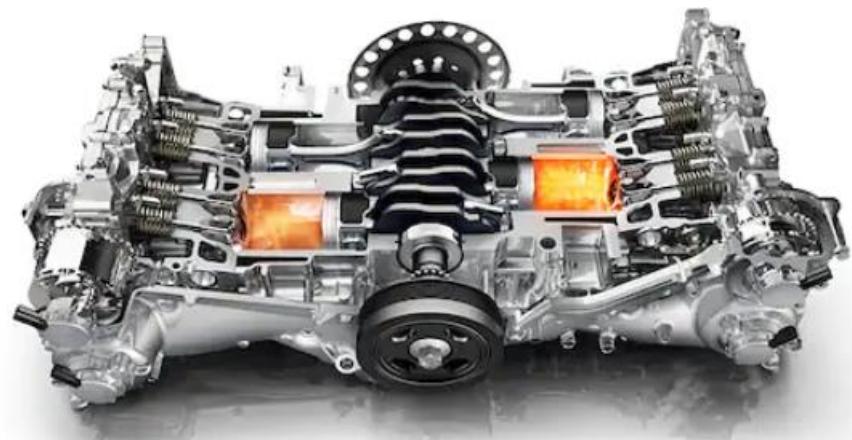
In-line engine



Radial engine

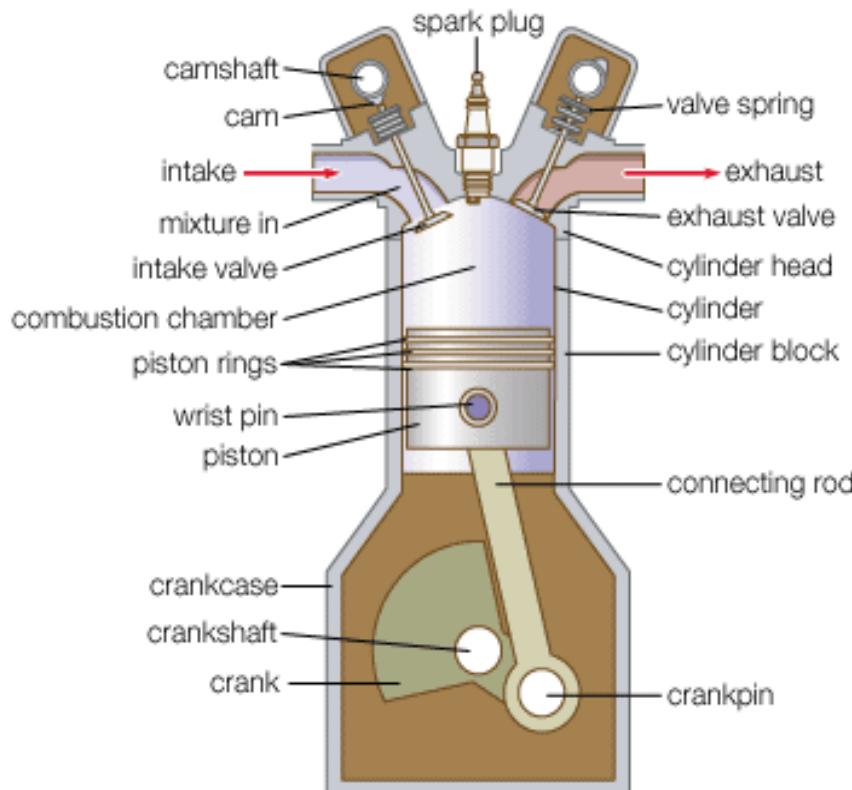


Boxer engine

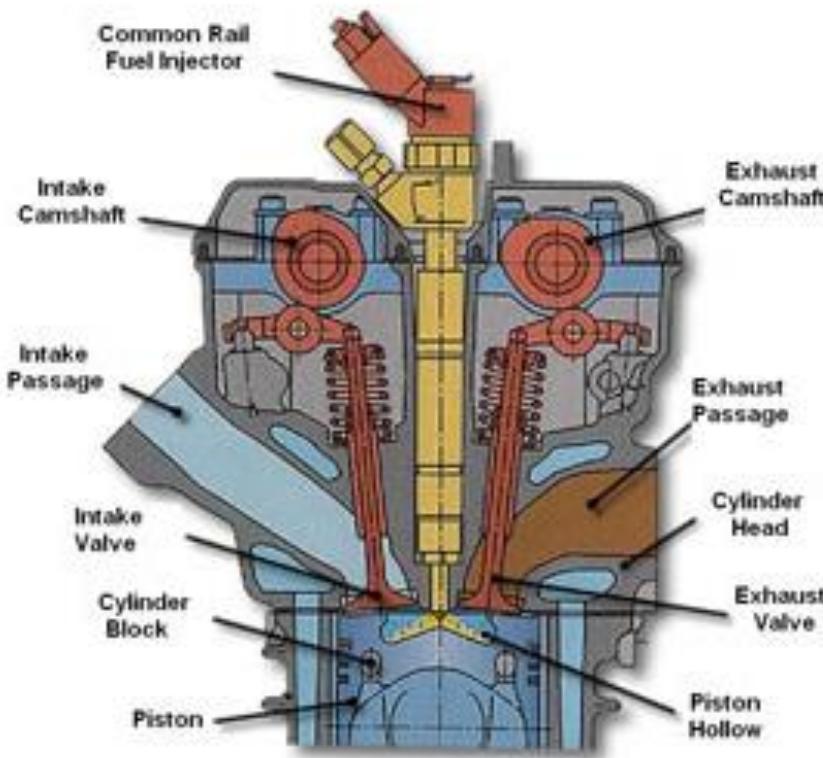


Engine

Main components of an internal-combustion engine



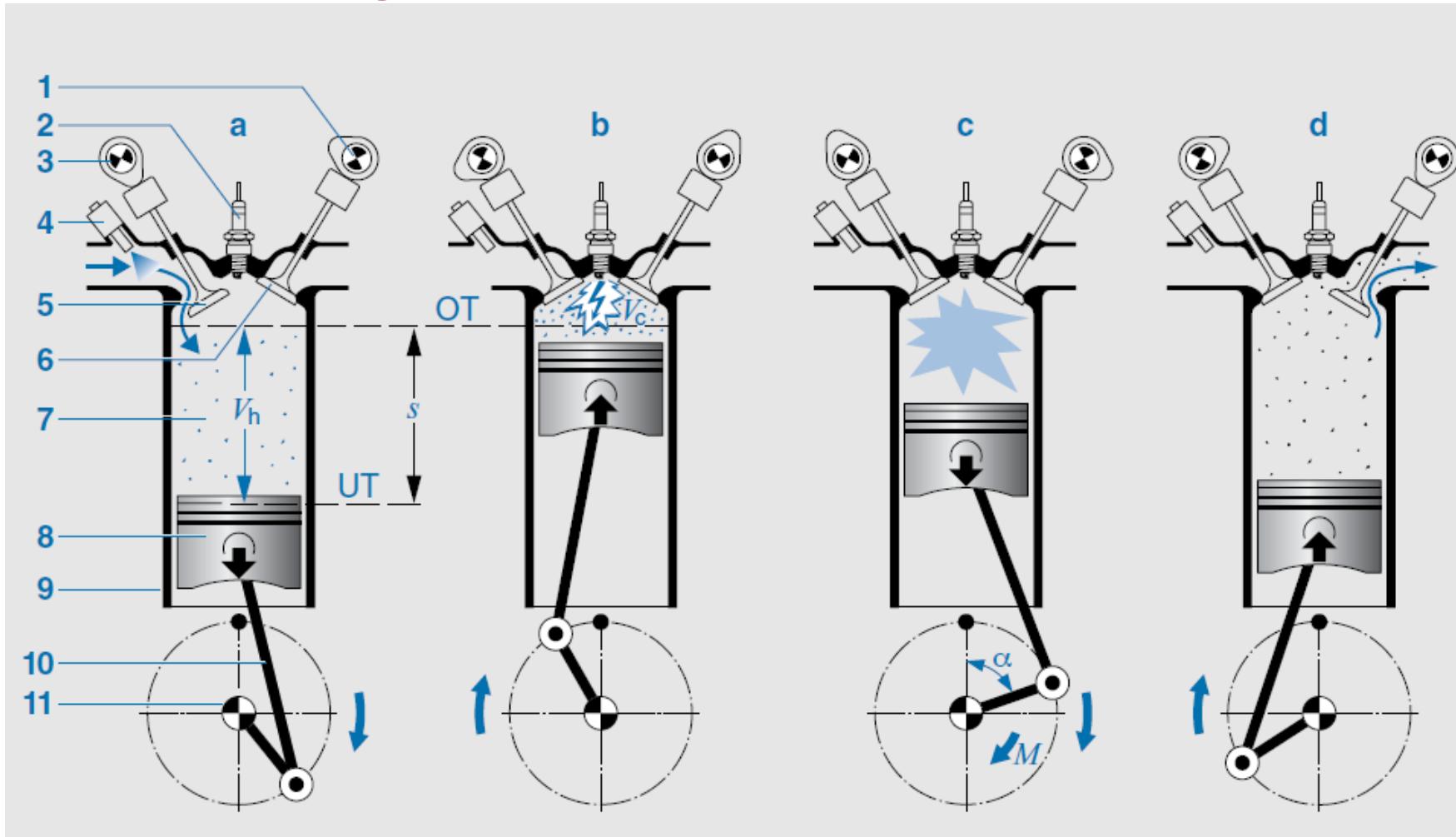
Gasoline engine



Diesel engine

Engine management System

4-Strokes Engine



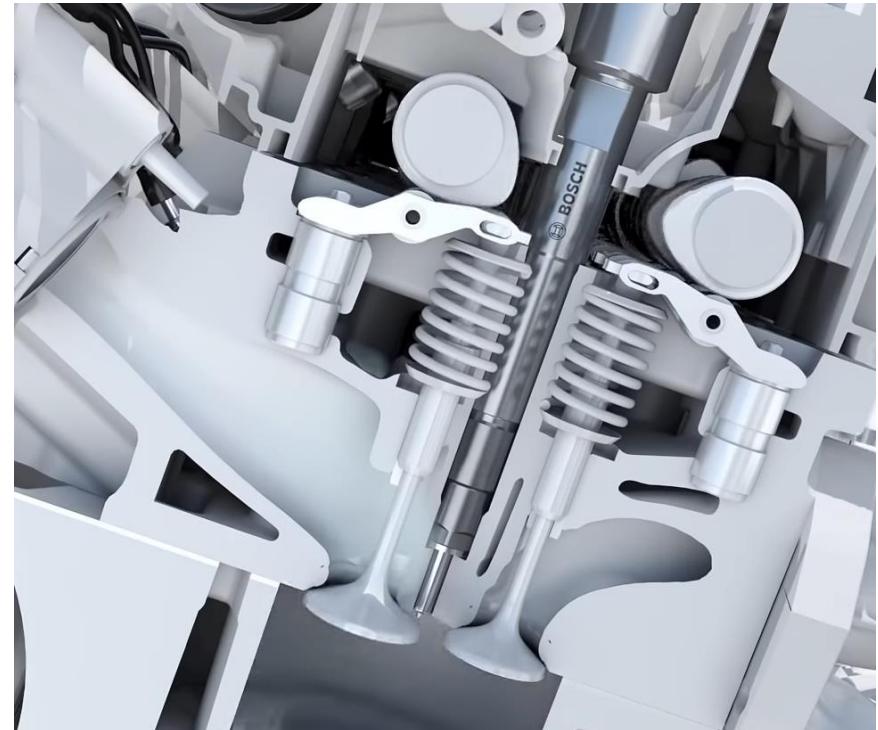
- a Induction stroke
- b Compression stroke
- c Power (combustion) stroke
- d Exhaust stroke
- 1 Exhaust camshaft
- 2 Spark plug
- 3 Intake camshaft
- 4 Injector
- 5 Intake valve
- 6 Exhaust valve
- 7 Combustion chamber
- 8 Piston
- 9 Cylinder
- 10 Conrod
- 11 Crankshaft
- M Torque
- α Crankshaft angle
- s Piston stroke
- V_h Piston displacement
- V_c Compression volume

Engine

Direct Injection Engine



Gasoline engine



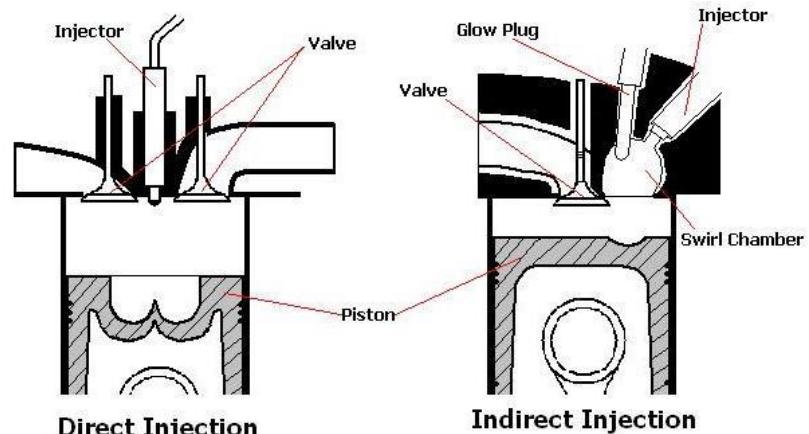
Diesel engine

Engine Indirect-Injection Engine

Port Fuel Injection(PFI)



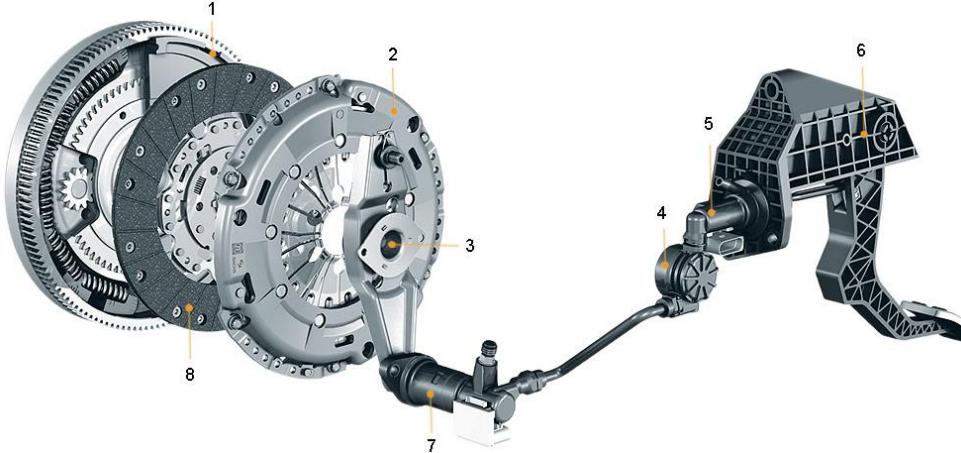
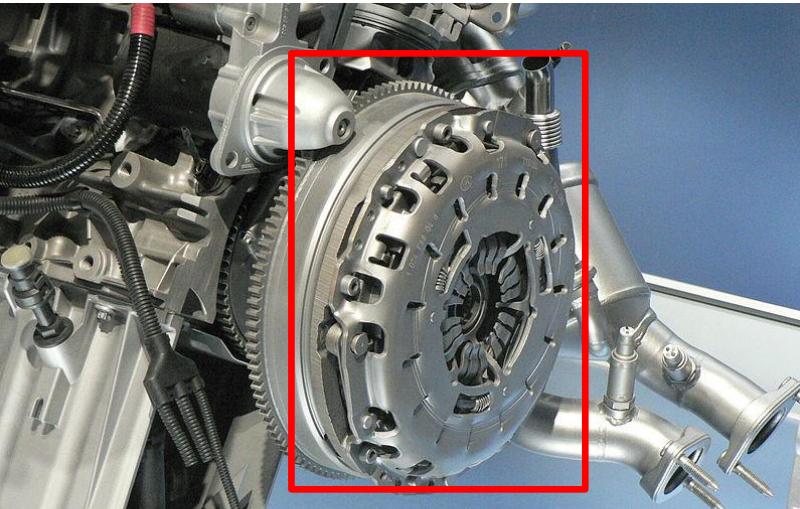
Gasoline engine



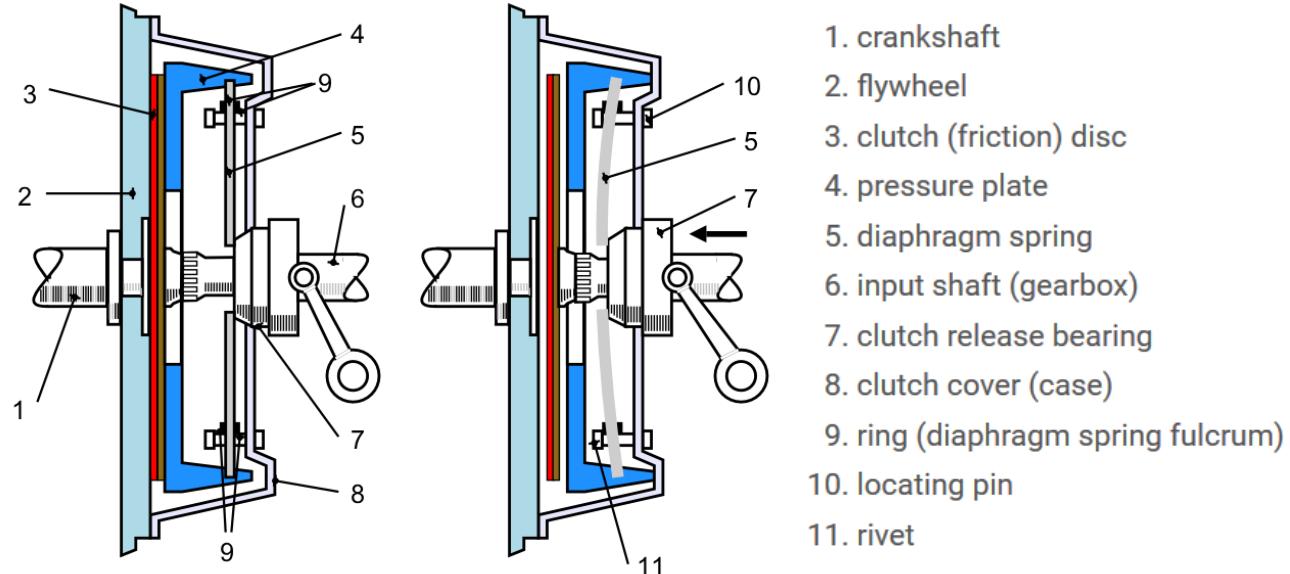
Diesel engine

Coupling Devices

Clutch



Clutch components (left – closed clutch, right – opened clutch)

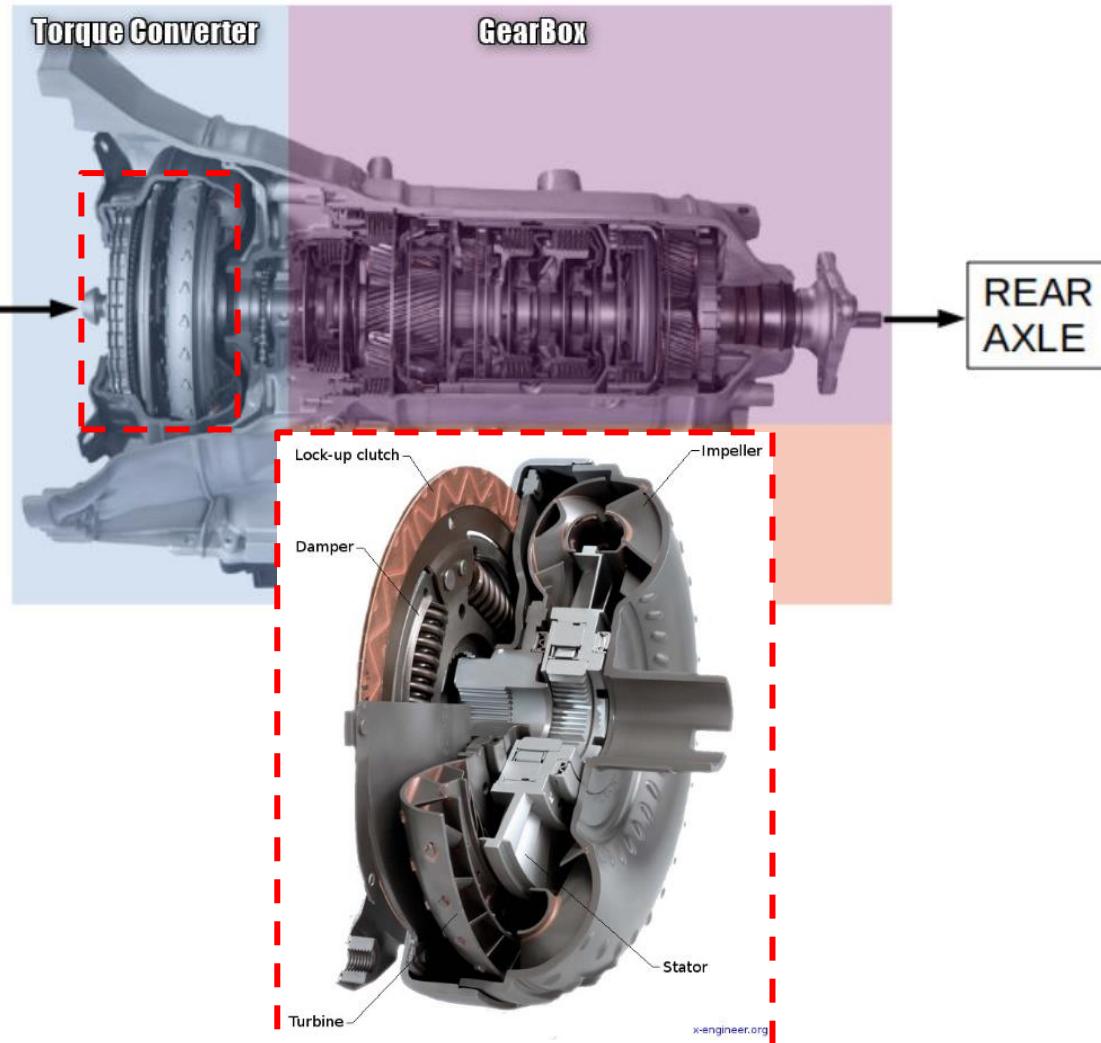


1. dual mass flywheel
2. clutch cover
3. mechanical releaser
4. pedal vibration damping device
5. master cylinder
6. plastic pedal
7. slave cylinder
8. clutch (friction) disc

Coupling Devices

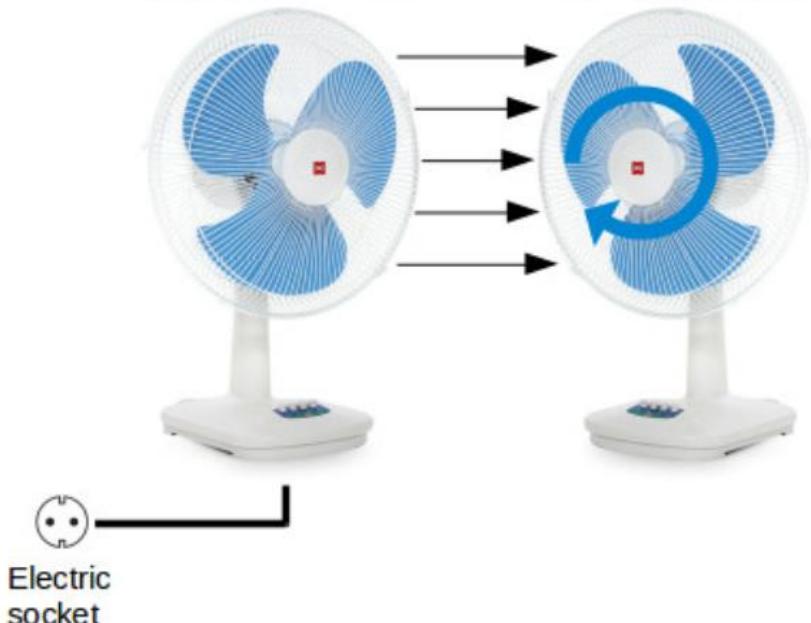
Torque Converter

Torque converter – principle of work

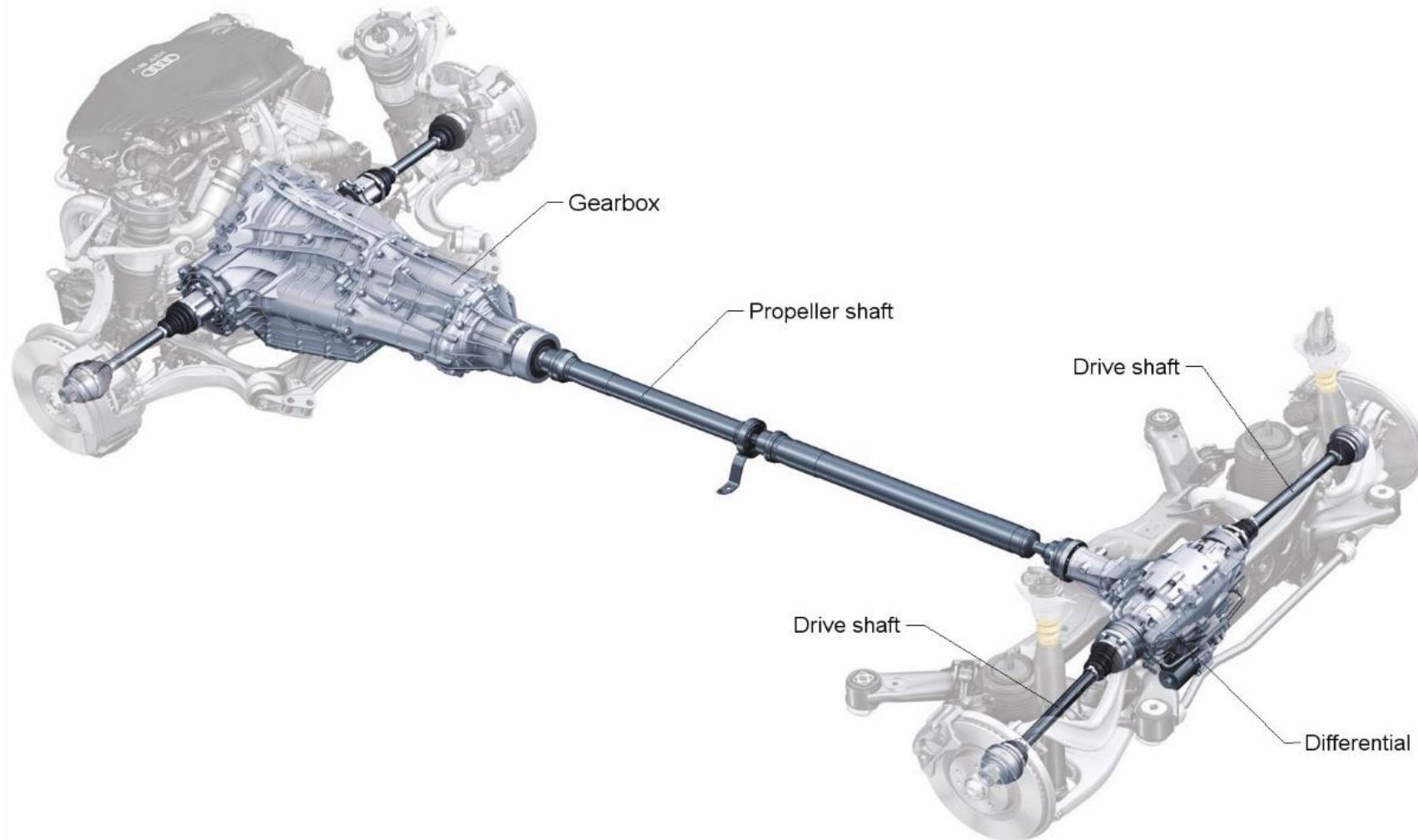


Fan powered from grid
(generates air flow)

Fan starts to spin due
to incoming air flow

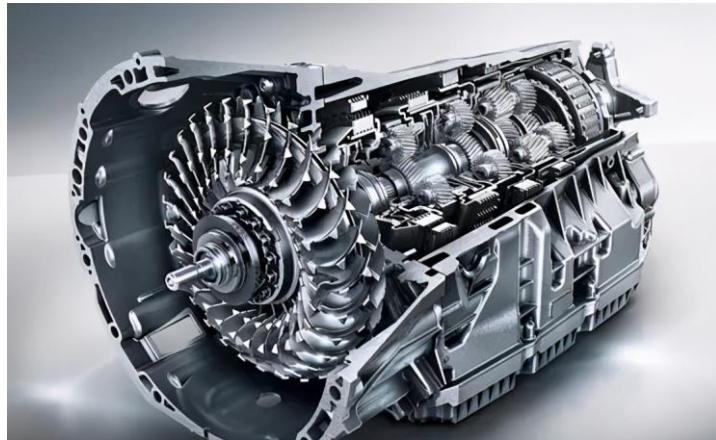
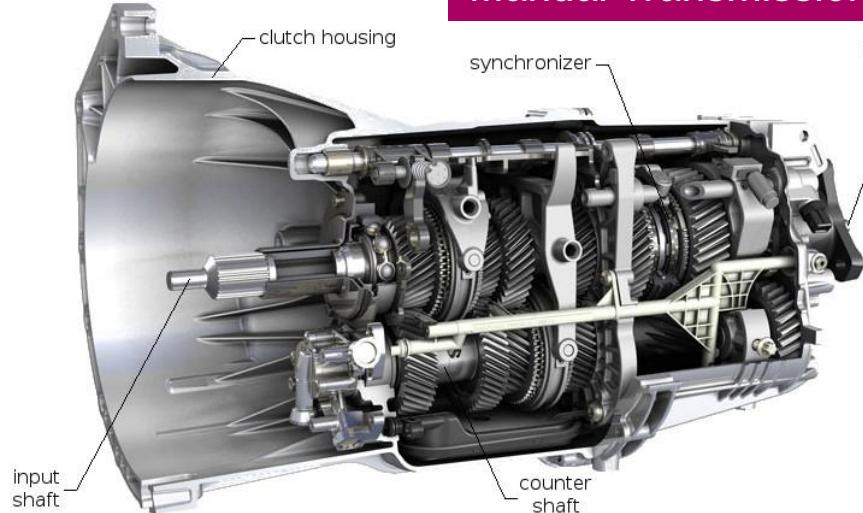


Drive Train



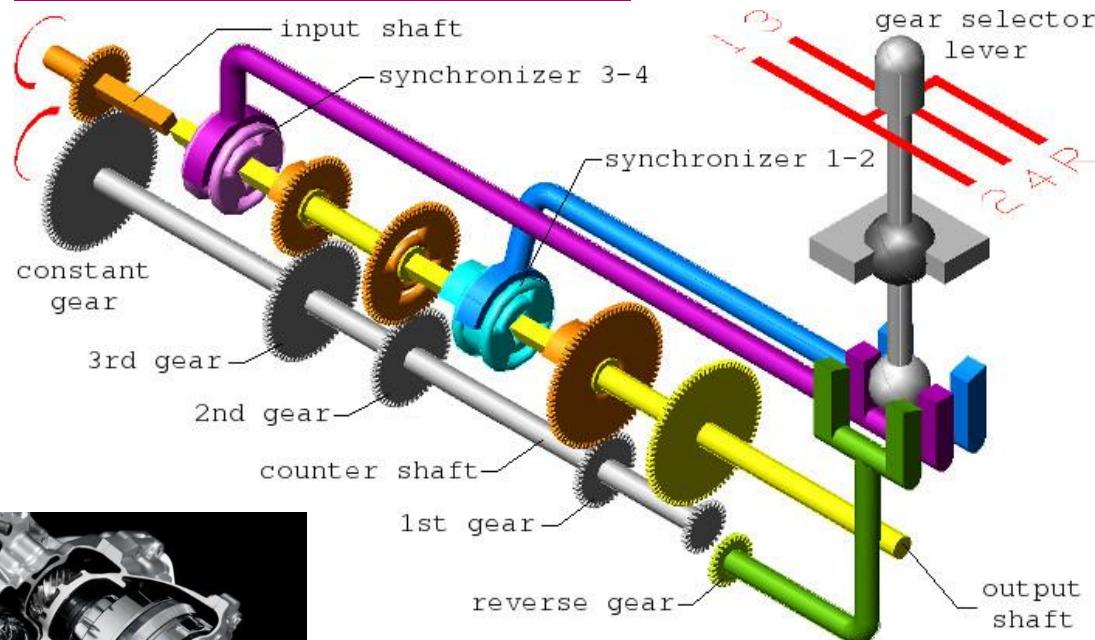
Drive Train Gear Box

Manual Transmission(MT)



Automatic Transmission

MT gearshift mechanism



Continuously Variable Transmission

Drive Train Gear Box



MT Gearshift



CVT Gearshift

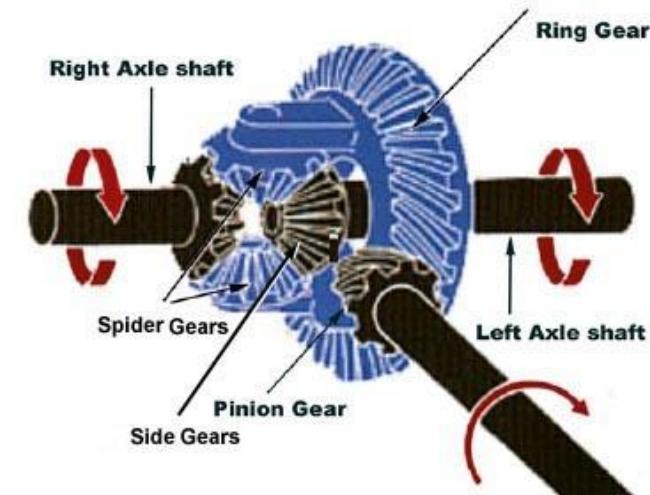
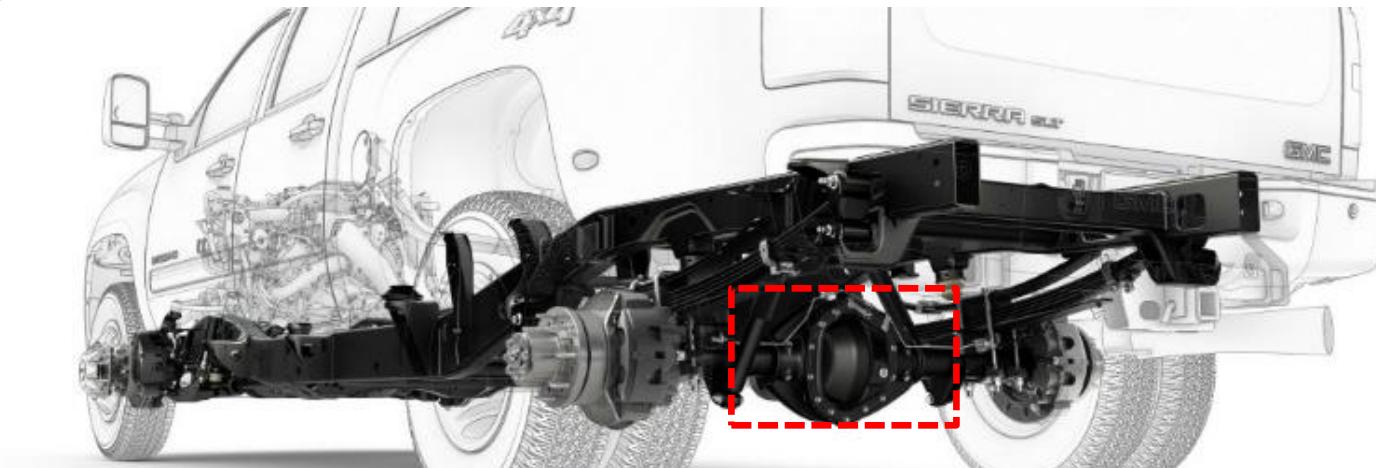


AMT Gearshift



AT Gearshift

Drive Train Differential

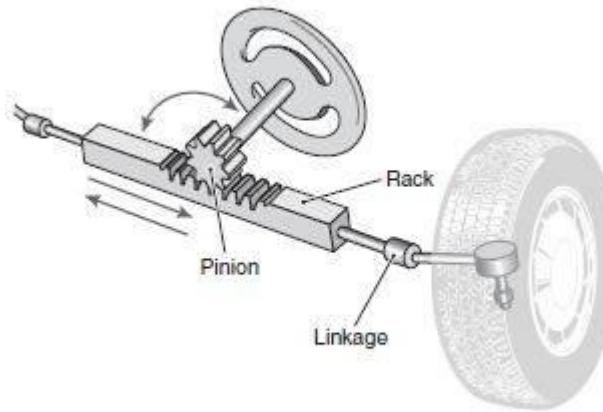
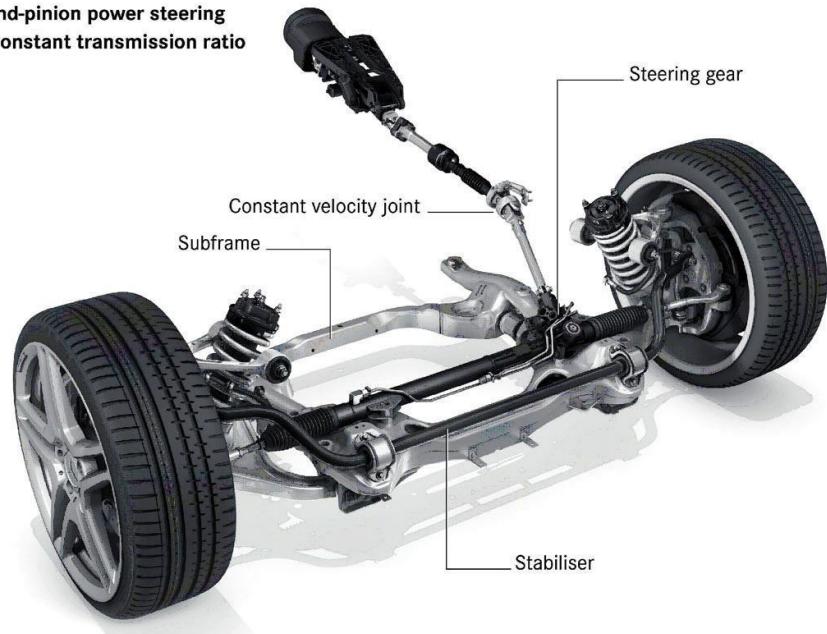


STEERING, BODY SYSTEM

Steering system

Mechanical steering

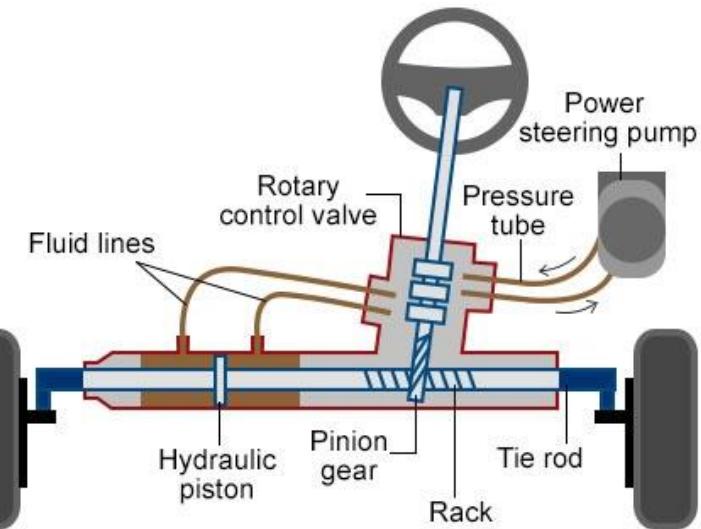
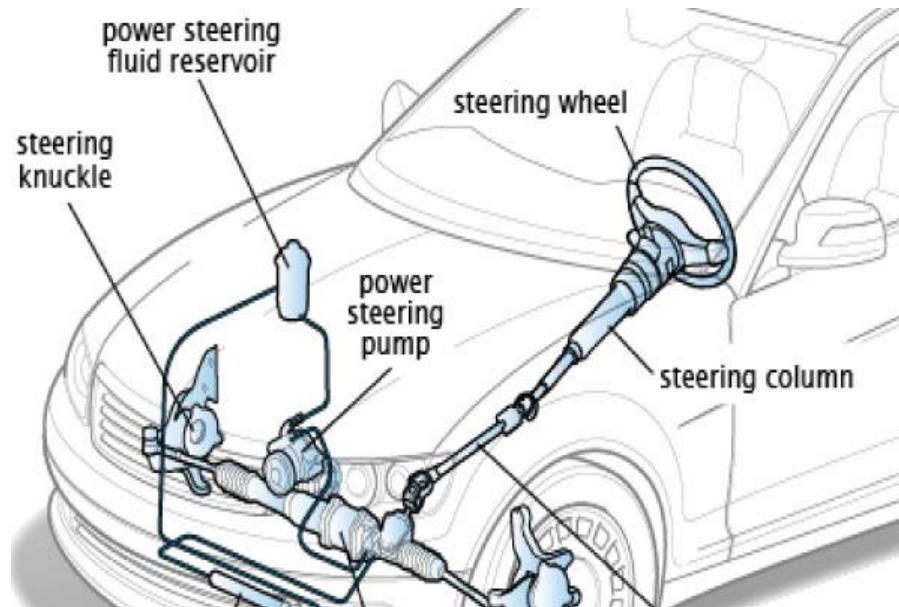
Direct: rack-and-pinion power steering system with constant transmission ratio



Rack-and-Pinion Steering Gear.

Steering system

Hydraulic power steering

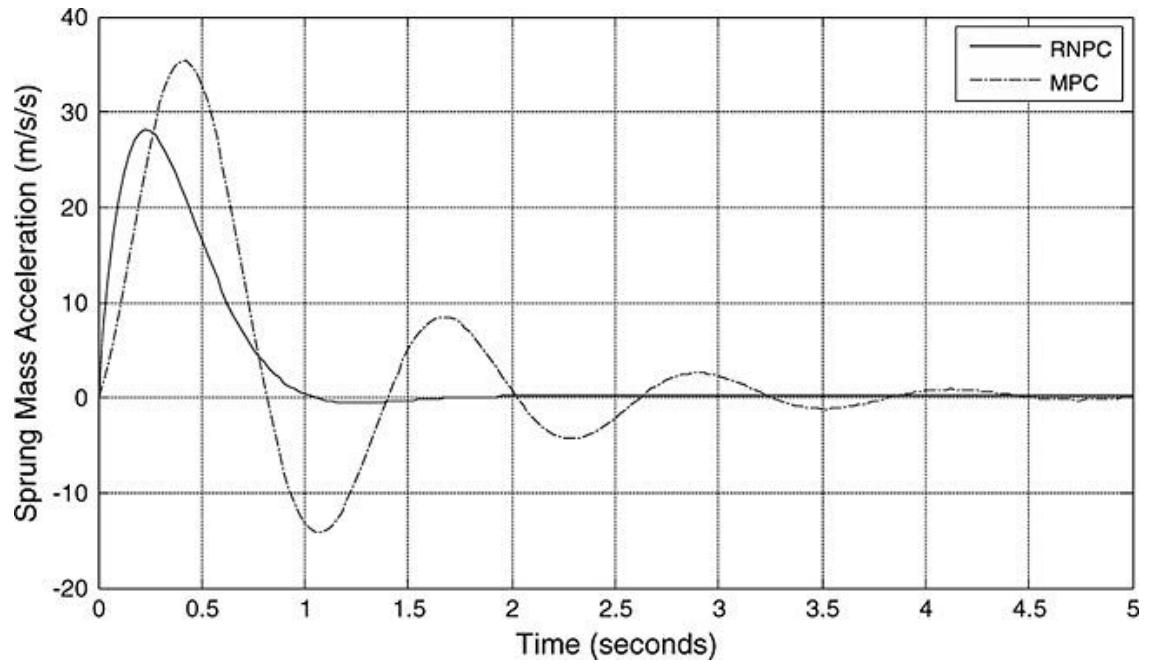
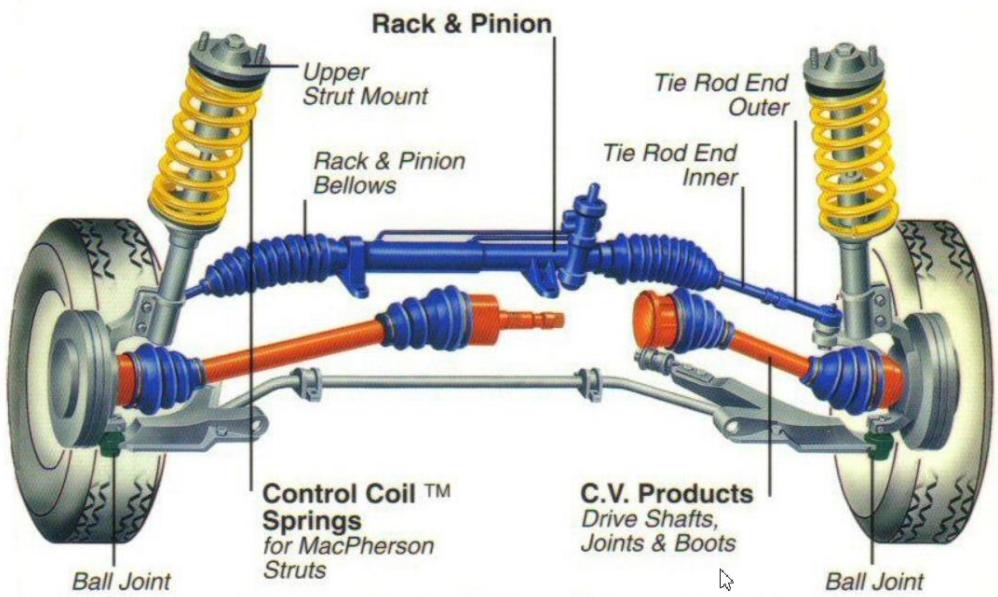


Steering system

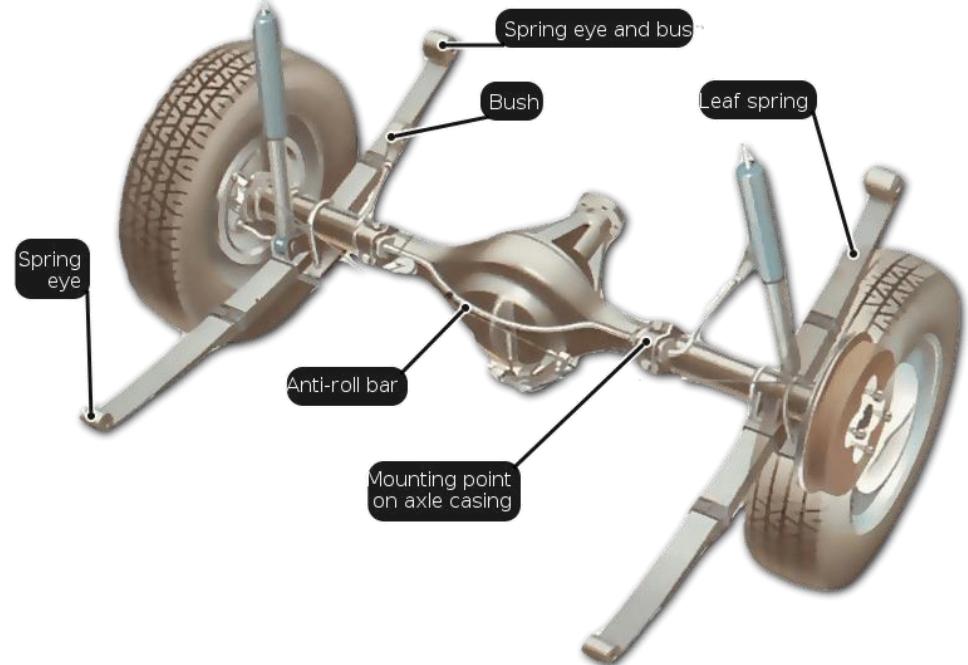
Electric power steering



Front suspension & steering system



Rear Suspension system - Leaf spring



Vehicle Frame & Body



Aerodynamics and Aeroacoustics effect

Safety / protect driver and passengers

Mounting other systems

- Lights / seats
- Windshields/ doors / windows
- HVAC



Aerodynamics and
Aeroacoustics testing

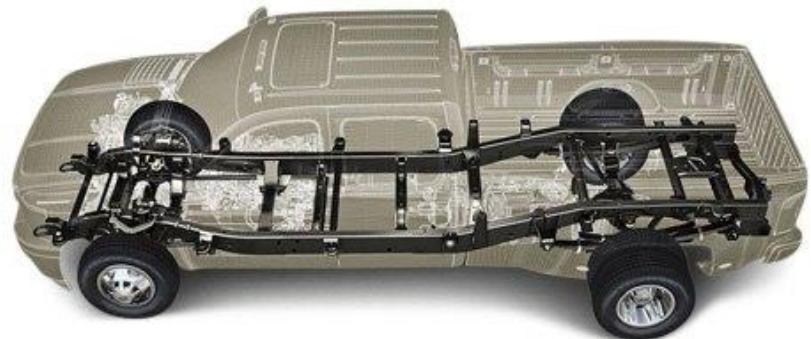


Spoiler

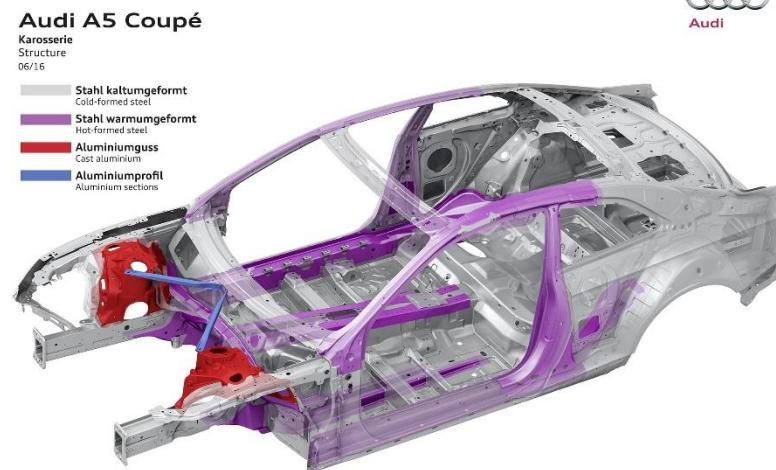


Car crashing, chassis
and airbag testing

Vehicle Frame & Body



Body on Frame

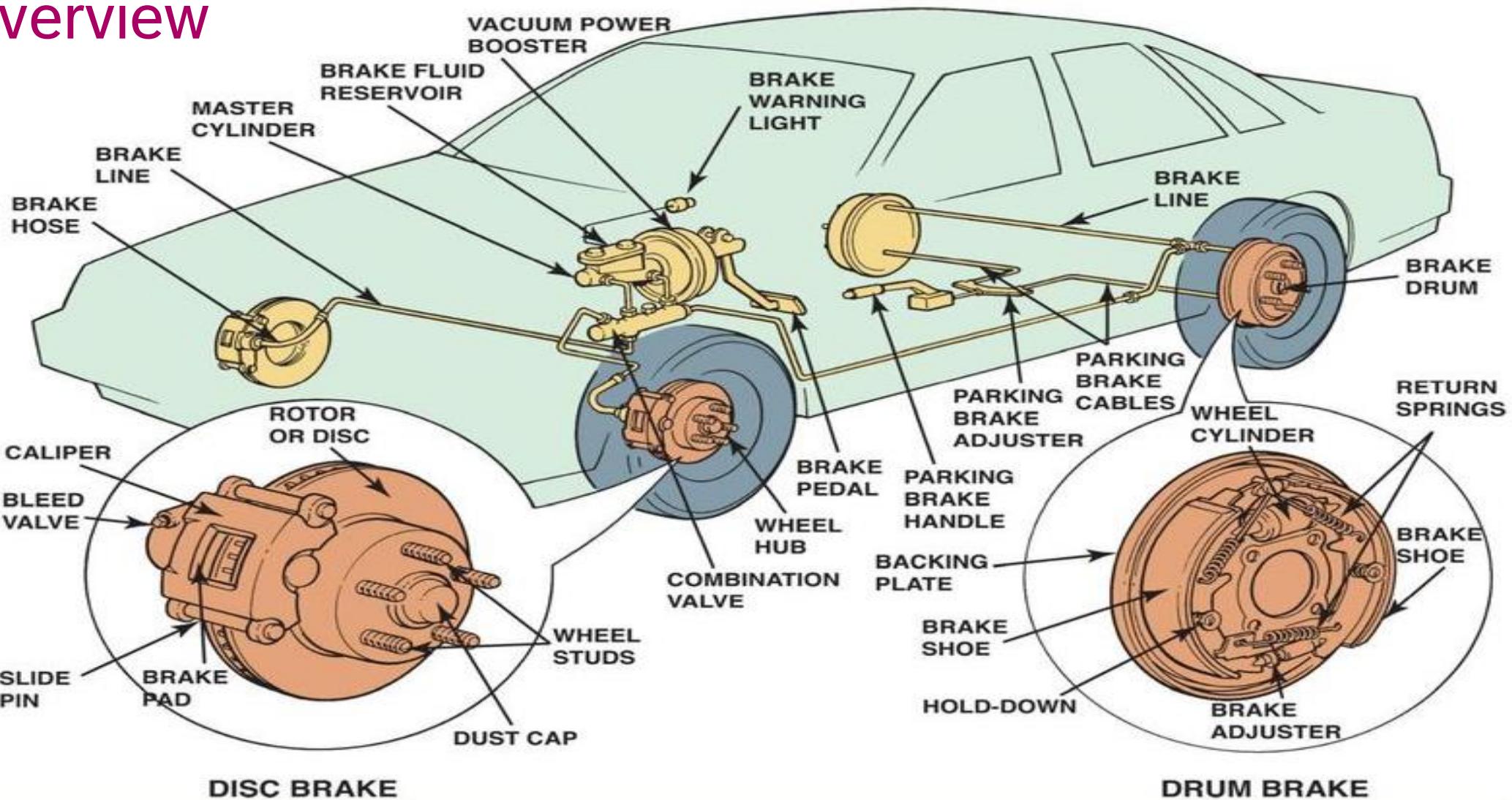


Uni-Body

BRAKING SYSTEM

Braking System

Overview

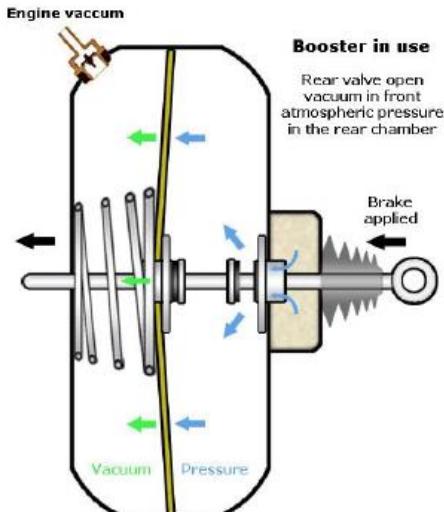


Braking System

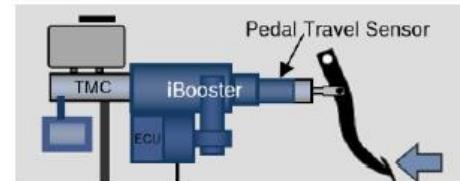
Vacuum Booster and iBooster

Brake Booster

Vacuum brake booster provides power assist to the brake system.



iBooster, an electromechanical brake booster that provides situation-dependent support when the driver initiates braking



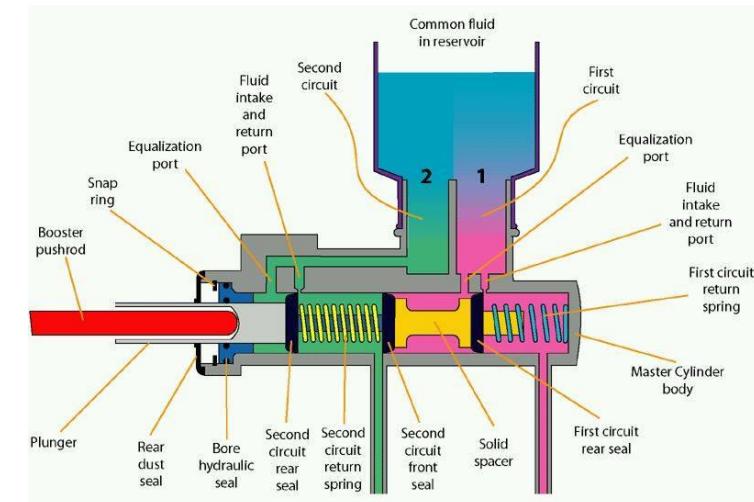
Braking System

Master Cylinder



Master cylinder is a control device that converts non-hydraulic pressure (commonly from a driver's foot) into hydraulic pressure

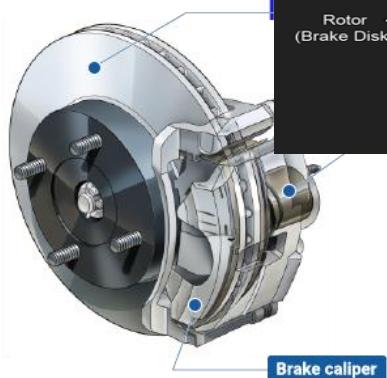
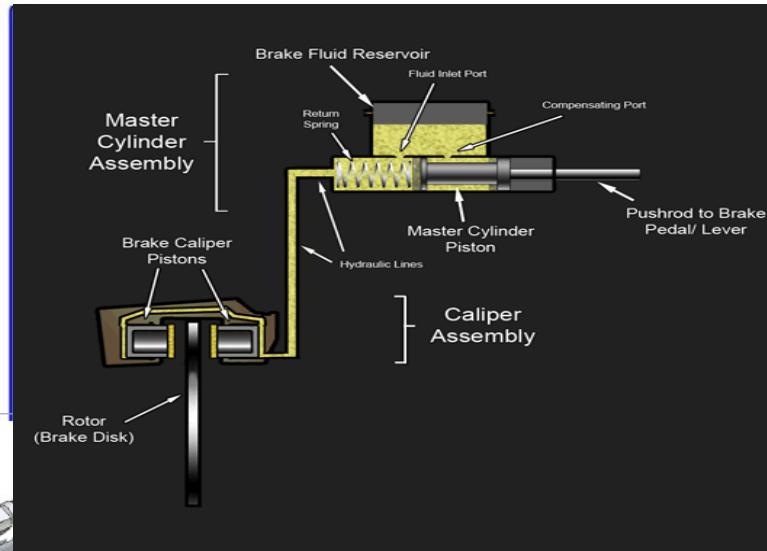
Reservoir is a store for the fluid which is utilized by the master cylinder to realize brakes on the wheel



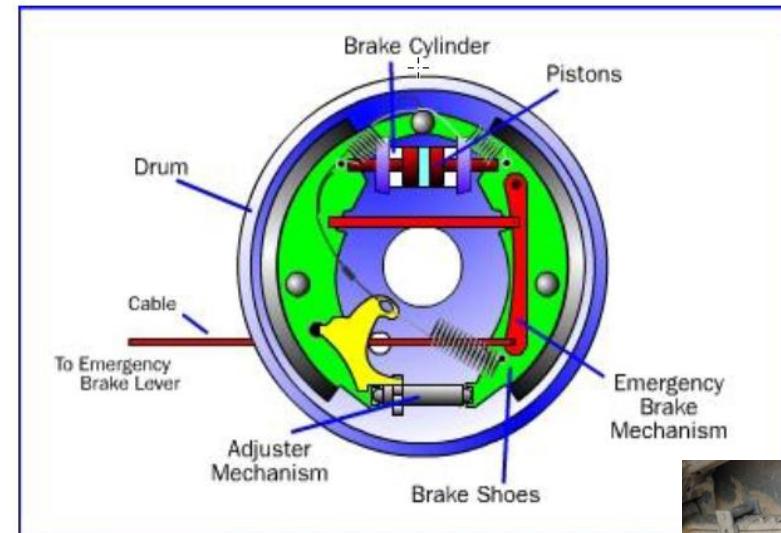
Braking System

Disc Brake and Drum Brake

Disc brake employing the friction of pads against a disc which is attached to the wheel.

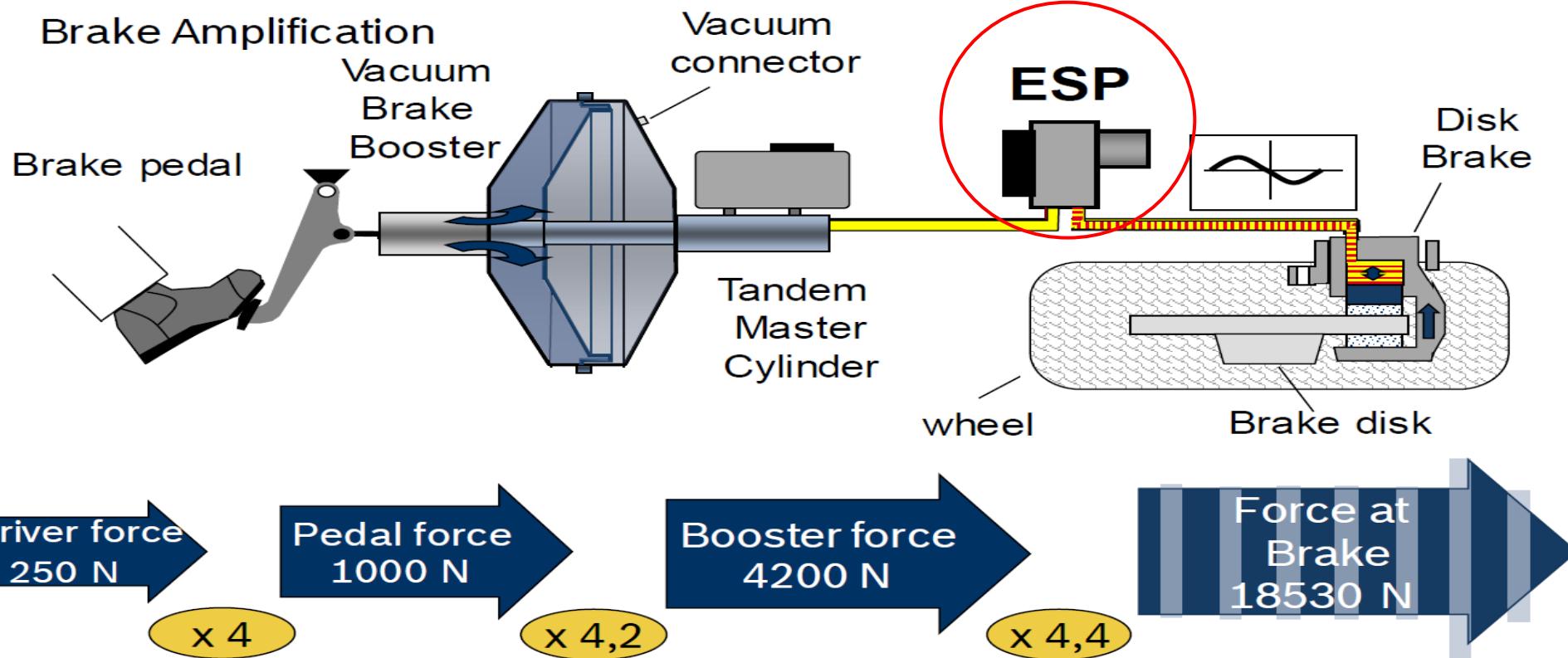


Drum brake press the brake shoes against the inside of a drum on the wheel.



Braking System

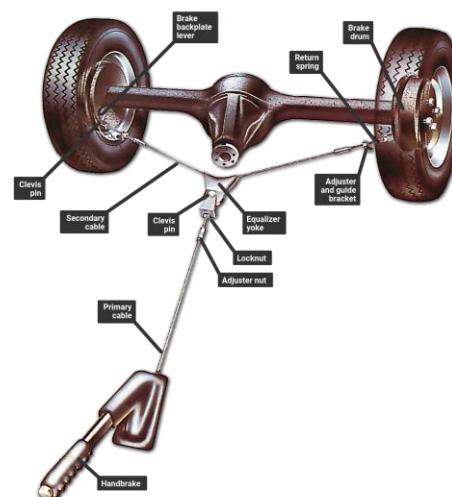
Amplification



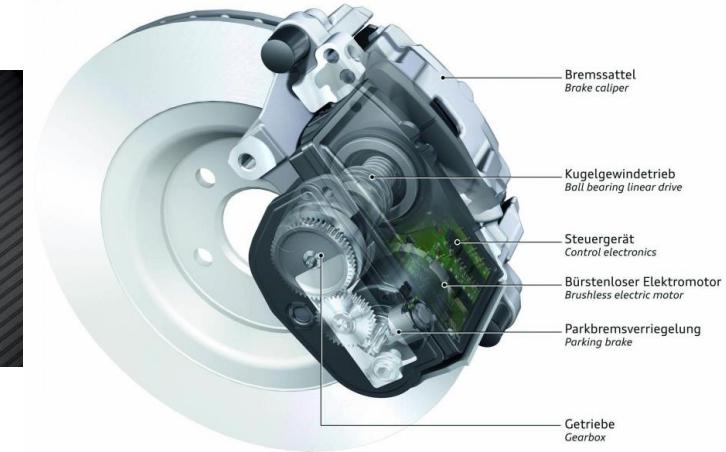
Braking System

Hand brake and Automatic Parking Brake

Handbrake

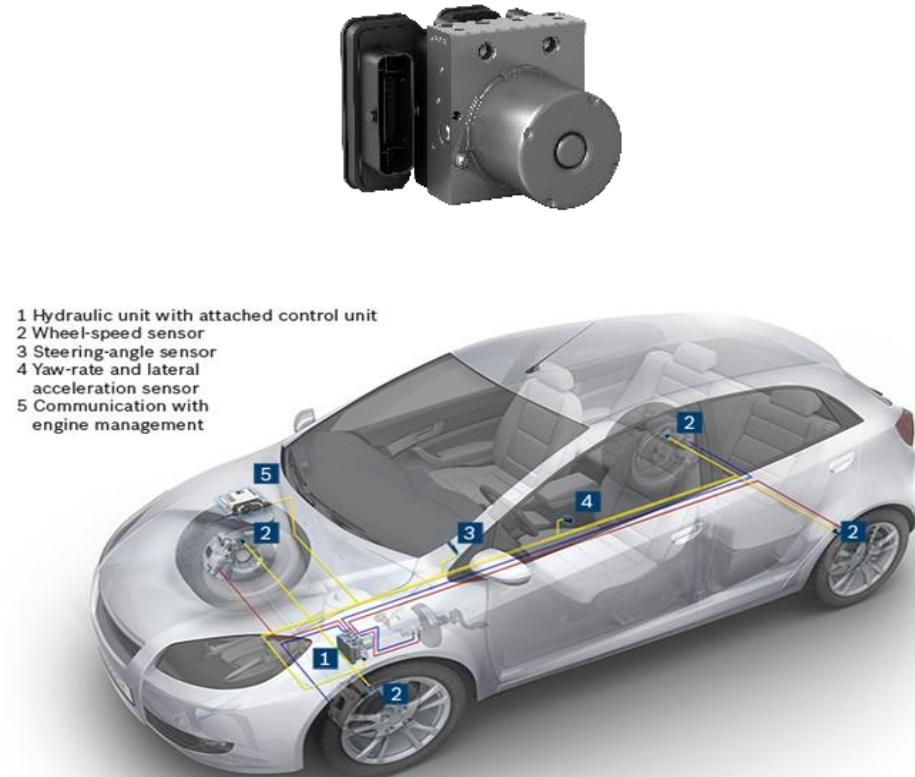
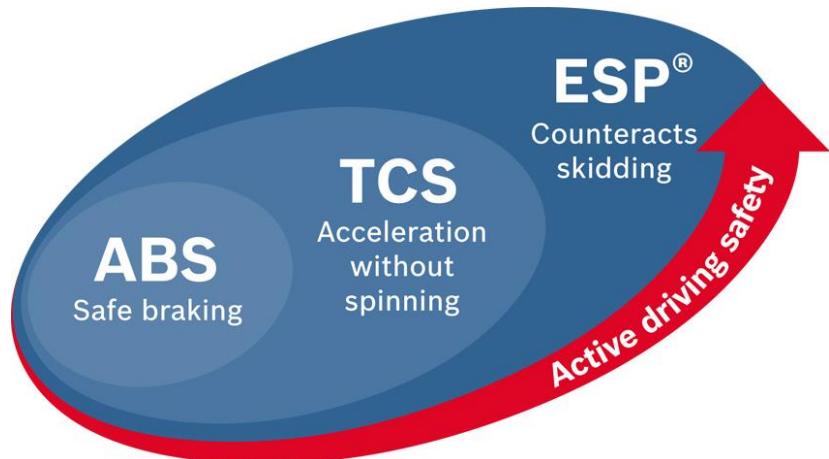


Automatic parking brake



SAFETY SYSTEM

Electronics Control Unit Active Safety System (AS)



Electronics Control Unit

AS - ABS Features and Benefits (Antilock Braking System)



Features & Function

If a wheel threatens to lock under heavy braking pressure, the system cuts off the braking pressure on this wheel only. If the wheel no longer threatens to lock, the braking pressure is raised again



Customer benefits

- Reduced stopping distance
- Steerability while braking
- Maintaining stability while braking on inhomogeneous surfaces
- Protects tires from flat braking spot

→ Designed to always maintain steerability and vehicle stability @braking

Electronics Control Unit

AS - TCS Features and Benefits (Traction Control System)

- While driving off or accelerating the slip between tires and road surface can increase so far that one or more wheels start slipping
- Slipping wheels cannot transfer motive or steering forces onto the road and the vehicle becomes uncontrollable
- If the driver demands a drive torque exceeding that transferable to the road, TCS intervenes: In fractions of a second it adapts the slip of the driven wheels to the best possible level
- **benefits of TCS:**
 - TCS prevents wheel slip
 - TCS increases driving stability
 - TCS maintains steerability



Traction Control System

Electronics Control Unit

AS - ESP Features and Benefits (Electronic Stability Program)

Road safety relies
on ESP® market
availability

- Increases driving stability actively in all driving situations
- Vehicle stabilization by individual wheel braking and engine management control



Customer benefits

- Reduced risk of skidding
- Maneuverability maintained even in extreme situations
- Significant decrease of severe and fatal accidents

Electronics Control Unit

AS - ESP Features and Benefits

► Understeering:

- vehicle turns less than driver steers, vehicle can't follow drivers request
- body slip angle and yaw rate too small
- you leave the road with the front-end
- control theory: lack of *steerability*



→ Oversteering:

- skidding: vehicle turns more than driver steers
- body-slip angle and yaw rate too large
- rear-end breaks away, body slip angle and yaw rate too big
- control theory: lack of *stability*



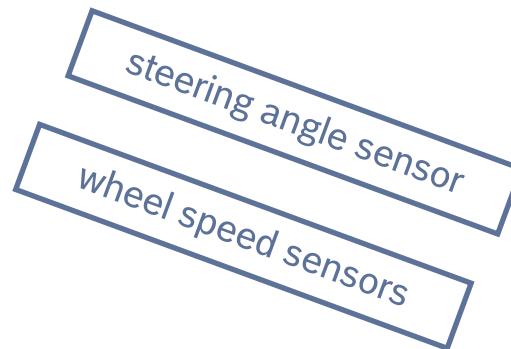
Electronics Control Unit

AS - ESP Features and Benefits

Target Yaw Rate

Base on **Ackermann formula**

$$\dot{\psi}_{Ack} = \delta \cdot \frac{v}{l} \cdot \frac{1}{1 + (v/v_{ch})^2}$$



- ▶ Variable **input signals** are
 - ▶ steering wheel angle
 - ▶ vehicle speed
- ▶ Fixed **model parameters** are
 - ▶ wheel base
 - ▶ (indirectly) steering gear ratio and
 - ▶ characteristic speed vch which is assumed „fixed“ for a given vehicle

Actual Yaw Rate

Yawrate sensors

Electronics Control Unit

AS - ESP Features and Benefits

The goal of ESP is to minimize the deviation from actual yawrate and expected yawrate from driver

Electronics Control Unit

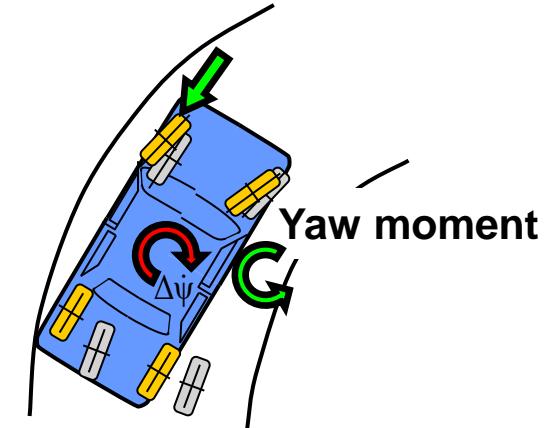
AS - ESP Features and Benefits

Intervention Strategy

Modify the brake torque at individual wheels

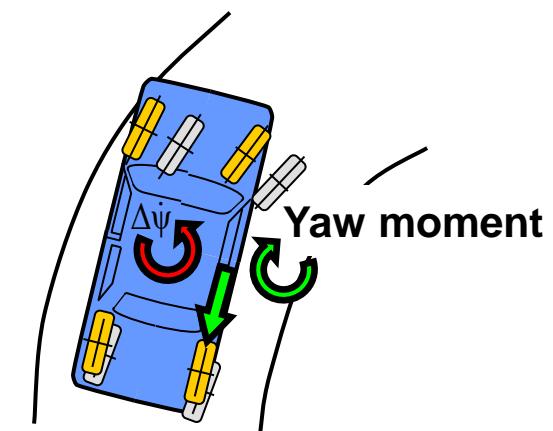
Oversteering:

- Yaw velocity is too large
- Stabilization by brake intervention at the curve outer front wheel

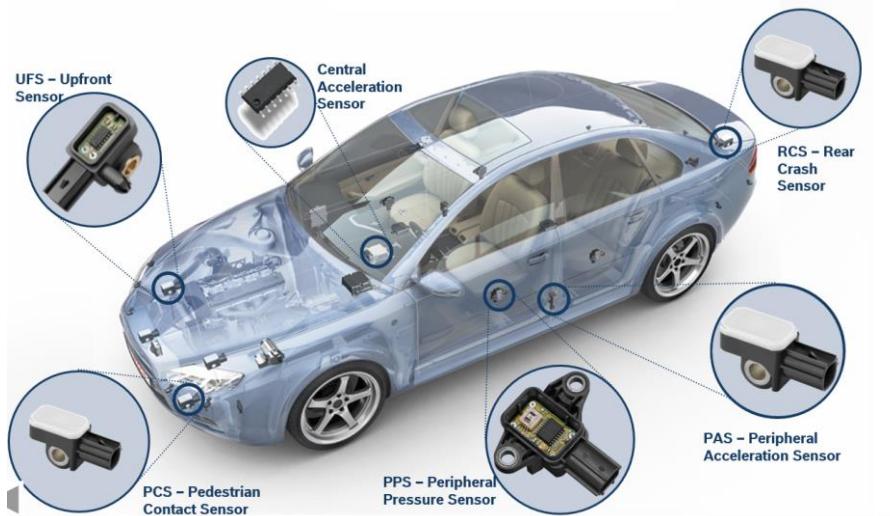
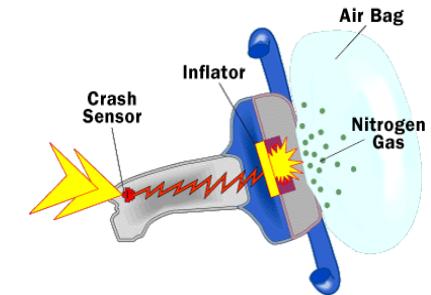
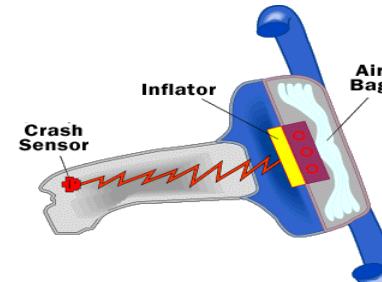
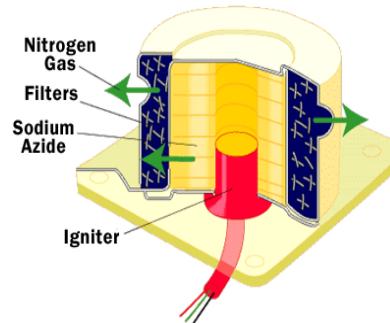
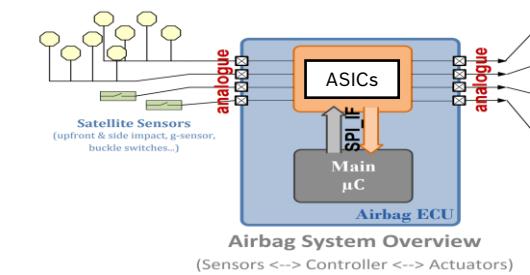


Understeering:

- Yaw velocity is too small
- Stabilization by brake intervention at the curve inner rear wheel



Electronics Control Unit Passive Safety

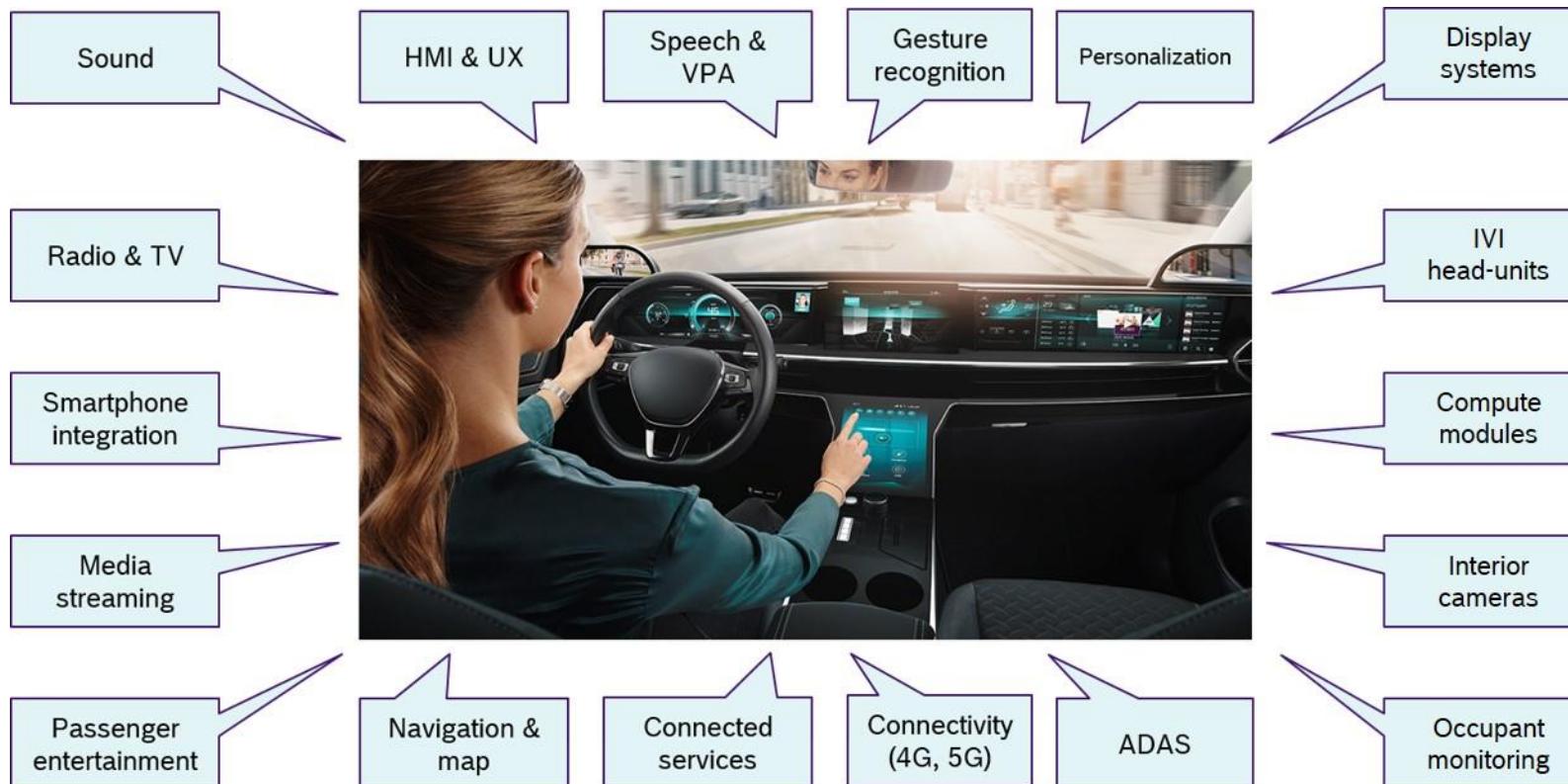


OVERVIEW OF CAR MULTIMEDIA

Trainer: Tran Duc Son



What is Car Multimedia? Bosch CM portfolio



Market share 2019

Bosch Car Multimedia: 9%
3rd largest IVI supplier worldwide
Market leader for digital clusters

Associates 2019

Bosch Car Multimedia: ~ 8.000 globally

Wide range of products in the Product Portfolio

CM Products & Domains

Cluster, IVI, HUD

- ▶ In an automobile, an **electronic instrument cluster**, **digital instrument panel** or *digital dash* for short, is a set of instrumentation, including the speedometer, that is displayed with a digital readout rather than with the traditional analog gauges. Many refer to it simply as a *digital speedometer*. (Wikipedia)
- ▶ An **automotive head unit**, sometimes called the infotainment system,^[1] is a component providing a unified hardware interface for the system, including screens, buttons and system controls for numerous integrated information and entertainment functions. (Wikipedia)
- ▶ A **head-up display**,^[1] also known as a **HUD** (/hʌd/), is any transparent display that presents data without requiring users to look away from their usual viewpoints. (Wikipedia)

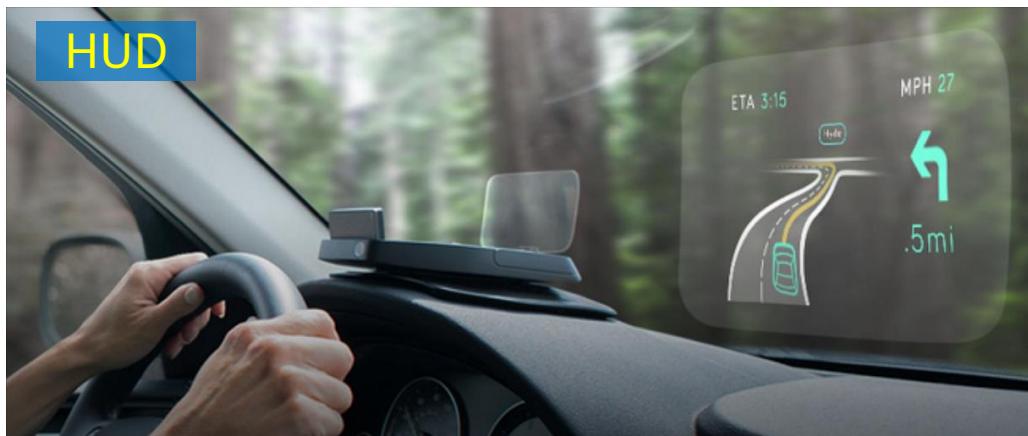
[https://www.bosch-mobility-
solutions.com/en/solutions/infotainment/display-and-interaction-
systems/](https://www.bosch-mobility-solutions.com/en/solutions/infotainment/display-and-interaction-systems/)



Dashboard



Infotainment



CM Products & Domains

Head-up Display

<https://youtu.be/D0vum9K5Ge4>



CM Products & Domains Cluster



CM Products & Domains Cluster

<https://youtu.be/Ql6fa6rd42g?t=39>

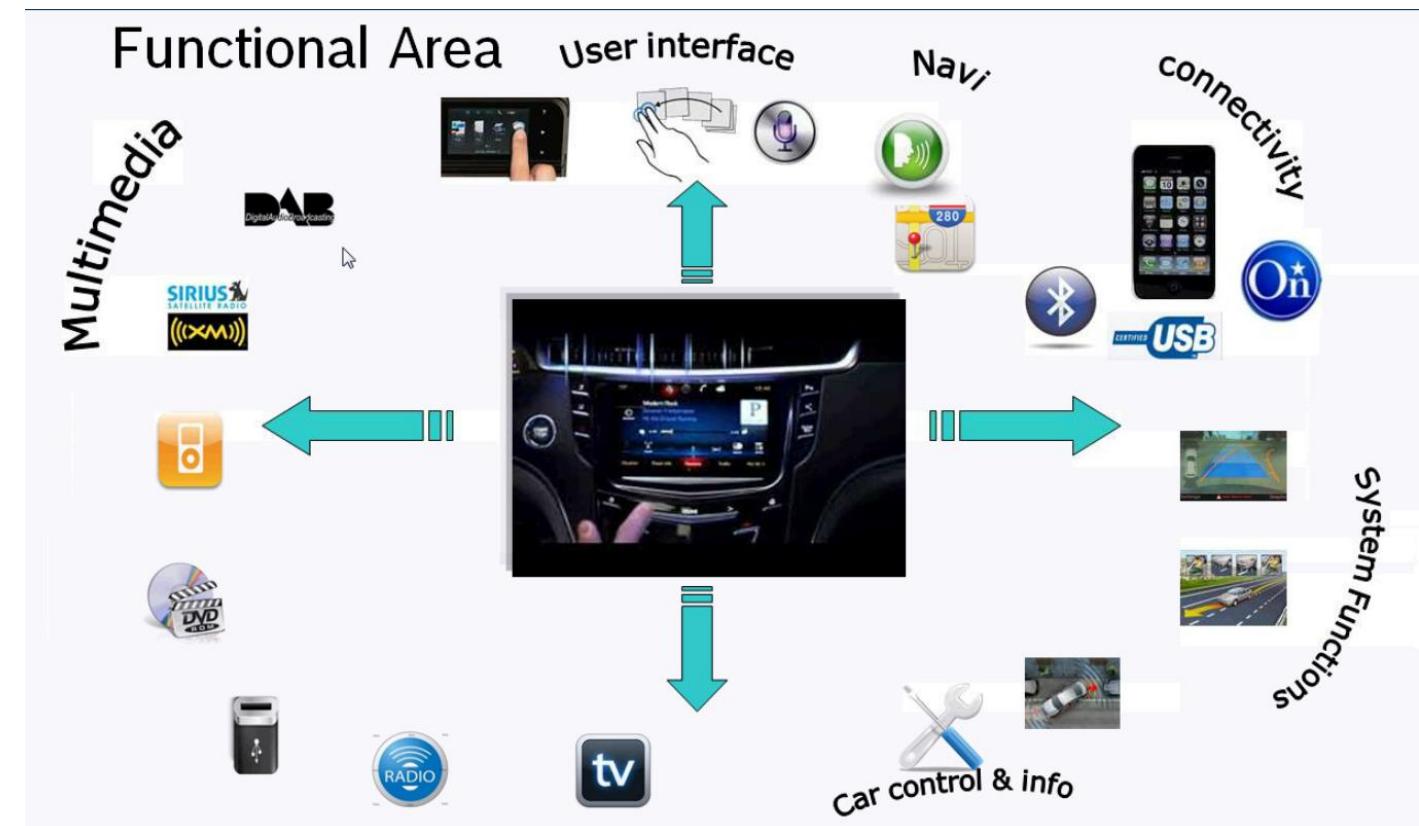
<https://www.bosch-mobility-solutions.com/en/solutions/infotainment/display-and-interaction-systems/>



CM Products & Domains

In-Vehicle Infotainment

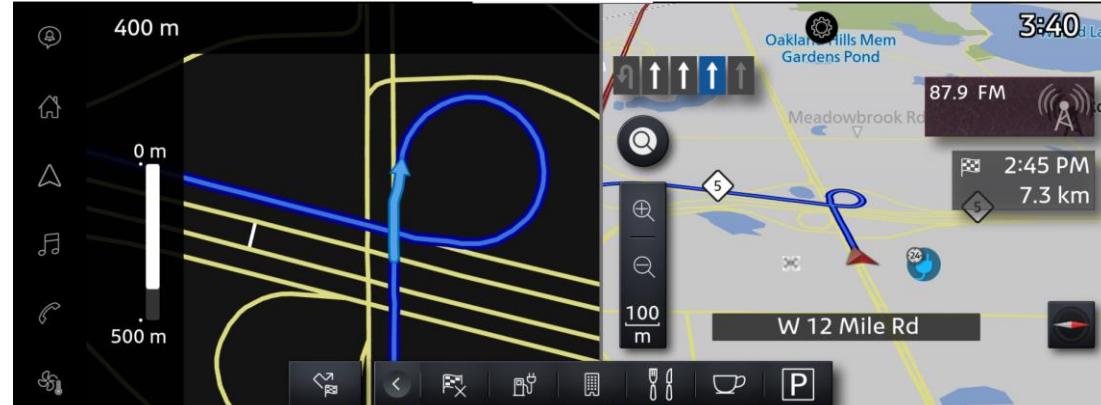
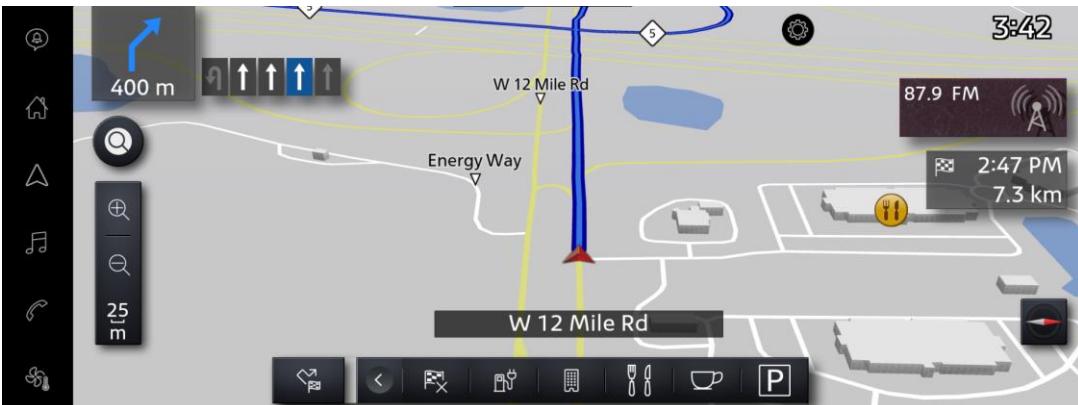
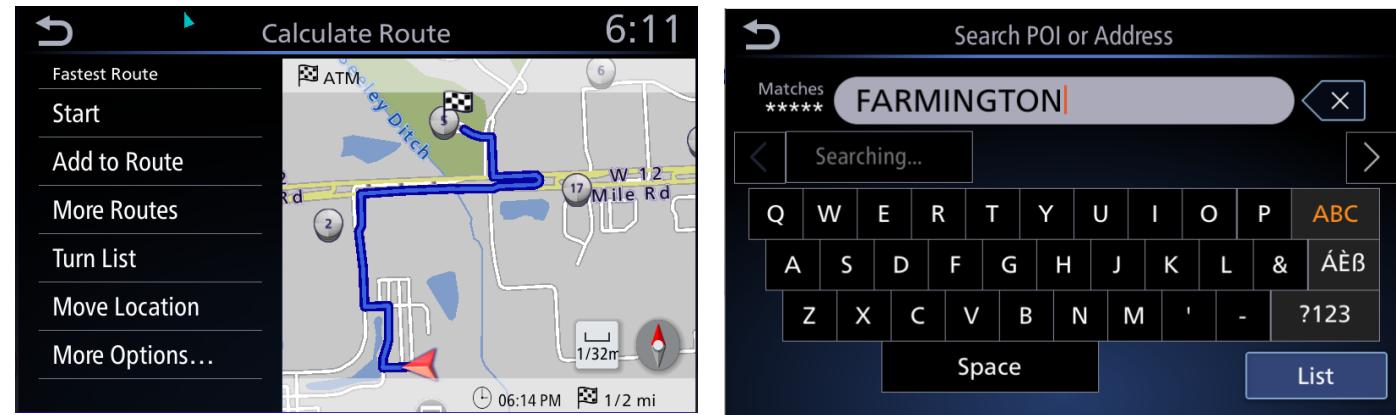
- ▶ Information
- ▶ Entertainment



CM Features

Navigation

- Richest features in IVI
- Map, Destination, Route Calculation, Route Guidance, AddressBook, etc.
- In migration with Speech, SXM, Telematics, etc.



CM Features Navigation

<https://youtu.be/yZUNBNSo7MI>



CM Features Navigation

<https://youtu.be/58R27lyNGQ0>



CM Features Reception

- AM, FM, DAB
- SXM:
 - **Sirius XM Holdings Inc.** is an American broadcasting company headquartered in Midtown Manhattan, New York City that provides satellite radio and online radio services operating in the United States



CM Features

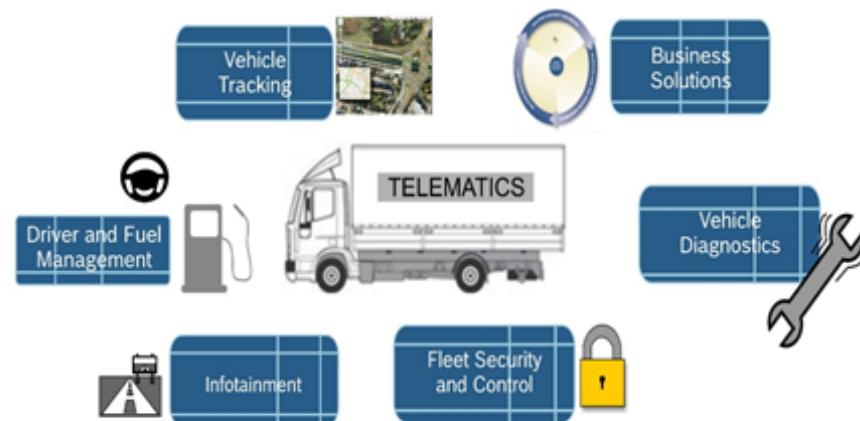
VICS

- ▶ https://en.wikipedia.org/wiki/Vehicle_Information_and_Communication_System
- ▶ **Vehicle Information and Communication System (VICS)** is a technology used in Japan for delivering traffic and travel information to road vehicle drivers. It provides simple maps showing information about traffic jams, travel time, and road work - usually relevant to your location with Infrared beacons.
- ▶ VICS is transmitted using:
 - FM multiplex broadcasting (uses DARC). With this method, you have to manually select road conditions on-screen.
 - Infrared beacons over Japan's highways and urban roads. With this method, road conditions automatically pop up.
 - Microwaves in the ISM band.
- ▶ The VICS information can be displayed on the car navigation unit at 3 levels:
 - Level-1: Simple text data
 - Level-2: In form of simple diagrams
 - Level-3: Data superimposed on the map displayed on navigation unit (e.g., traffic congestion data)
- ▶ Information transmitted includes traffic congestion data, data on availability of service areas (SA) and parking areas (PA), information on road works and traffic collisions.
- ▶ Some advanced navigation units might utilize this data for route calculation (e.g., choosing a route to avoid congestion) or the driver might use his own discretion while using this information.

CM Features

Telematics

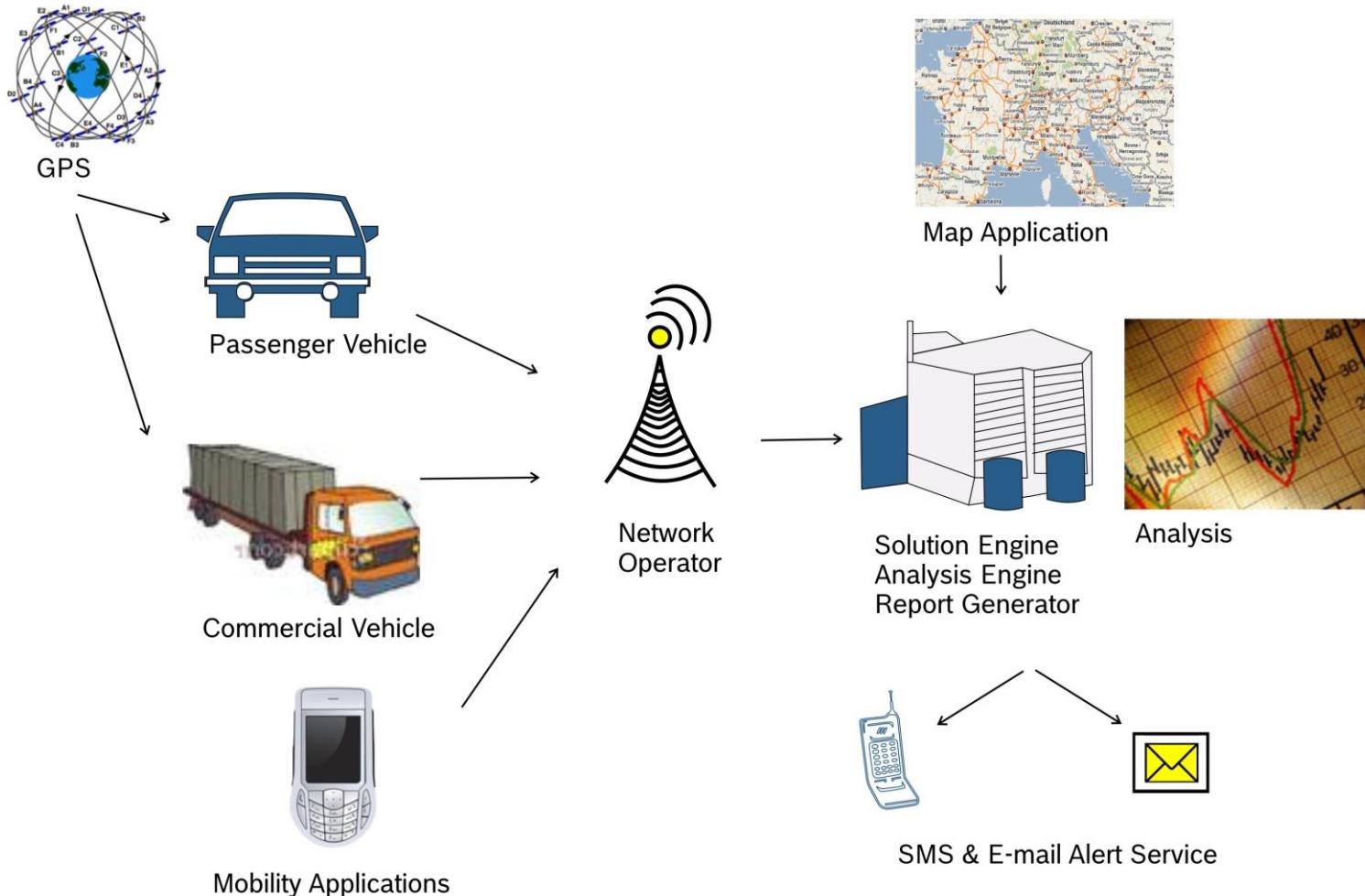
- **Telematics**: Telecommunication + Informatics
- Telematics is an interdisciplinary field that encompasses telecommunications, vehicular technologies, road transportation, road safety, electrical engineering (sensors, instrumentation, wireless communications, etc.), and computer science (multimedia, Internet, etc.).



Source: Frost & Sullivan

CM Features

Telematics



CM Features Telematics

<https://youtu.be/XwhzEiUYZ54>



CM Features

SPI - Smartphone Integration

- ▶ Carplay
- ▶ Android Auto
- ▶ mySPIN
- ▶ Baidu Carlife
- ▶ Yandex Auto



CM Features

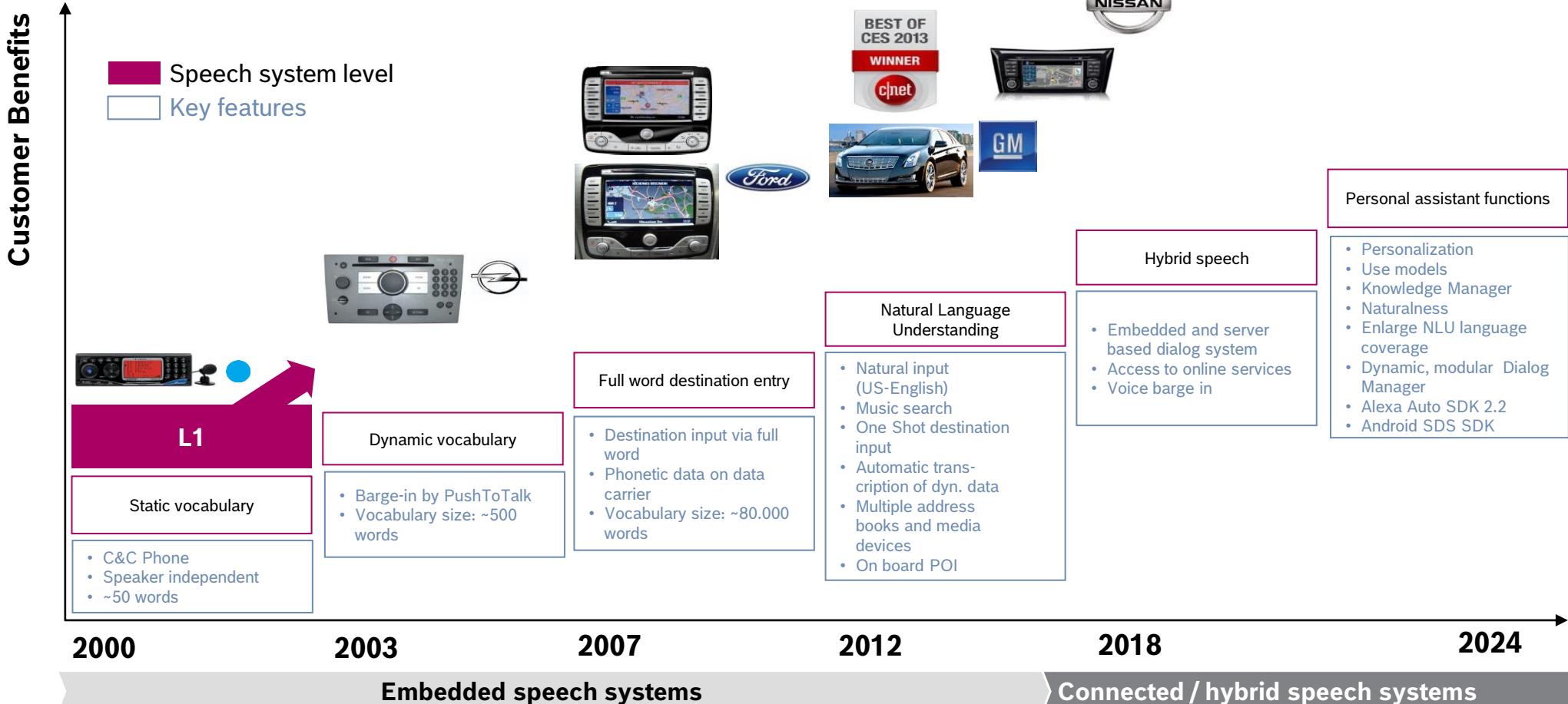
SDS - Speech Dialog System

- A **speech dialog system** (SDS) is a computer system able to converse with a human with voice. It has two essential components that do not exist in a written text dialog system: a speech recognizer and a text-to-speech module (written text dialog systems usually use other input systems provided by an OS). It can be further distinguished from **command and control** speech systems that can respond to requests but do not attempt to maintain continuity over time.
(Wikipedia)



CM Features

SDS - Speech Dialog System



CM Features

Others

- ▶ Media (CD, DVD, USB, Bluetooth, iPod, etc)
- ▶ DTV
- ▶ Phone
- ▶ HVAC (Heating, Ventilation, and Air Conditioning)
- ▶ ADAS (Advanced Driver Assistant System): Around View Camera, Dashcam, Driver monitoring
- ▶ Remote Control App
- ▶ Diagnosis
- ▶ Software update, Map Update via Wifi (OTA – Over The Air)

CM Features

Scene interrupt

- ▶ Detail scene/popup interrupt will be defined clearly in interrupt management specification.
- ▶ In normal system, camera scene (RVC, AVM, Sonar) has highest priority.
- ▶ Following priority group would be smartphone (phone call, message, personal assistance)
- ▶ Traffic information ahead (accident, traffic jam, emergency info...)

CM Features

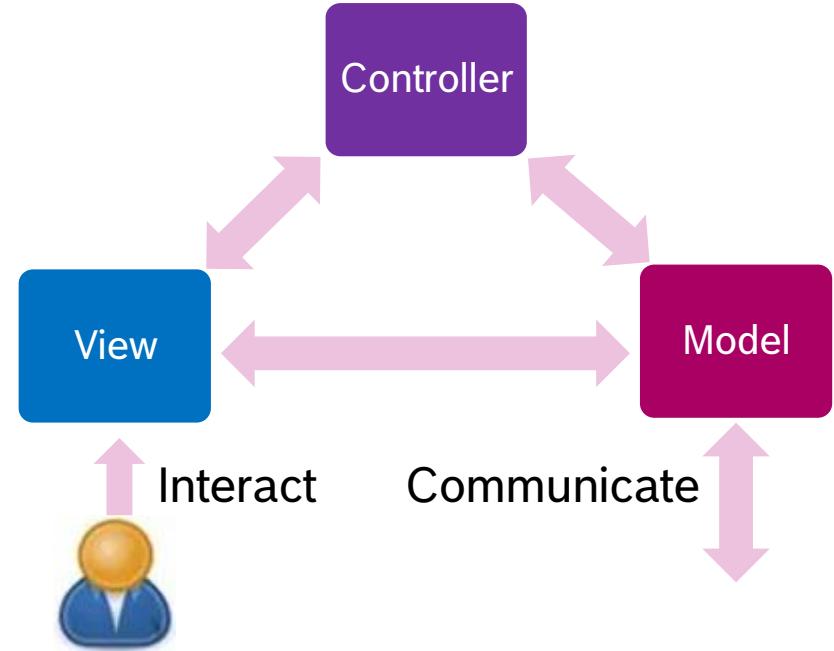
Audio source interrupt

- ▶ Entertainment source (FM, internet radio,...)
- ▶ BT-Phone call (incl. ringing, Send call to hold, voice recognition during call,...)
- ▶ Read SMS
- ▶ Offboard SDS (via Bluetooth: Siri, S-Voice, Google-Now....)
- ▶ Navi announcement (Guidance, Speed limit)
- ▶ Detail audio source interrupt management defined in specification (Bose/non-Bose system)

HMI Development overview

HMI Architecture

- ▶ CM HMI applications development based on ASF framework
- ▶ HMI App architecture design pattern: MVC
- ▶ The Model (HALL) manipulate application data.
- ▶ The View (GUI) presents the model's data to the user.
- ▶ The Controller (SM) control the application state, listen to event triggered from user or other components.
- ▶ View, Controller, Model communicate via message. Message, event, action are defined commonly in HMI contract files.
- ▶ HMI application communicate to other message-based service technologies in the automotive domain like DBUS, CCA, CMS



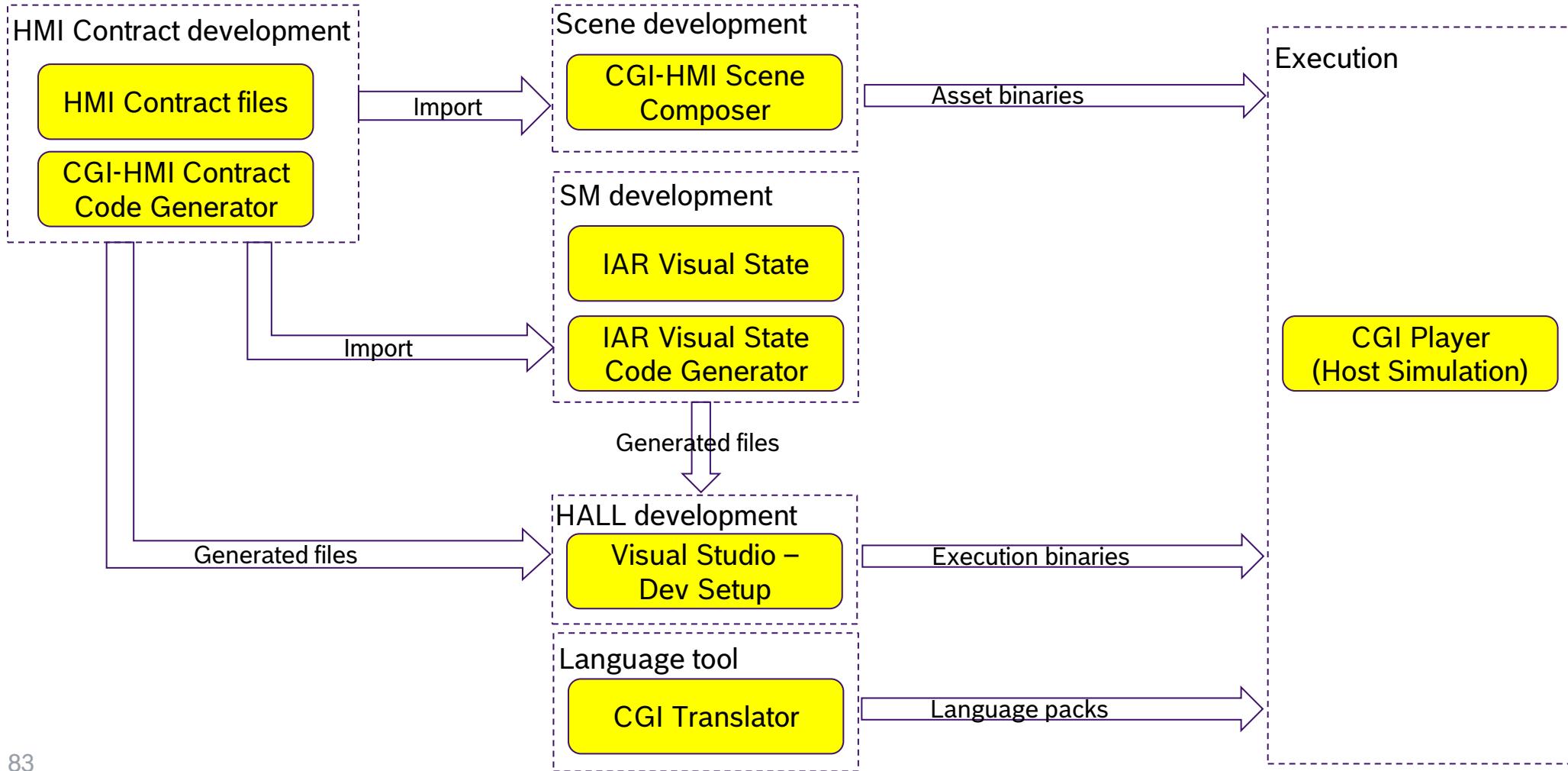
HMI Development overview

Overview

- ▶ HMI Application for CM project use CGI Studio tools chain which support to generated C++ code for message communication.
- ▶ GUI development by CGI Studio – Scene composer
- ▶ SM development by IAR Visual State
- ▶ HALL development with Visual Studio

HMI Development overview

Overview



HMI Development overview

GUI development

- Development tool: [CGIStudio – Scene Composer](#)



HMI Development overview

GUI development

► Common Input:

- HMI contract files
- Specification
- Text ID (for translation)

► GUI Input :

- HMI contract generated files
- Graphic design (.psd)
- Graphic resource (.bmp, .png, ...)
- Common widget, composite (list, text, layout,...)

► Output :

- Scene design
- Asset binary
- Resource asset binary
- Language package binary



HMI Development overview

SM development

- Development tool: IAR Visual State



HMI Development overview

SM development

► Common Input:

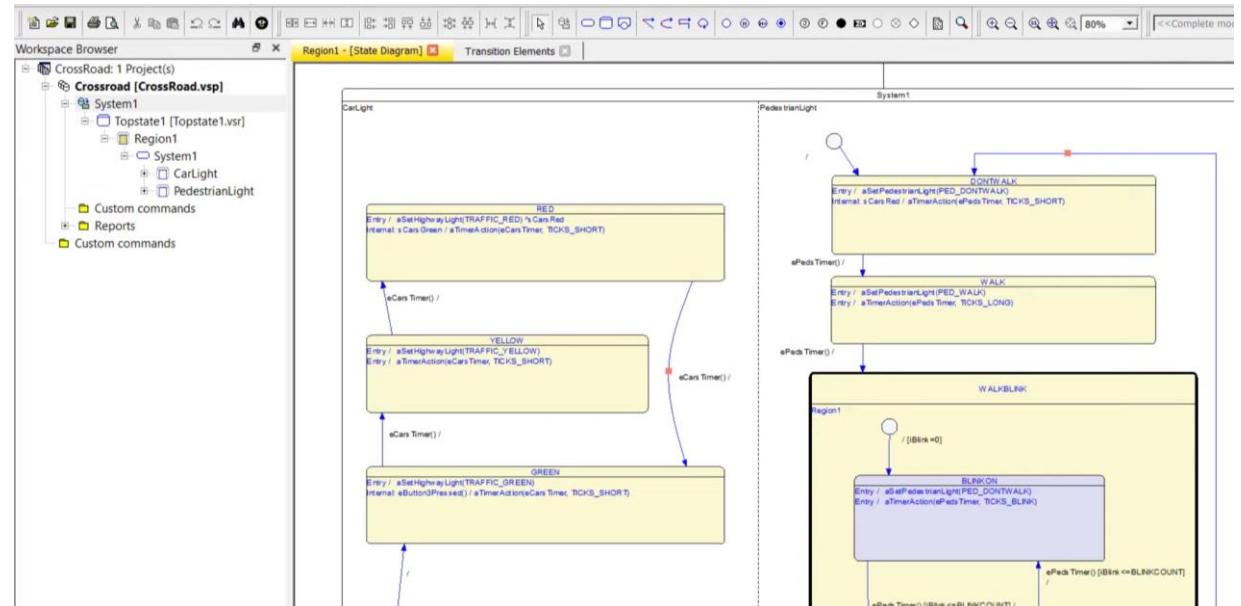
- HMI contract files
- Specification
- Text ID (for translation)

► Input :

- HMI contract generated files

► Output :

- Generate C++ files



HMI Development overview

HALL development

► Common Input:

- HMI contract files
- Specification
- Text ID (for translation)

► Input :

- HMI contract generated files

► Output :

- Model handler C++ files

OVERVIEW OF ADVANCED DRIVER ASSISTANCE SYSTEM (ADAS)

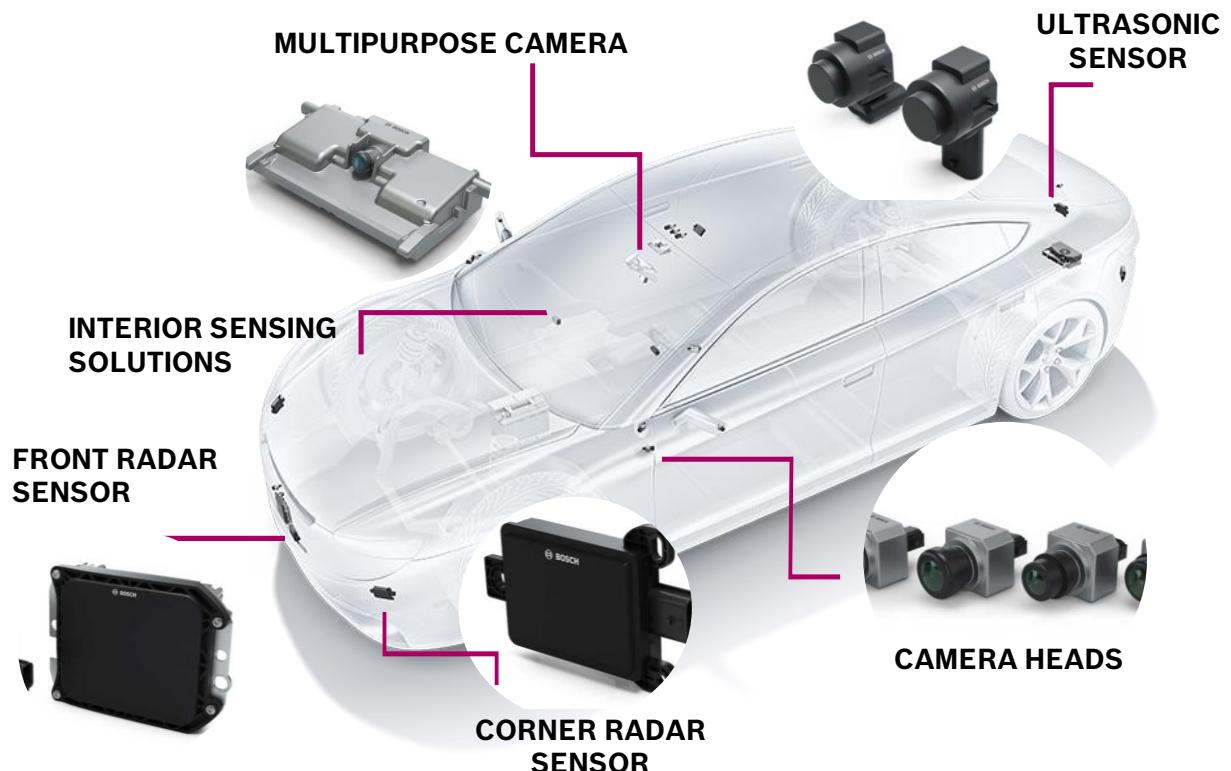
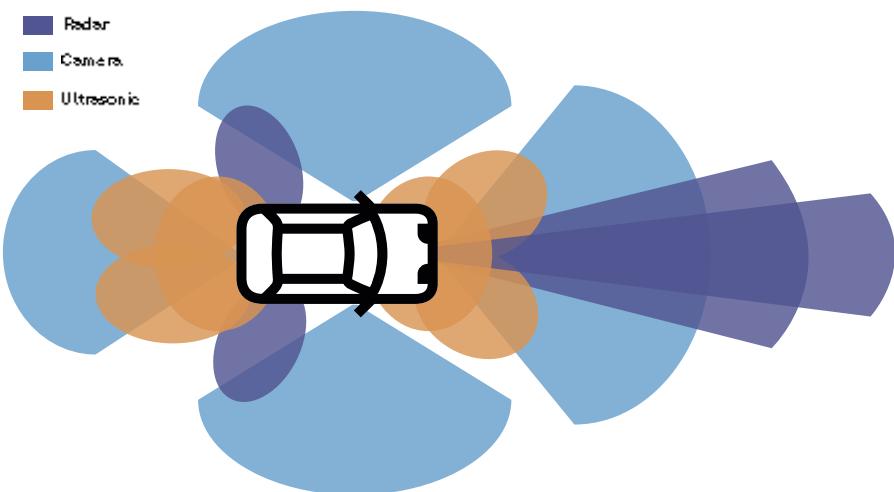
Trainer: Nguyen Trung Duong



Electronics Control Unit

ADAS System

- ADAS support you and reduce the stress of driving maneuvers in routine driving & in critical situations.
- Driving Assistance leads to: More comfortable driving & More safety driving.

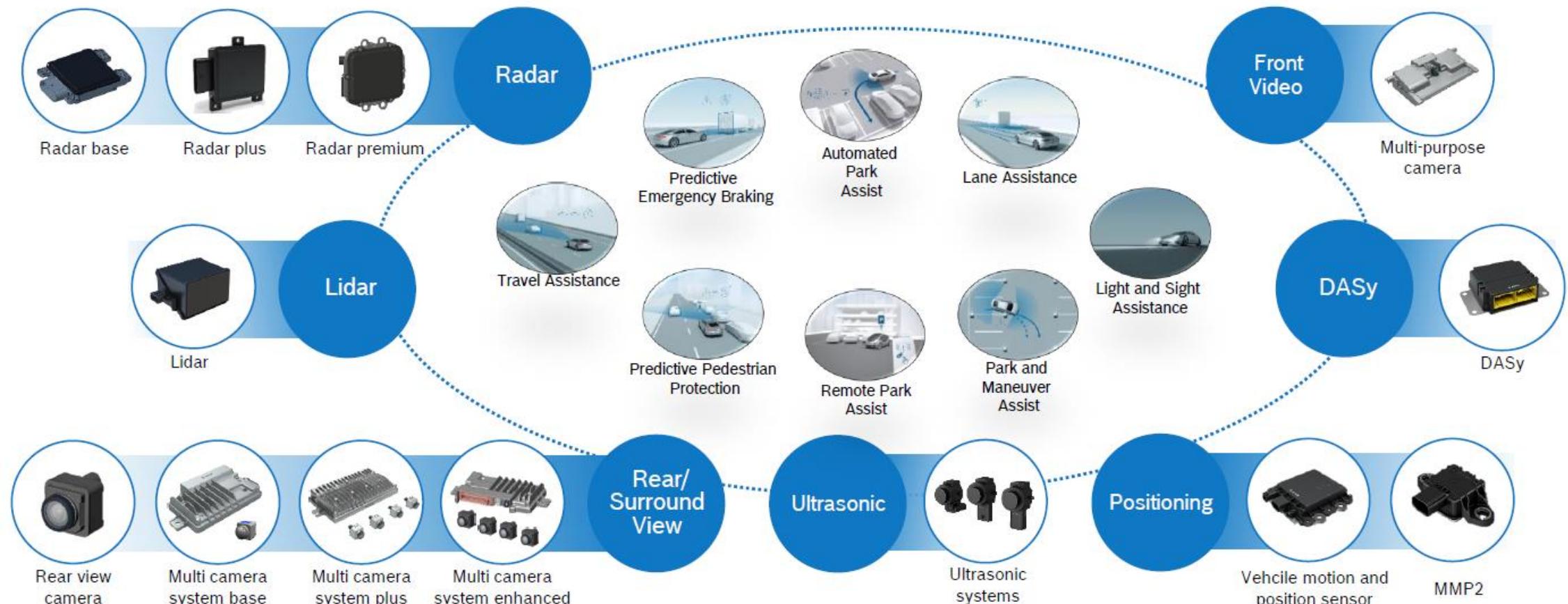


- Radar
 - Camera
 - Ultrasonic
- Rear cross traffic alert
 - Side view assist
 - Emergency braking
 - Adaptive cruise control
 - Lane departure warning

- Lane keeping assist
- Traffic sign recognition
- Road signature
- Intelligent headlight control
- Park pilot
- Blind spot detection

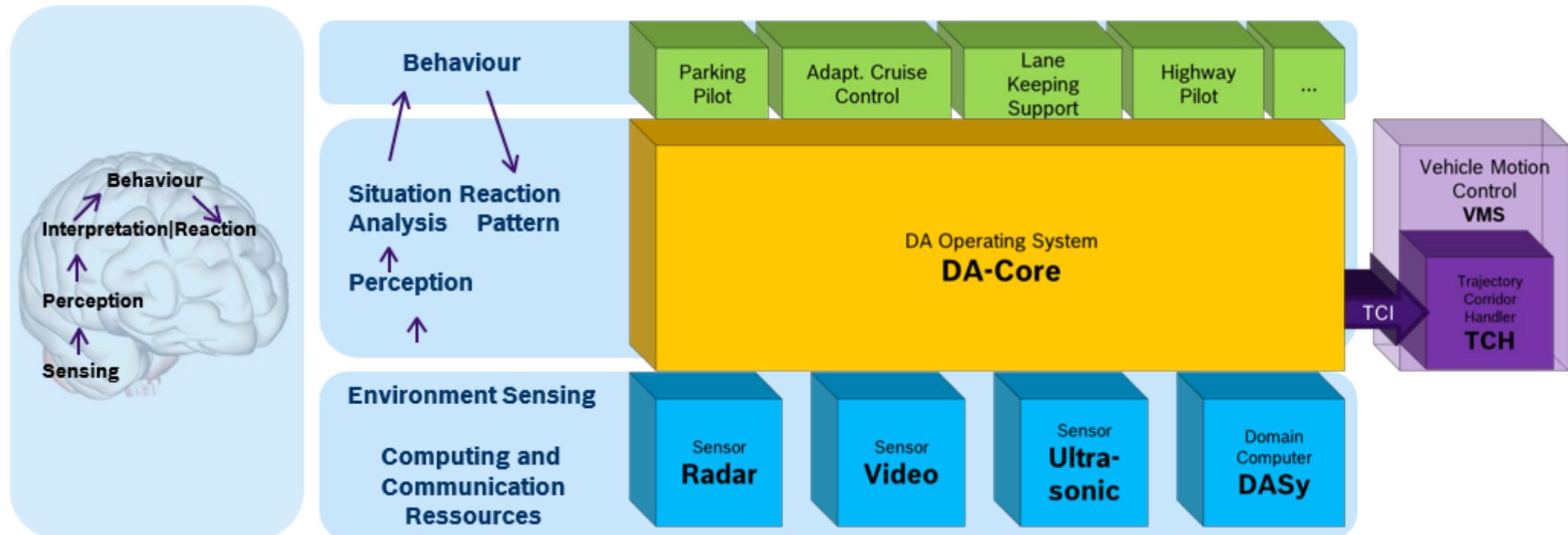
Electronics Control Unit

ADAS - Components and Features



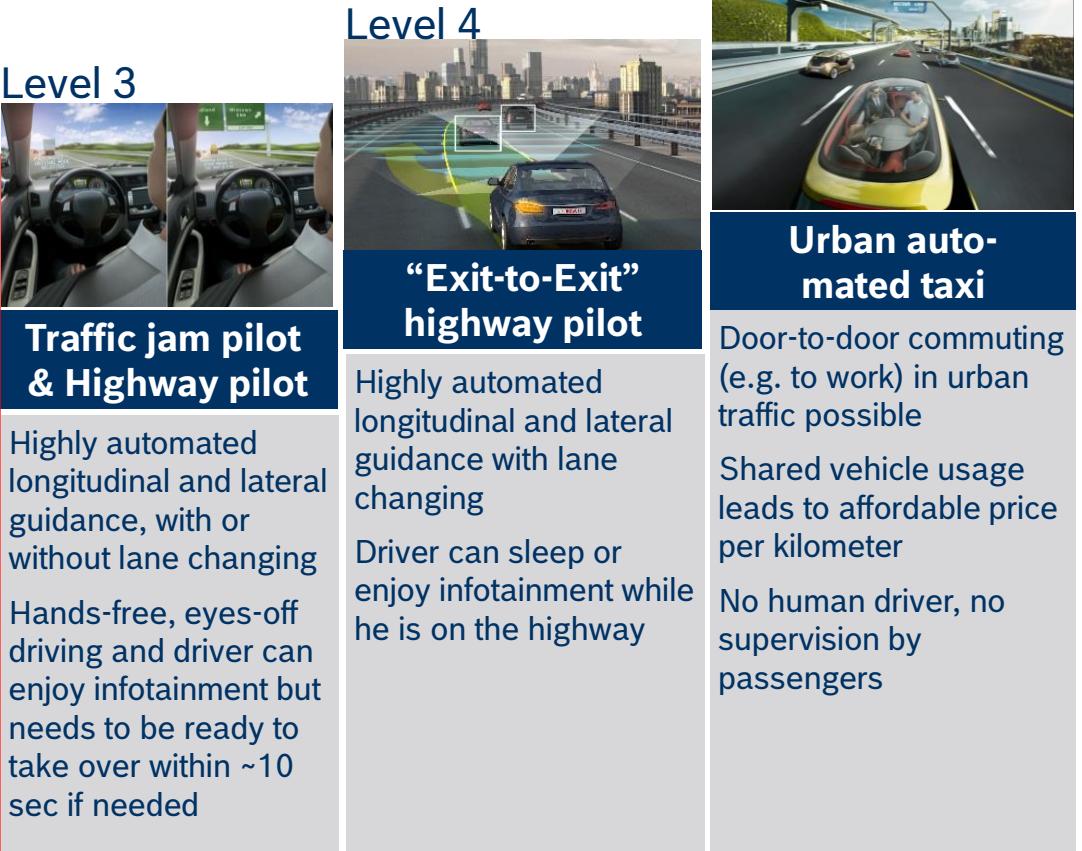
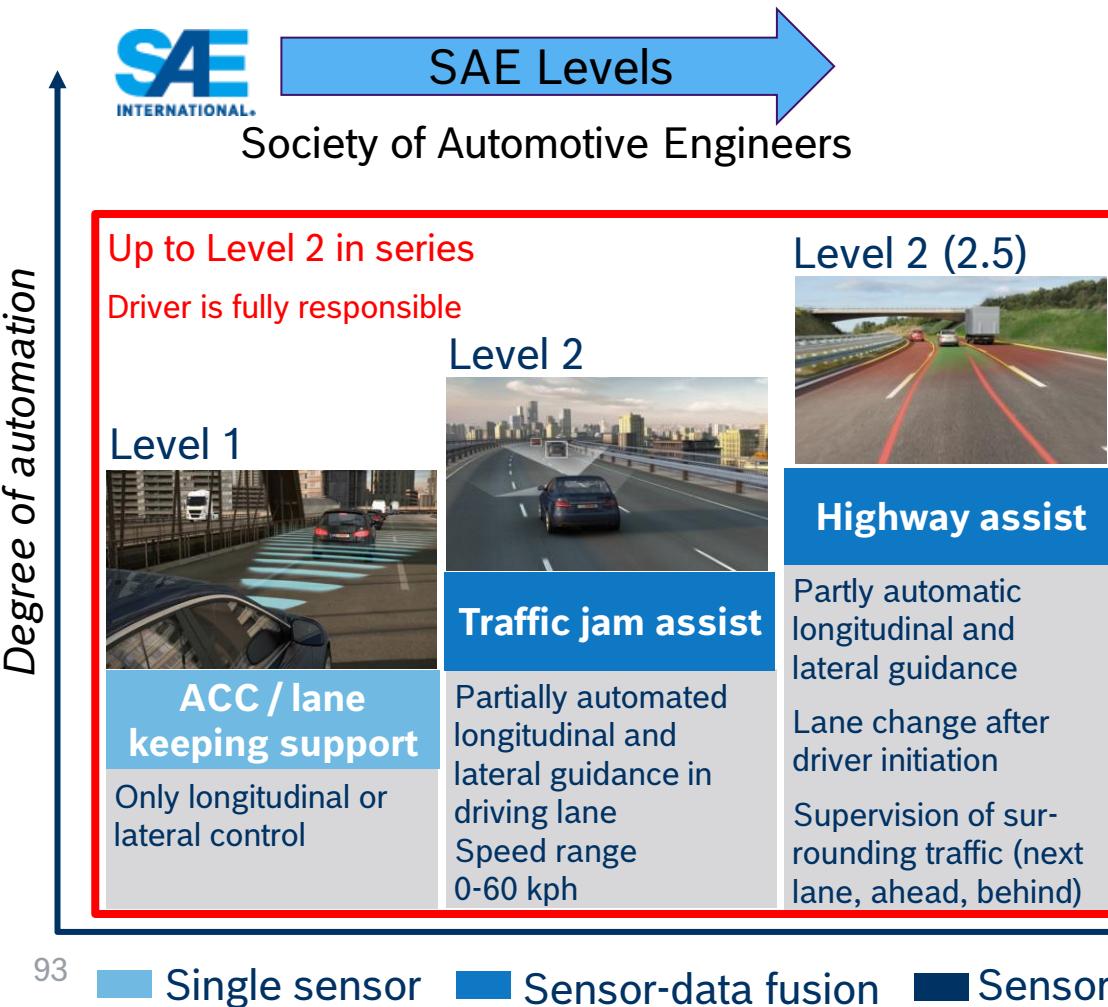
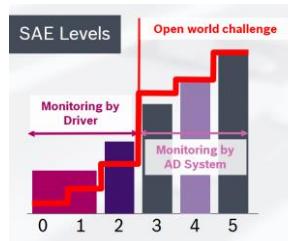
Driver Assistance Systems

Overview – DA Core



Electronics Control Unit

ADAS - Overview of SAE Levels



Electronics Control Unit

ADAS - Adaptive Cruise Control (ACC, ACC Stop & Go)

Features

- ▶ Measures distance (time gap) to preceding vehicle
- ▶ Automatic speed/distance control to preceding vehicle with safe and comfort distance; intelligent reaction on cutting-in/cutting-out vehicles
- ▶ Velocity range: approx. 30...>200 kph (MRR covers range up to approx. 180kph)
- ▶ Detailed configuration is discussed and customized on project level based on requested use case. Parameters include e.g. max. speed, corresponding deceleration as well as ISO Norms on deceleration
- ▶ ACC Stop & Go (approx. 0...>200 kph): Braking to standstill behind stopping target vehicle, automatic restart after road-free confirmation by driver (optional: automatic restart confirmed by optional sensor)

Customer benefits

- ▶ Relaxed and safe driving, reduced risk of rear-end collisions, higher comfort, incl. stop & go traffic
- ▶ Flexible sensor concept allows multi-sensor configurations
- ▶ Note: ACC (Stop & Go) also implementable with single LRR sensor

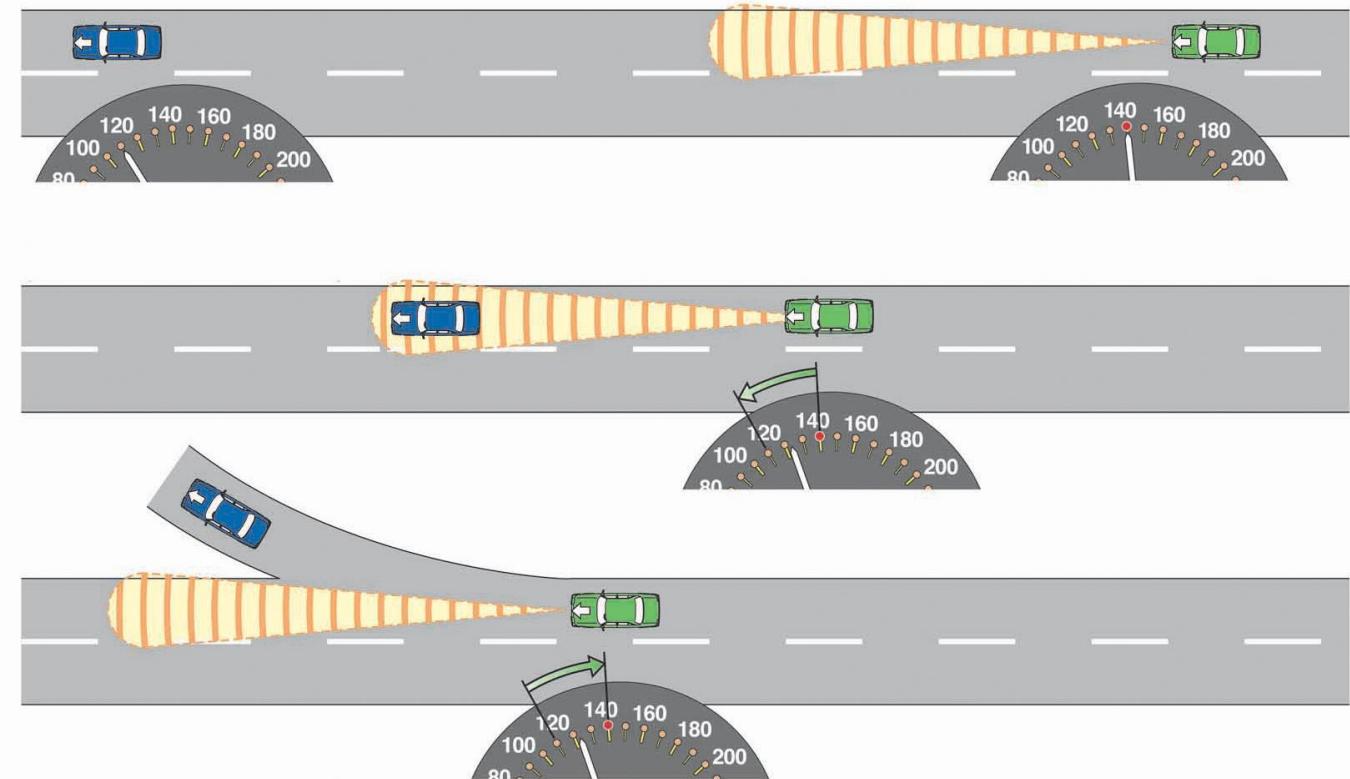
System requirements

- ▶ 1R (LRR or MRR); 1R1V
- ▶ ESP®



Adaptive Cruise Control Working Principle

- ▶ Adjust vehicle speed based on driver's setting
- ▶ Adapt vehicle speed to match the vehicle in front of according to distance set by driver
- ▶ Detect curve traffic, cut-in, cut-out situation using yaw-rate sensor

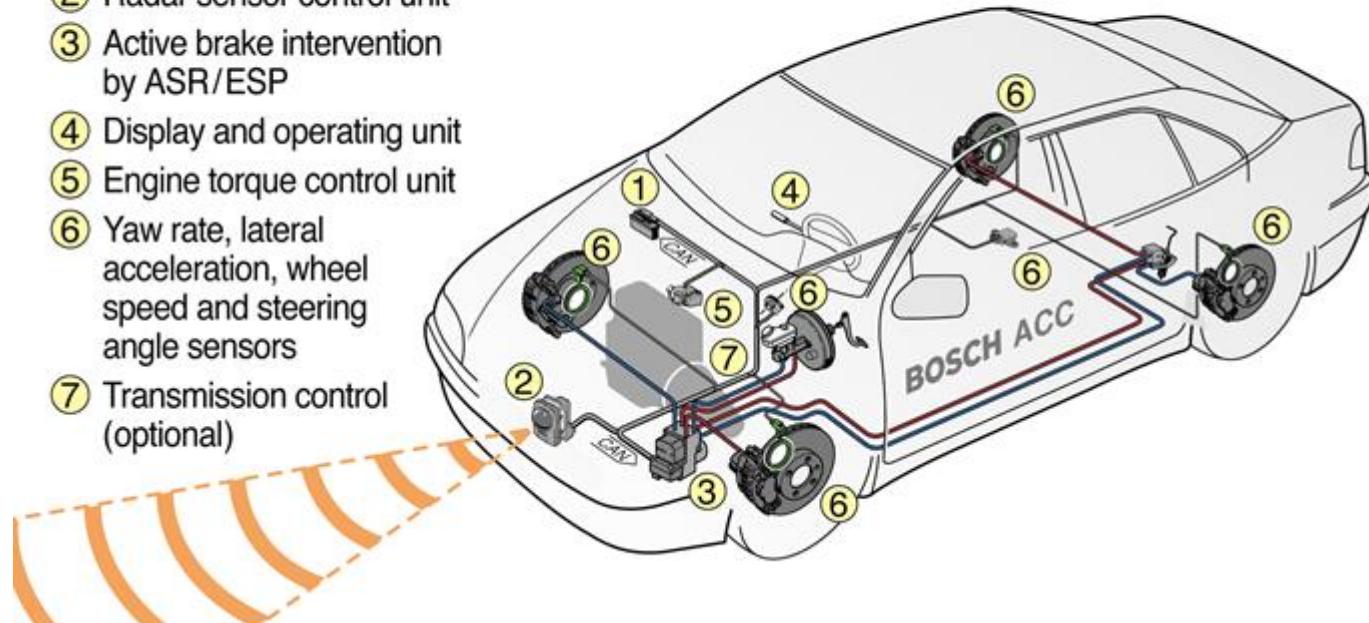


Electronics Control Unit

ACC – Interfaces and Partner Control Units

Components

- ① Engine management ECU
- ② Radar sensor control unit
- ③ Active brake intervention by ASR/ESP
- ④ Display and operating unit
- ⑤ Engine torque control unit
- ⑥ Yaw rate, lateral acceleration, wheel speed and steering angle sensors
- ⑦ Transmission control (optional)



Electronics Control Unit

ADAS - Lane Keeping Support (LKS)

Features

- ▶ Tracking of the vehicle position within driving lane
- ▶ Smooth returning to the lane center
- ▶ Situation-based intervention calculation
- ▶ Lateral vehicle motion via steering wheel or brake intervention
- ▶ Optional:
 - ▶ partly integration into ESP®
 - ▶ LKS plus with tighter lateral control
 - ▶ Adaptation of lateral control to oncoming traffic (long-range front sensing required)
 - ▶ Preview support by map

Customer benefits

- ▶ Support in case of unintentional lane departure
- ▶ Effective driver support in case of inattentiveness
- ▶ Correction of driving mistakes
- ▶ Assistance during monotonous and complex driving situations

System requirements

- ▶ MPC or SVC
- ▶ Electric Power Steering or ESP®
- ▶ Optional: MRR/LRR
- ▶ Optional: Digital map



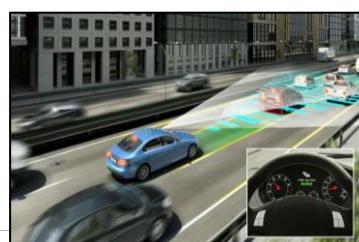
Electronics Control Unit

ADAS - Traffic Jam Assist

Features

- ▶ Partly automated driving in congested traffic on highways
- ▶ Speed range: 0 ... 60 km/h
- ▶ Longitudinal and lateral guidance
- ▶ Hands-off driving: speed-dependent time-limitation; driver still responsible to monitor the driving environment
- ▶ Driver takeover: lane change necessity, irregular obstacles in lane, lane not drivable (width, curvature, ...), vehicles approaching from side
- ▶ Can be included in Highway

Assist Functionality (recommendation)



Customer benefits

- ▶ Safe and relaxed driving in traffic jams
- ▶ Prevention of rear-end collisions

System requirements

- ▶ MRR + MPC or SVC;
MPC only to be confirmed after exchange
of OEM performance requirements, e.g.
vehicle to vehicle distances (min, max) or
precision of speed to follow
- ▶ Optional: 12 USS (signal quality must be in
line with Bosch requirements specification if
competitor USS is used)
- ▶ Electric Power Steering
- ▶ ESP®

Adaptive Cruise Control Traffic Jam Assist

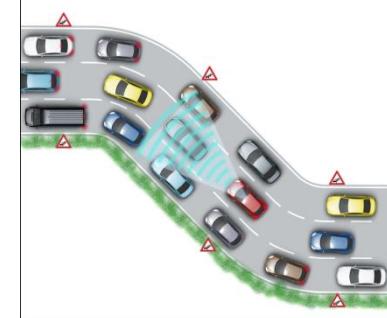
Features

- Automated lateral and longitudinal guidance:
 - maximum velocity ~60 km/h
 - Follows lanes, estimated from vehicles in neighbouring lanes and lane markings
 - Comfortably avoid stationary obstacles within own lane
 - Short term hands off allowed



Customer benefits

- Improve comfort in monotone traffic jam situations
- Driver does not need to concentrate on routine control tasks



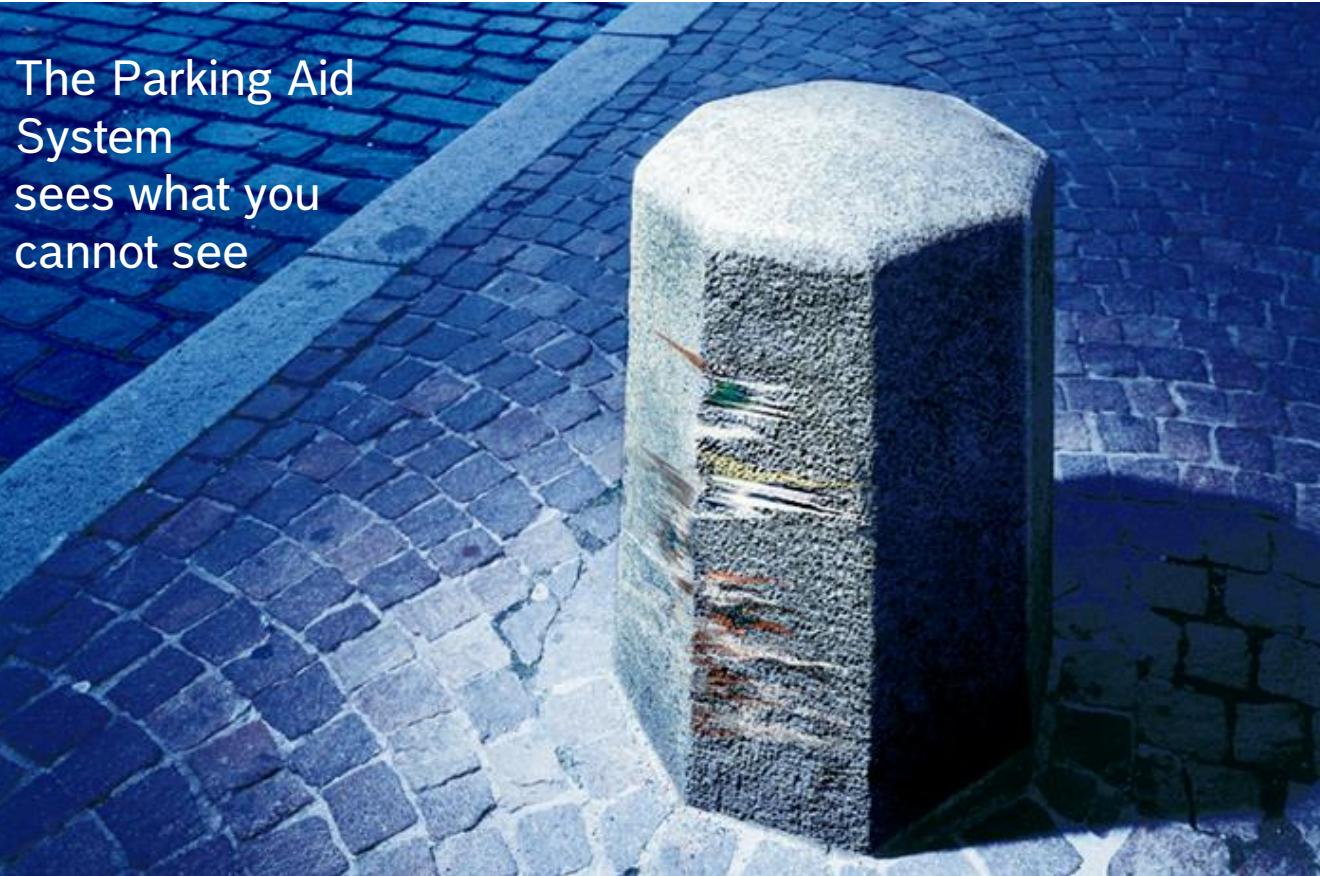
System requirements

- Sensor: MRR + MPC
- Brake system:
ESP® or comparable



Electronics Control Unit

USS – Parking Aid System



Bosch GEN6 Ultrasonic Platform Use Case overview

Function families

PDC based

PAS
SDW
MEB
MCB
MAA

PSC based

PSC
cPSC
pPSC
dPSC
PEB
PCB
POC
APA
...

Remote

RPA
Garage P.
Free Drive

SVA based

SVA
SDI

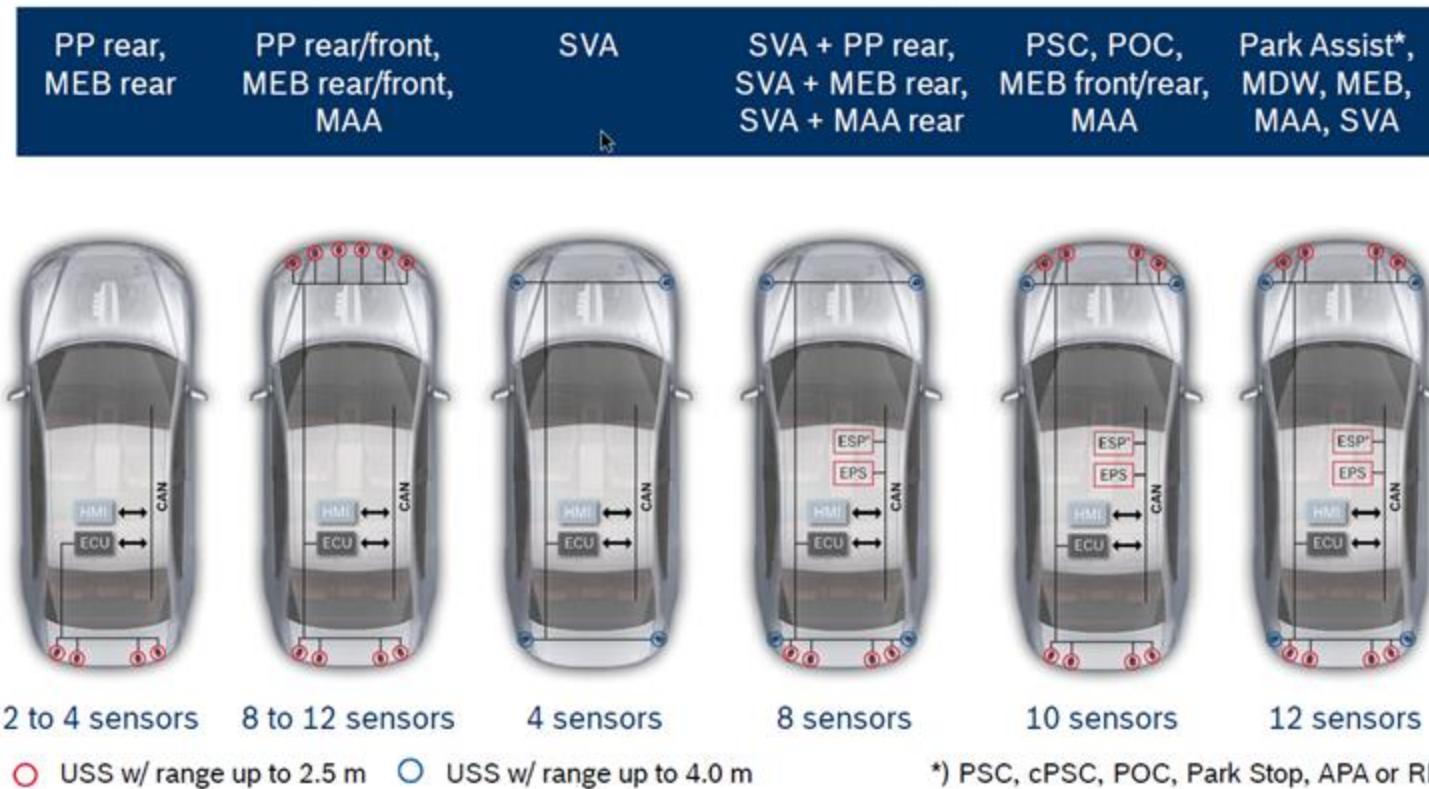
List of abbreviation:

PAS:	Parking Assistance System
SDW:	Side Distance Warning
MEB:	Manoeuvre Emergency Brake
MCB:	Manoeuvre Comfort Brake
MAA:	Manoeuvre Acceleration Avoidance
SVA:	Side View Assist
SDI:	Side Distance Information
PSC:	Park Steering Control
cPSC:	Cross Park Steering Control
pPSC:	Parallel Park Steering Control
dPSC:	Diagonal Park Steering Control
PEB:	Park Emergency Brake
PCB:	Park Comfort Brake
POC:	Pull Out Control
APA:	Autonomous Park Assist
RPA:	Remote Park Assist

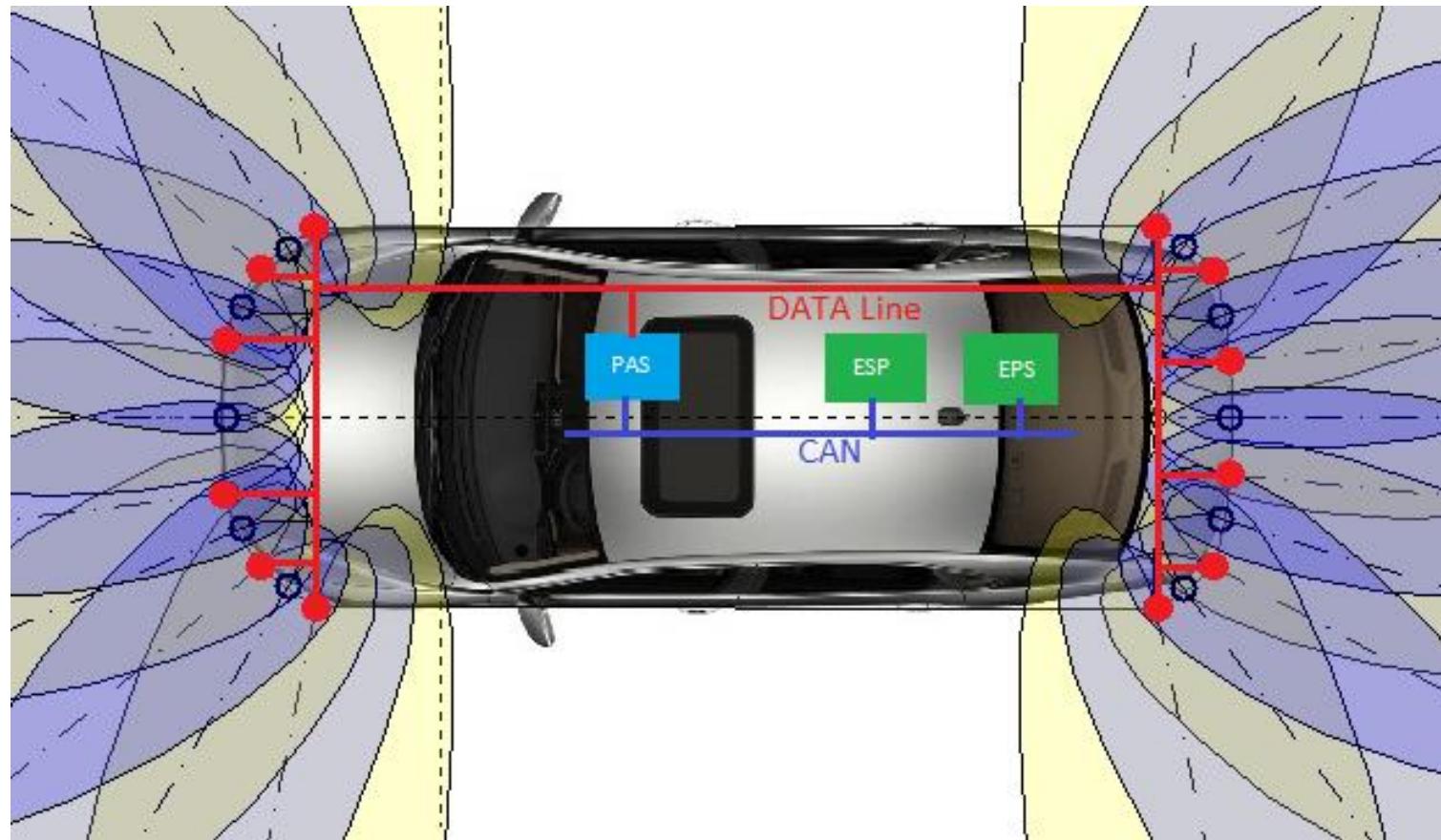
Electronics Control Unit

USS – Parking Aid System

Scalability of Ultrasonic-based Systems



Electronics Control Unit USS – Parking Aid System



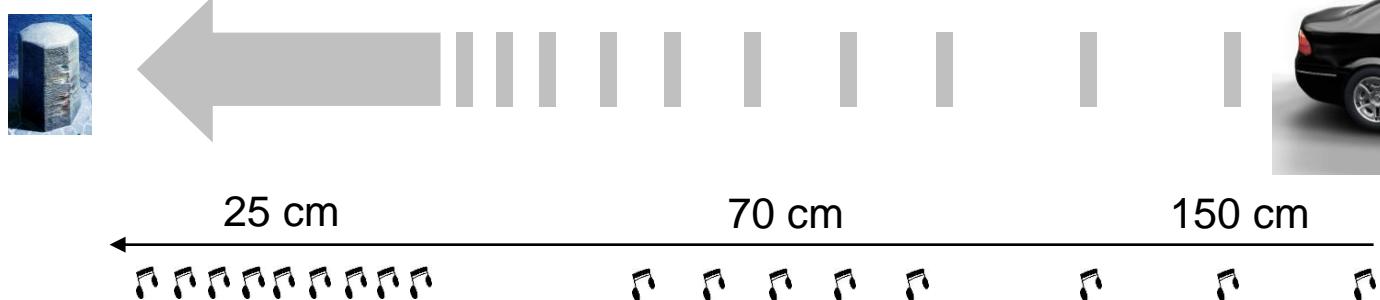
Electronics Control Unit USS – Parking Aid System

Picture from internet ☺



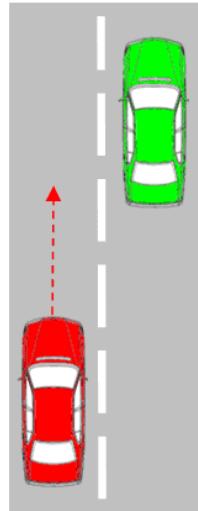
PAS – SDW indicator use cases:

- The distance is signalled optically and/or acoustically
- The signal changes as the distance is reduced
- A permanent tone sounds at less than 25 cm and all the LEDs light up in the optical display

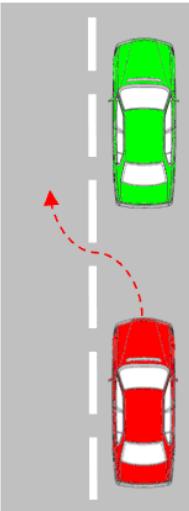


SVA Use Cases – Warnings to be Issued

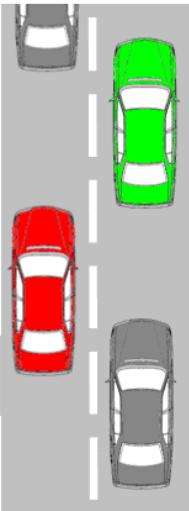
Target Vehicle: Red Car



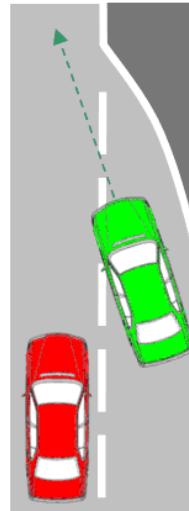
Bypassing



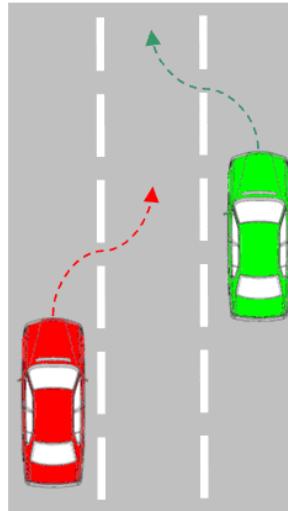
Overtaking



Stagnation
in Blind Spot



Ending Lane /
Driveway



Converging into
Same Lane

EGO Vehicle: Green Car



Electronics Control Unit

Automatic/ Remote Park Assist – USS only (APA / RPA)

Features

- ▶ Automatic parking into or out of parking slot including longitudinal control, lateral control and gear switch
- ▶ Driver activates, monitors and deactivates the parking from inside the car using a “dead man”-switch or outside the car using a mobile device

Supported use cases

- ▶ Parallel and perpendicular parking (front-in and back-in)
- ▶ Garage parking, Pull-out control

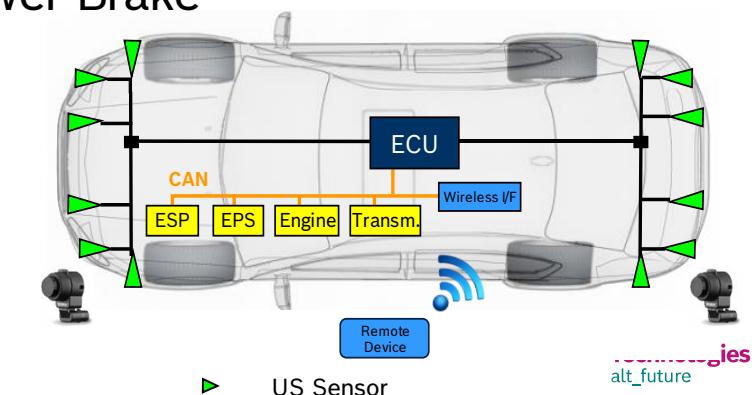


Customer benefits

- ▶ High convenience due to high automatization
- ▶ Use of tight parking spaces
- ▶ Efficient parking process
- ▶ Avoid vehicle damage
- ▶ Significant stress relief

System requirements

- ▶ Electric Power Steering
- ▶ Electrical Power Brake
- ▶ 12 USS
- ▶ ESP®



Thank you!

Bosch
Global
Software
Technologies
alt_future