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GlobalLogic®

Automotive Diagnostics

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Consultant

Public

The most important question.

Public

How to make an ISO norm sound interesting?

Public

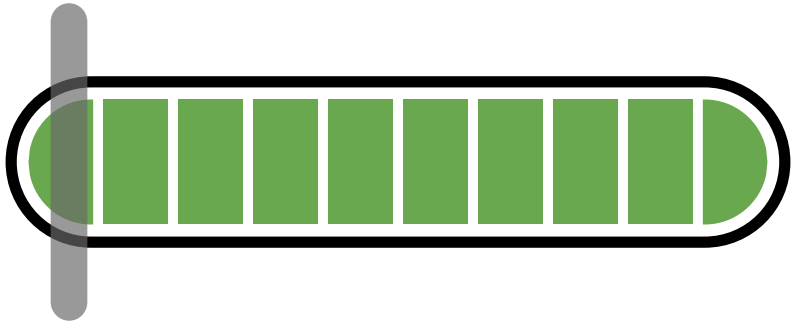
Hahahaha

Source: https://loveforquotes.com/i/google-facebook-mechanic-108410

Source: GlobalLogic Krakow ❤️

Geek-o-meter

Funny Story



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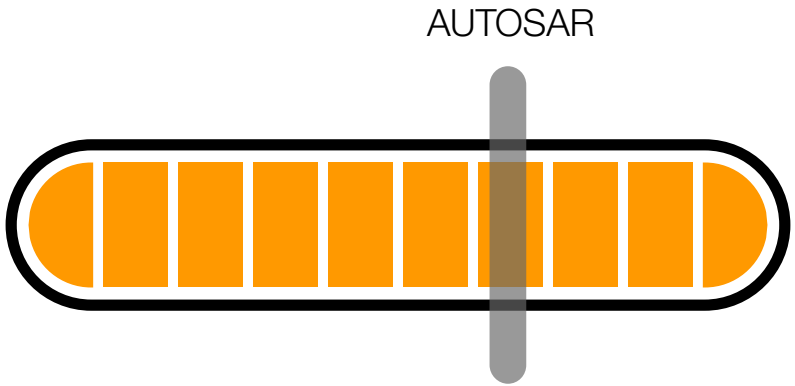
Source: https://www.presentationgo.com/presentation/progress-bar-for-powerpoint-and-google-slides/

Geek-o-meter



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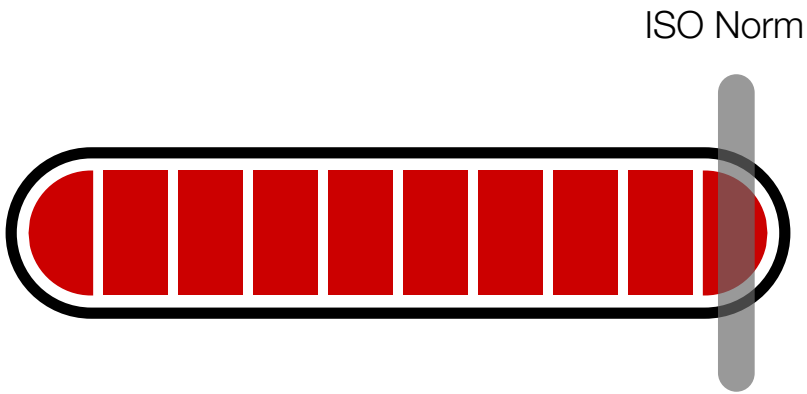
Source: https://www.presentationgo.com/presentation/progress-bar-for-powerpoint-and-google-slides/

Geek-o-meter



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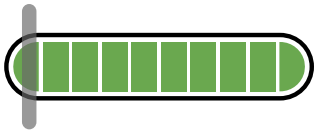
Source: https://www.presentationgo.com/presentation/progress-bar-for-powerpoint-and-google-slides/

Cars’ software is complicated.



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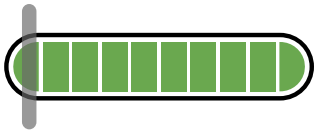
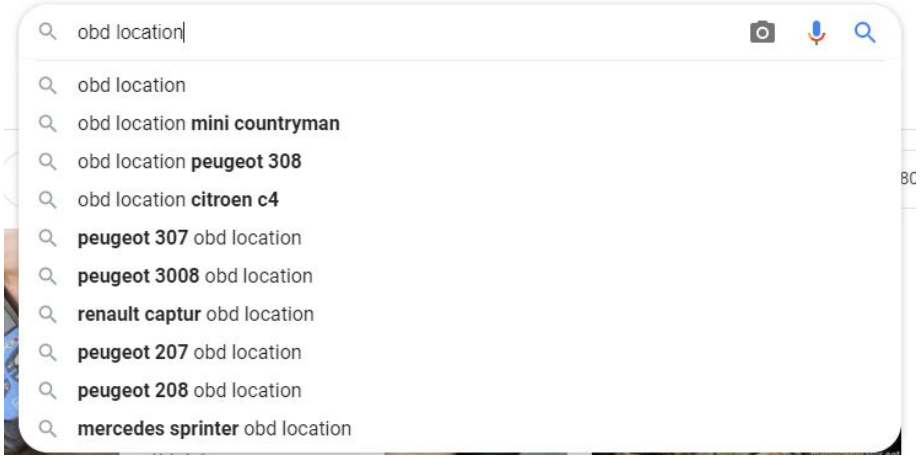
So, what “automotive diagnostics” actually means?



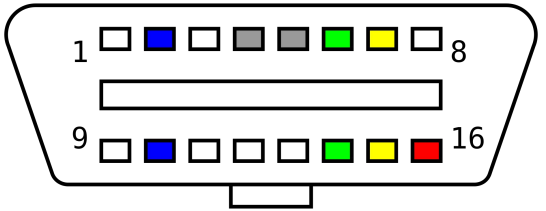
OBD-II

Has to be within 60cm from the steering wheel.
All currently produced cars have it.



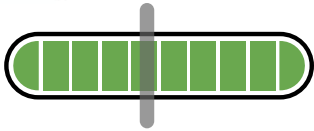
Sources: https://www.geotab.com/blog/obd-ii/, https://www.amazon.in/Vital-Deluxe-Stethoscope-Doctors-Students/dp/B07PPMD2Q7

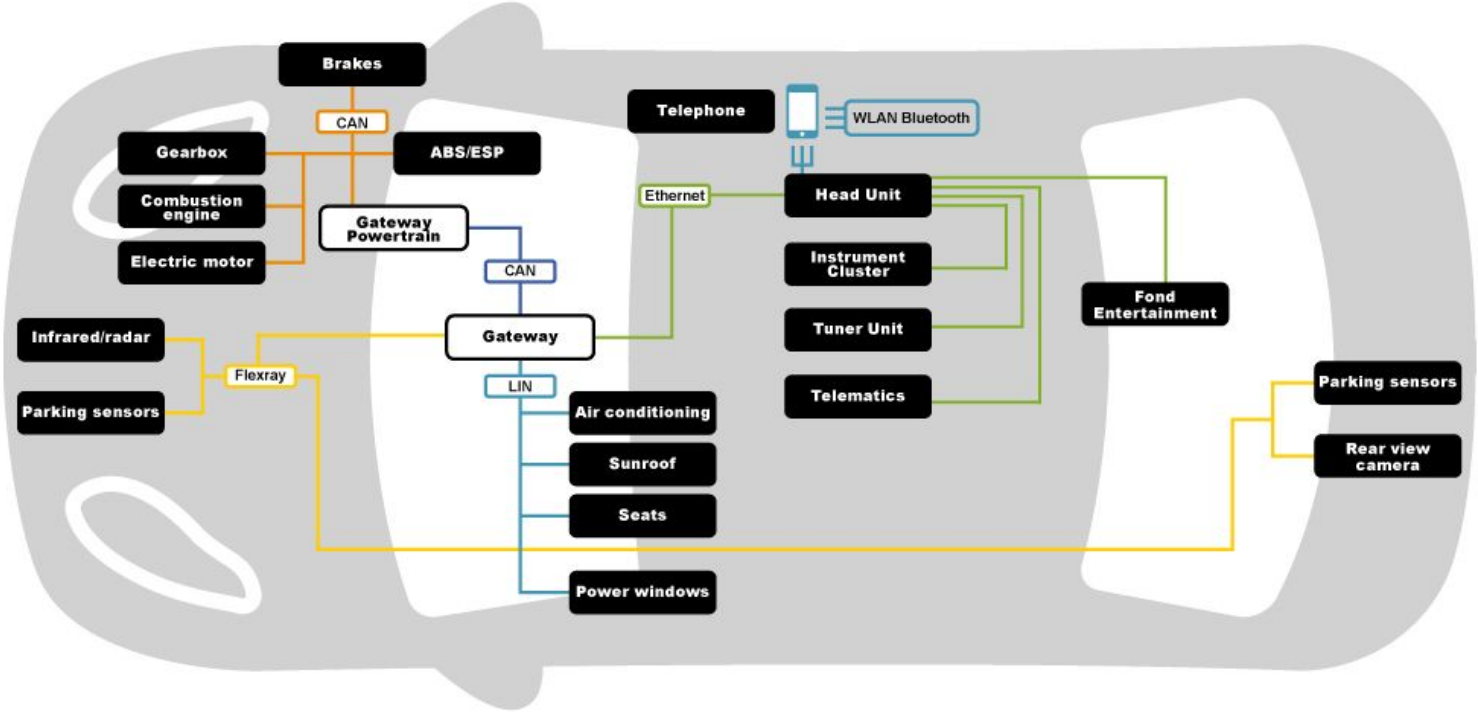
OBD-II



1	Manufacturer discretion. GM: J2411 GMLAN/SWC/Single-Wire CAN. VW/Audi: Switched +12 to tell a scan tool whether the ignition is on.	9	Manufacturer discretion. GM: 8192 baud ALDL where fitted. BMW: RPM signal.
2	Bus positive Line of SAE J1850 PWM and VPW	10	Bus negative Line of SAE J1850 PWM only (not SAE 1850 VPW)
3	Manufacturer discretion. Ford DCL(+) Argentina, Brazil (pre OBD-II) 1997–2000, USA, Europe, etc. Chrysler CCD Bus(+) Ethernet TX+ (Diagnostics over IP)	11	Manufacturer discretion. Ford DCL(-) Argentina, Brazil (pre OBD-II) 1997–2000, USA, Europe, etc. Chrysler CCD Bus(-) Ethernet TX- (Diagnostics over IP)
4	Chassis ground	12	Not connected Manufacturer discretion: Ethernet RX+ (Diagnostics over IP)
5	Signal ground	13	Manufacturer discretion. Ford: FEPS - Programming PCM voltage Ethernet RX- (Diagnostics over IP)
6	CAN high (ISO 15765-4 and SAE J2284)	14	CAN low (ISO 15765-4 and SAE J2284)
7	K-line of ISO 9141-2 and ISO 14230-4	15	L-line of ISO 9141-2 and ISO 14230-4
8	Manufacturer discretion. Many BMWs: A second K-line for non OBD-II (Body/Chassis/Infotainment) systems. Activate Ethernet (Diagnostics over IP)	16	Battery voltage

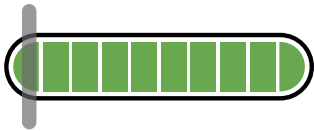
By Xoneca - Own work, CC0, https://commons.wikimedia.org/w/index.php?curid=30884736





Source: https://www.telemotive.de/en/engineering/expertise/bus-systems/

Ultimate Question of Life, Automotive and Everything.



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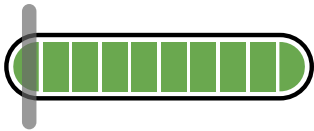
4.4.0.

...

obviously



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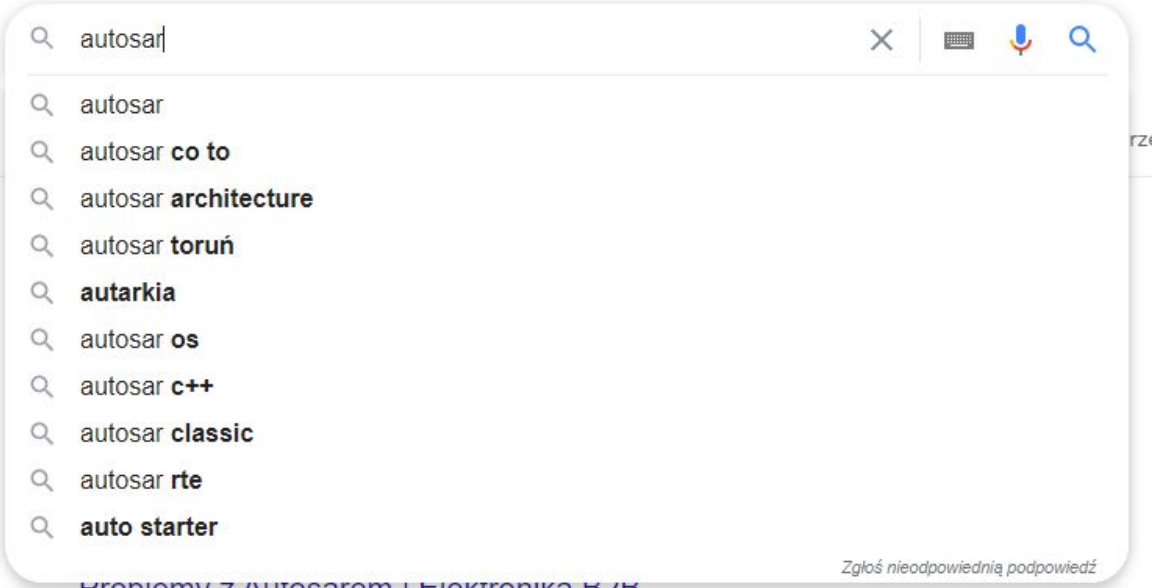
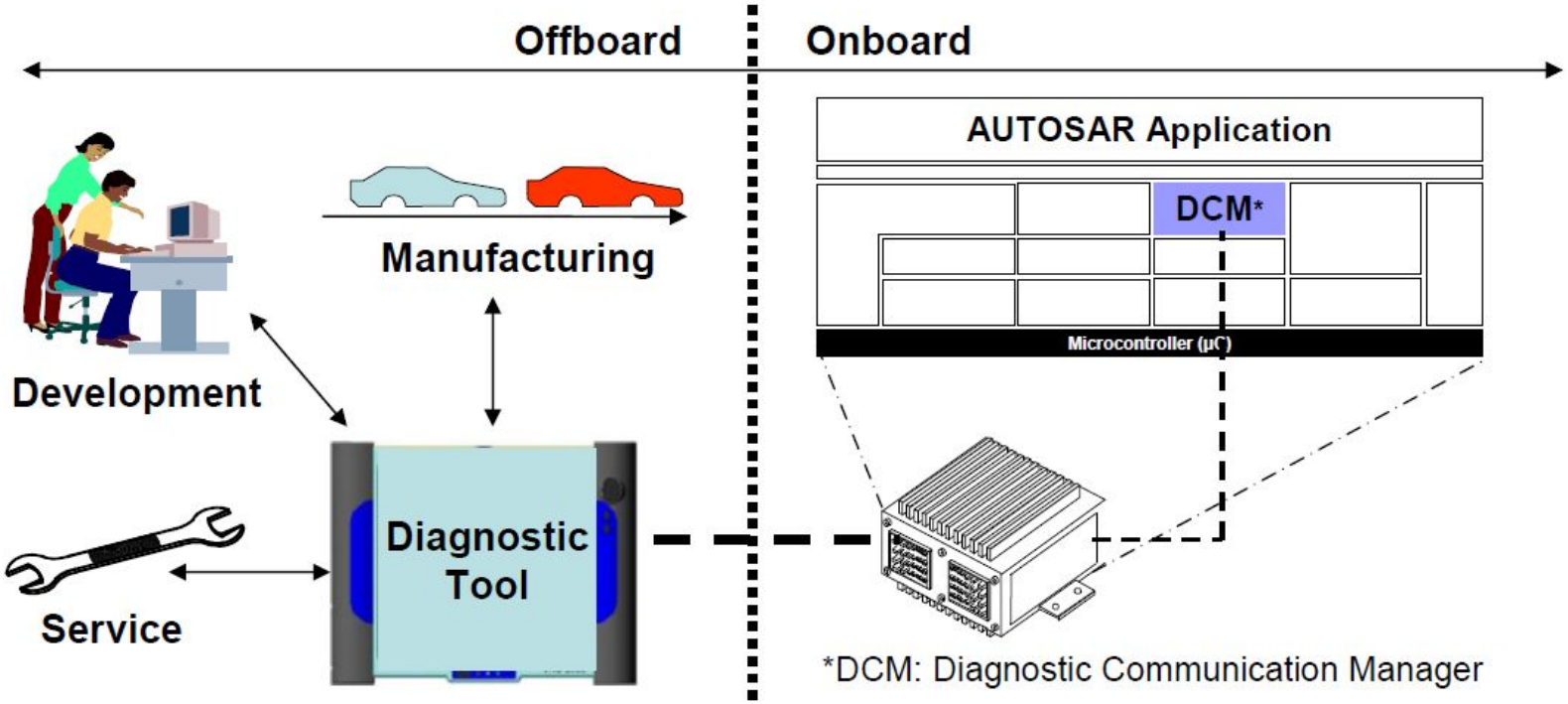
AUTOSAR Diagnostics

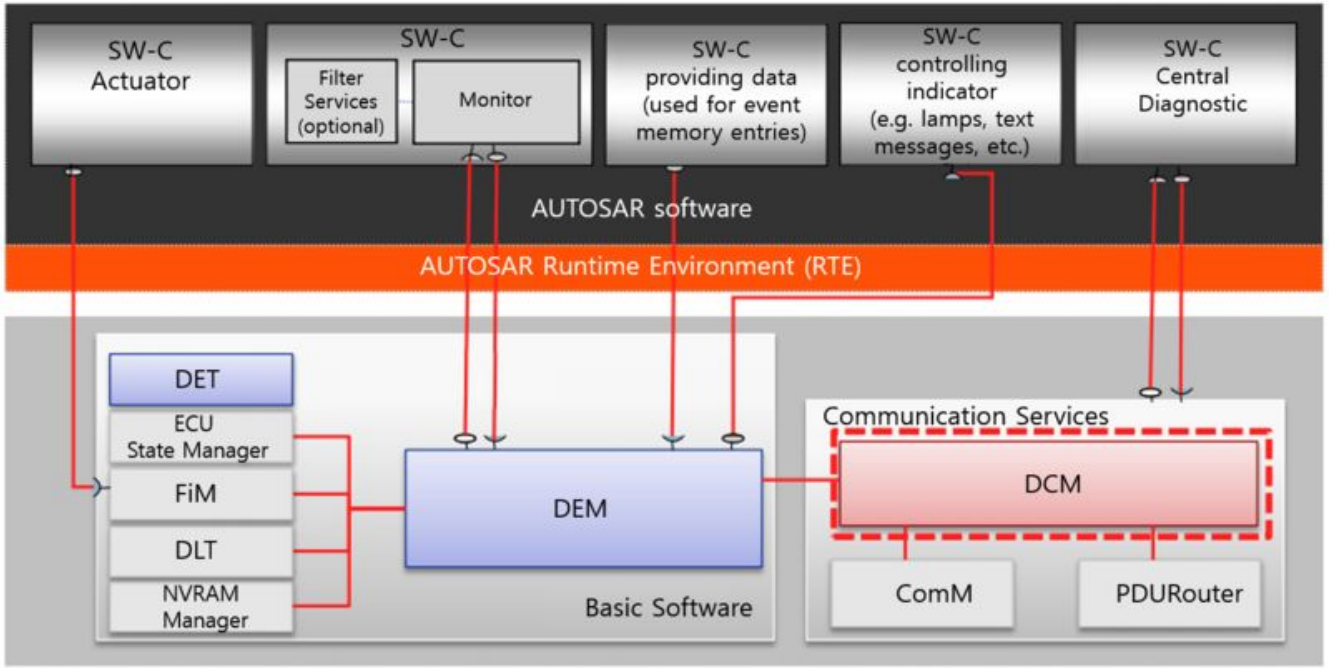


AUTOSAR Diagnostics - DCM



Source: https://www.vtronics.in/2019/11/autosar-for-dummies-vehicle-diagnostics.html

AUTOSAR Diagnostics - DCM



Source: https://www.vtronics.in/2019/11/autosar-for-dummies-vehicle-diagnostics.html

Diagnostics in AUTOSAR - Process

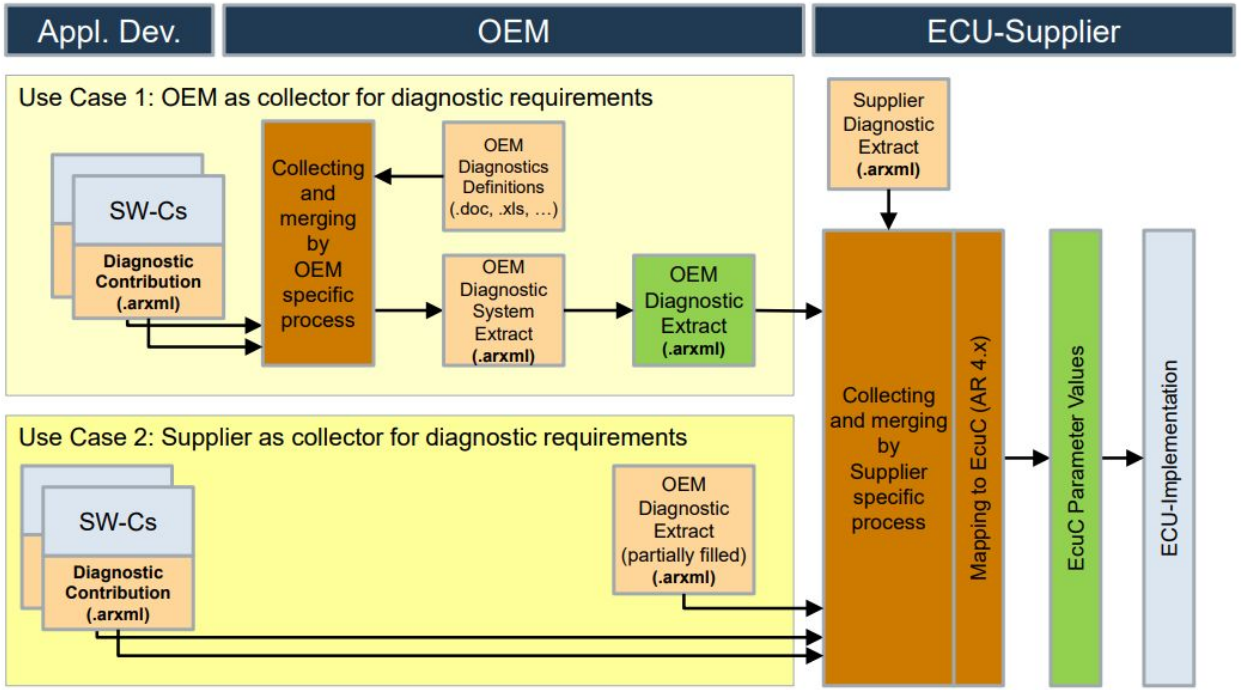
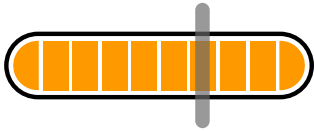
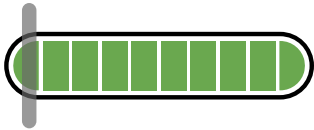


Figure 1.1: Scope of this document in the ECU Development work-flow

Source: https://www.autosar.org/fileadmin/user_upload/standards/classic/4-3/AUTOSAR_SWS_DiagnosticCommunicationManager.pdf



Diagnostics I
Telling your car, what it is.



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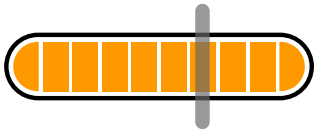
RIDs/DIDs - Routine and Data Identifiers

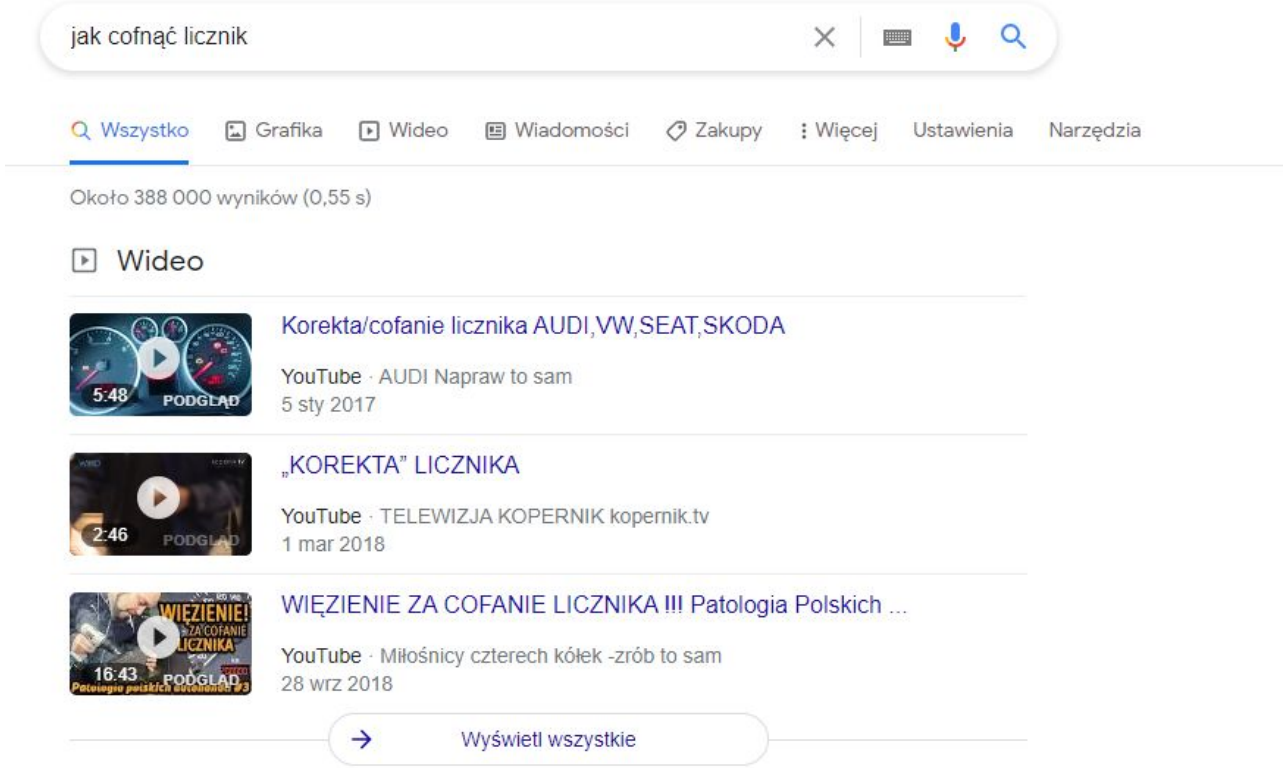
Table 1903-03: Examples of Data Identifier (DID) - Examples

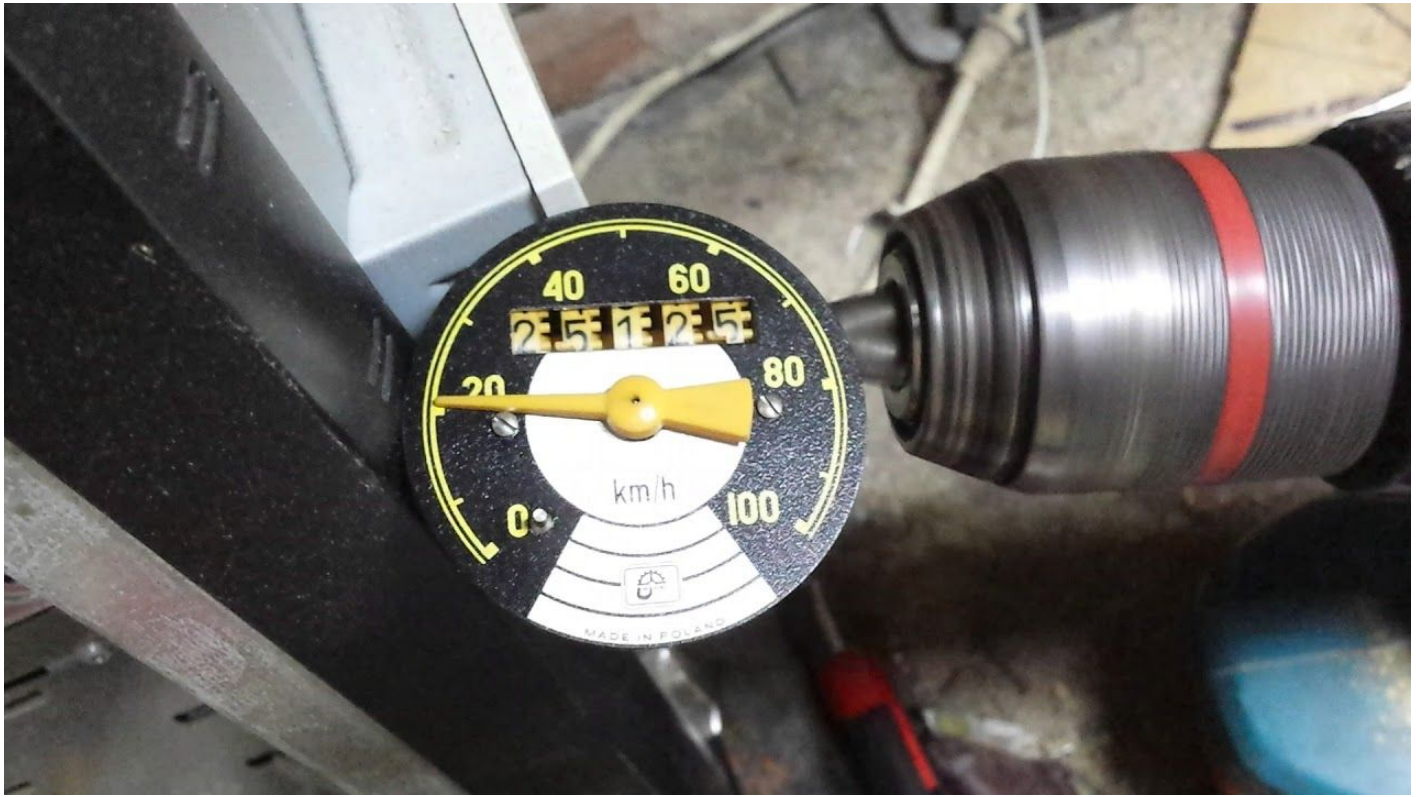
DID	Description
0xF180	Boot software identification
0xF18C	ECU serial number
0xF190	Vehicle Identification Number (VIN)

Source: https://www.dgtech.com/wp-content/uploads/2019/08/WP1903_UDS_V01.pdf



RIDs/DIDs - Routine and Data Identifiers





Source: https://youtu.be/CLGYIrPWEsM

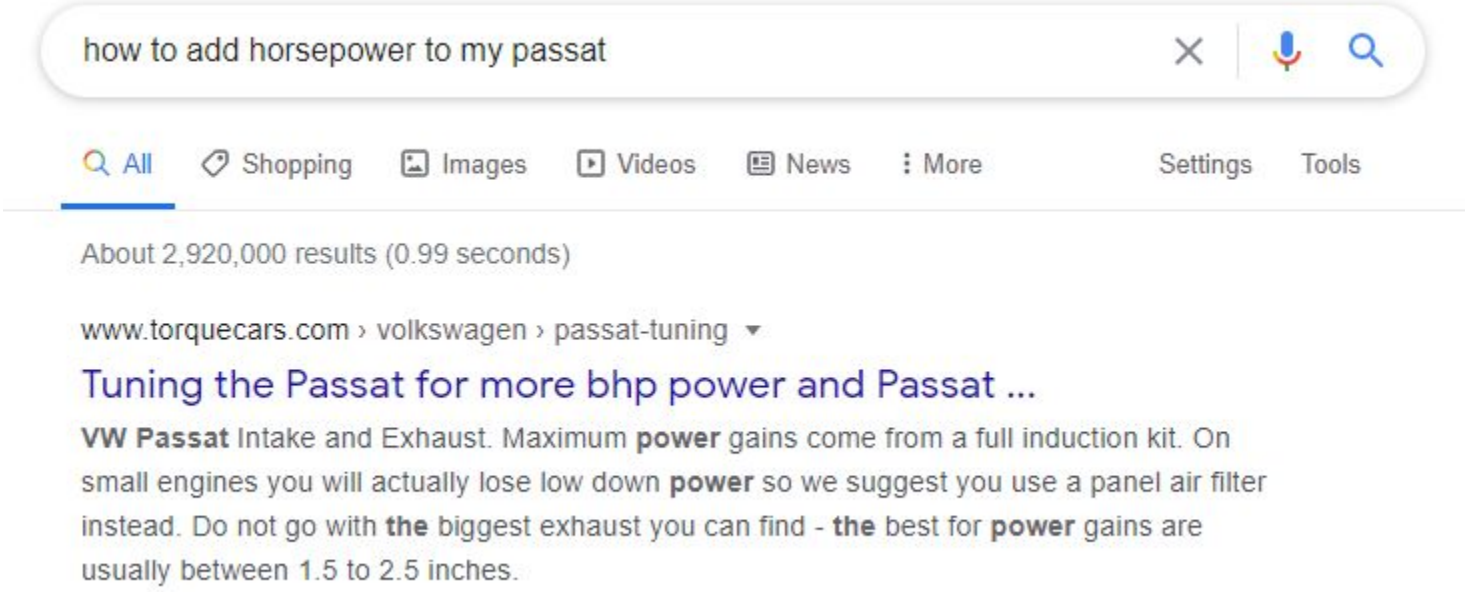
source: https://autofakty.pl/autoencyklopedia/tester-diagnostyczny/

10k$

source: https://pl.aliexpress.com/item/32371696141.html

3$

UDS - practical approach



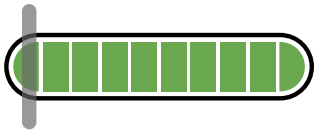
UDS - Unified diagnostic services

Service	Service Id
Diagnostic Session Control	0x10
ECU Reset	0x11
Security Access	0x27
Clear Diagnostic Information	0x14
Read DTC Information	0x19
Write/Read Data By Identifier	0x2E / 0x22
Routine Control	0x31
Request Download	0x34
Transfer Data	0x36

ISO 14229-1 Road vehicles — Unified diagnostic services (UDS)

https://www.iso.org/standard/72439.html

Diagnostics II
Errors



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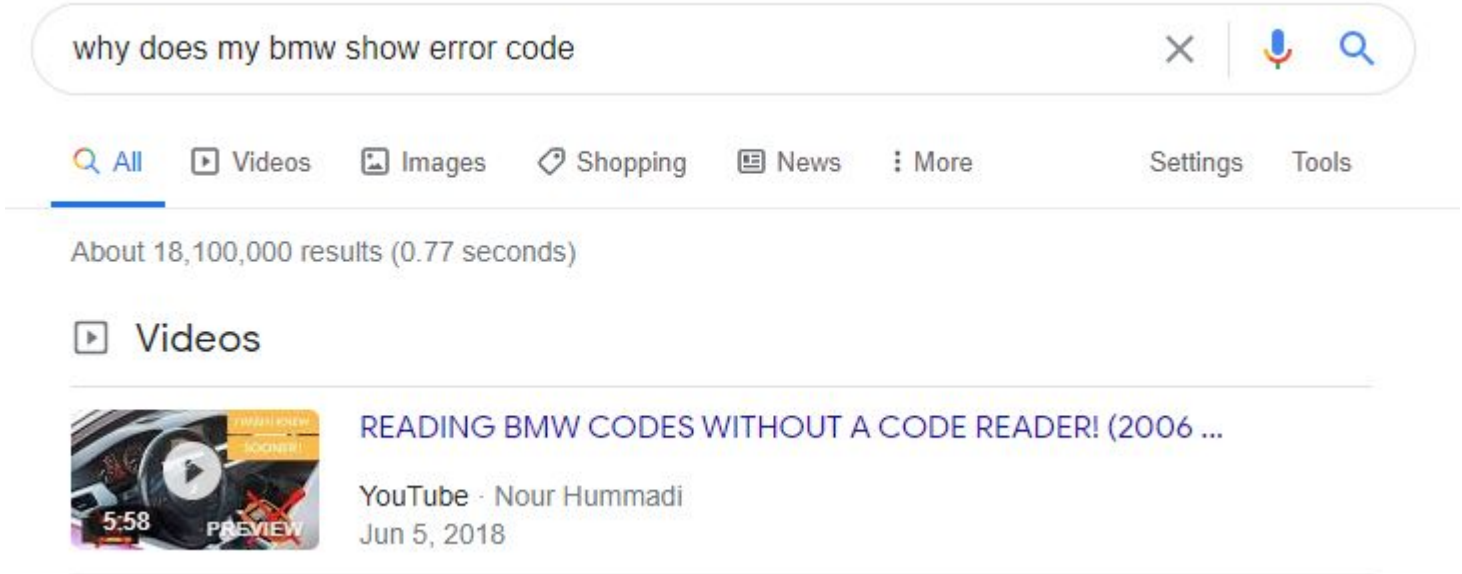
source: https://www.topleft.shop/products/this-little-light-of-mine-check-engine-light-cel-meme-vinyl-decal-sticker

DTC - practical approach

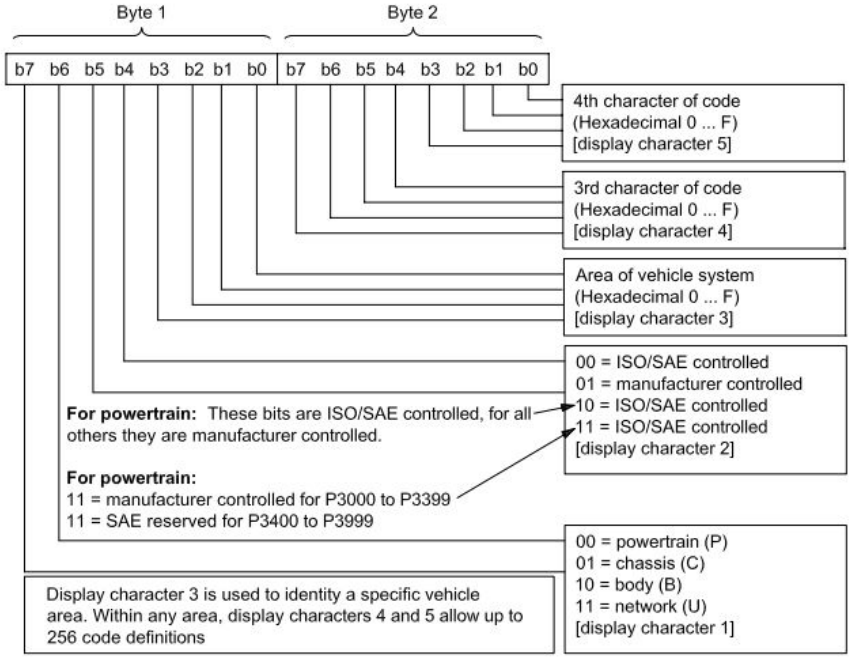


DTCs - Diagnostic Trouble Codes - ID

ISO 15031-6 Road vehicles — Communication between vehicle and external equipment for emissions-related diagnostics

Part 6: Diagnostic trouble code definitions

https://www.sis.se/api/document/preview/906710/



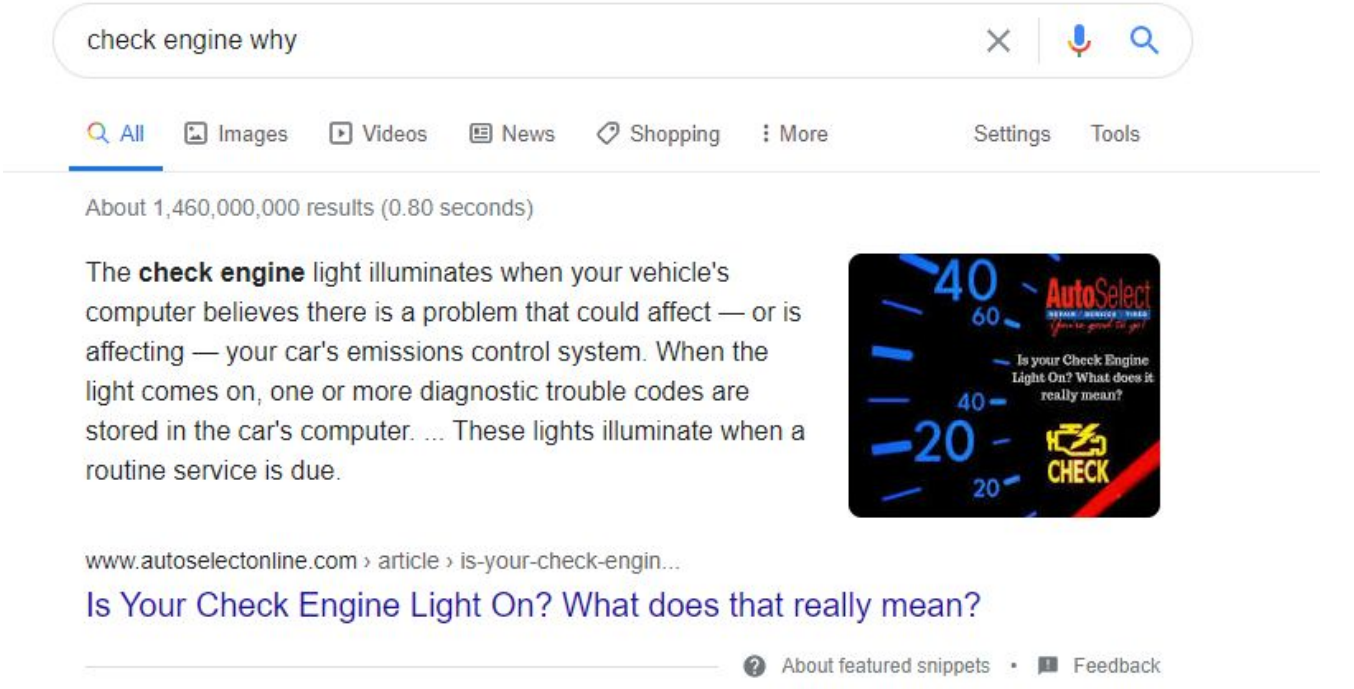
DTCs - Diagnostic Trouble Codes - Status

DTC Status Byte

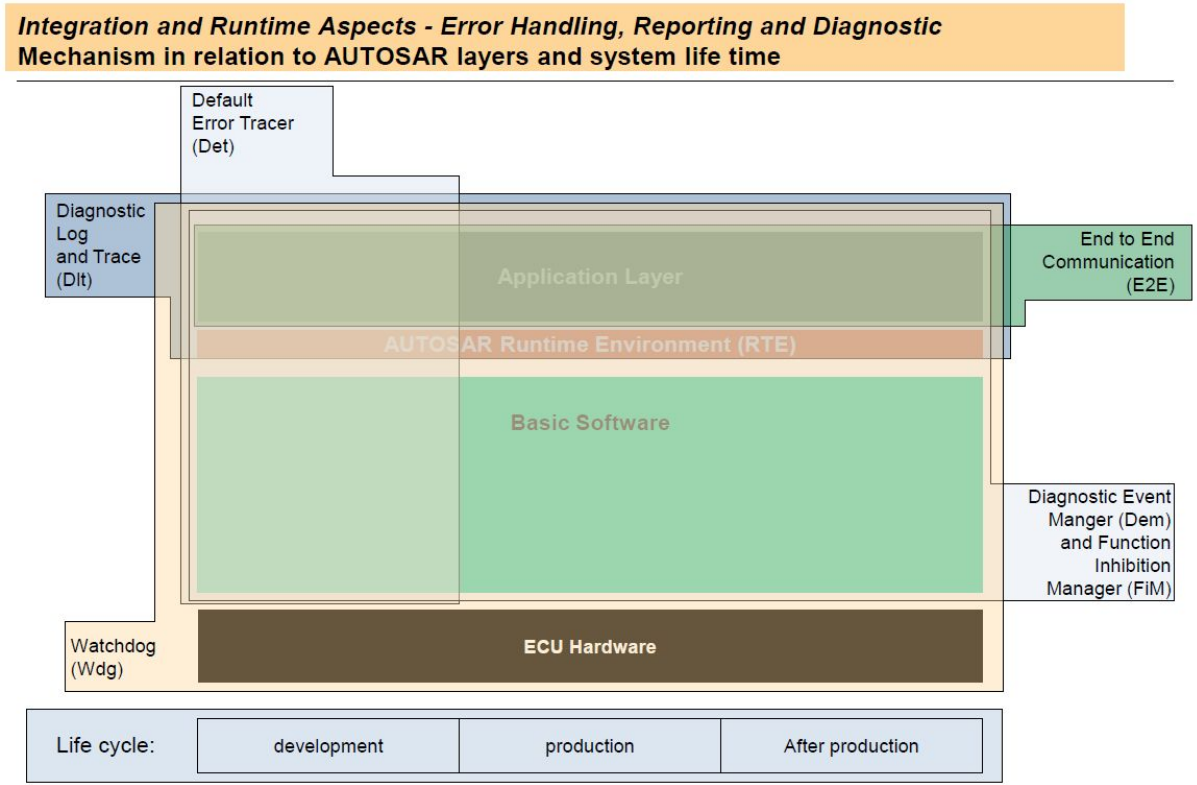
bit #	hex	state	description
0	0x01	testFailed	DTC failed at the time of the request
1	0x02	testFailedThisOperationCycle	DTC failed on the current operation cycle
2	0x04	pendingDTC	DTC failed on the current or previous operation cycle
3	0x08	confirmedDTC	DTC is confirmed at the time of the request
4	0x10	testNotCompletedSinceLastClear	DTC test not completed since the last code clear
5	0x20	testFailedSinceLastClear	DTC test failed at least once since last code clear
6	0x40	testNotCompletedThisOperationCycle	DTC test not completed this operation cycle
7	0x80	warningIndicatorRequested	Server is requesting warningIndicator to be active

source: https://automotive.wiki/index.php/ISO_14229#DTC_Status_Byte

DTCs - Snapshots (Freeze frames) & Extended Data

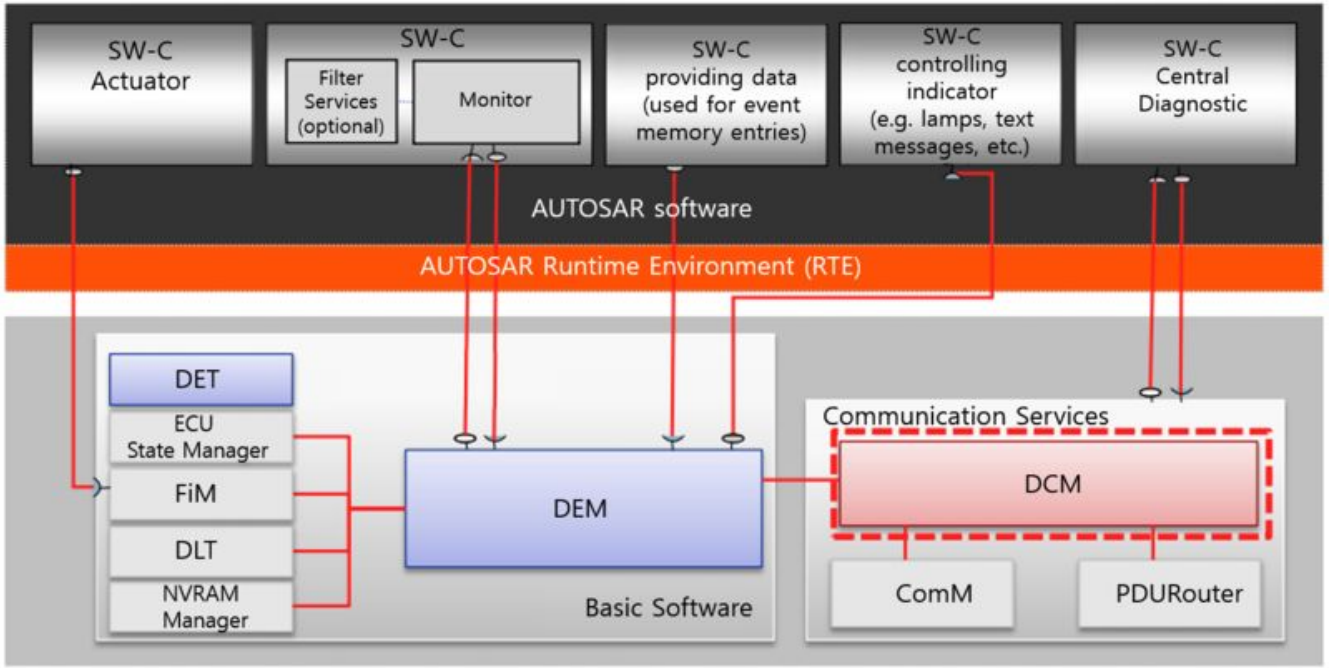


AUTOSAR Diagnostics - Errors



Source: AUTOSAR General Specification

AUTOSAR Diagnostics - DEM



Source: https://www.vtronics.in/2019/11/autosar-for-dummies-vehicle-diagnostics.html

Diagnostics in AUTOSAR - FiM

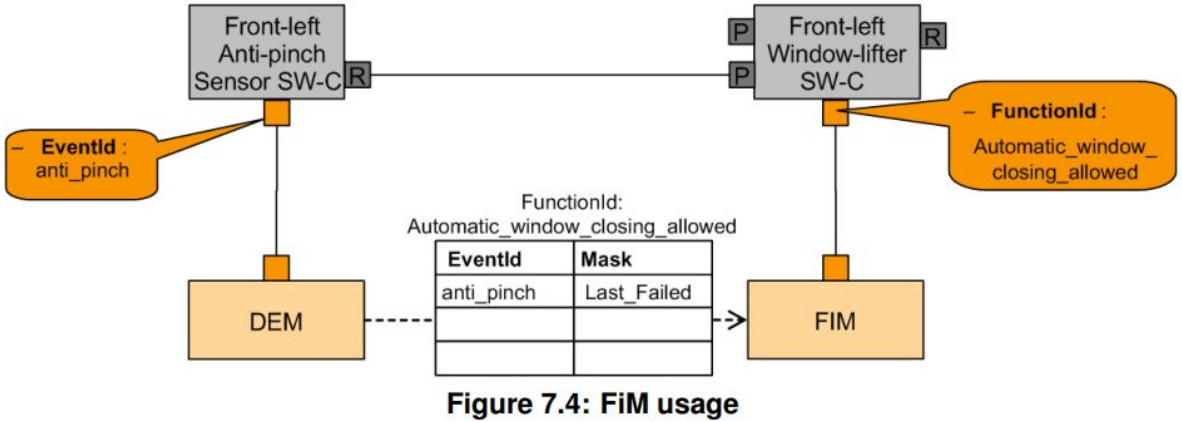


Figure 7.4: FiM usage

Source: AUTOSAR FiM Specification

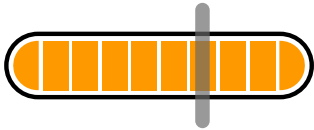
Source: https://therevjs.files.wordpress.com/2013/05/crutches.jpg

Diagnostics in AUTOSAR - DET

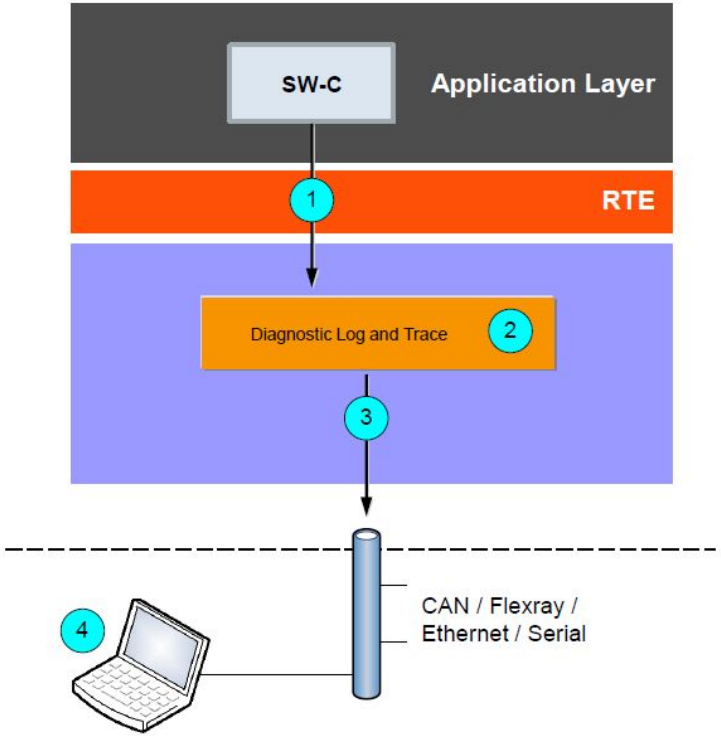
Due to the always specific (non generic!) requirements regarding functionality in error cases there is no explicit specification of the DET implementation, except:

- Configurable lists of error hooks will be executed in case of an error report.
- Interfaces will be provided to report errors, allow optional error recovery after reset, to handle optional error recovery information and to retrieve version information.

Source: AUTOSAR DET Specification



Diagnostics in AUTOSAR - DLT



Source: AUTOSAR DLT Specification

Dr. Robert Ford, Bernard Lowe, Westworld, Westworld The Original, Westworld 1x01, Westworld S01E01, Season 1, HBO
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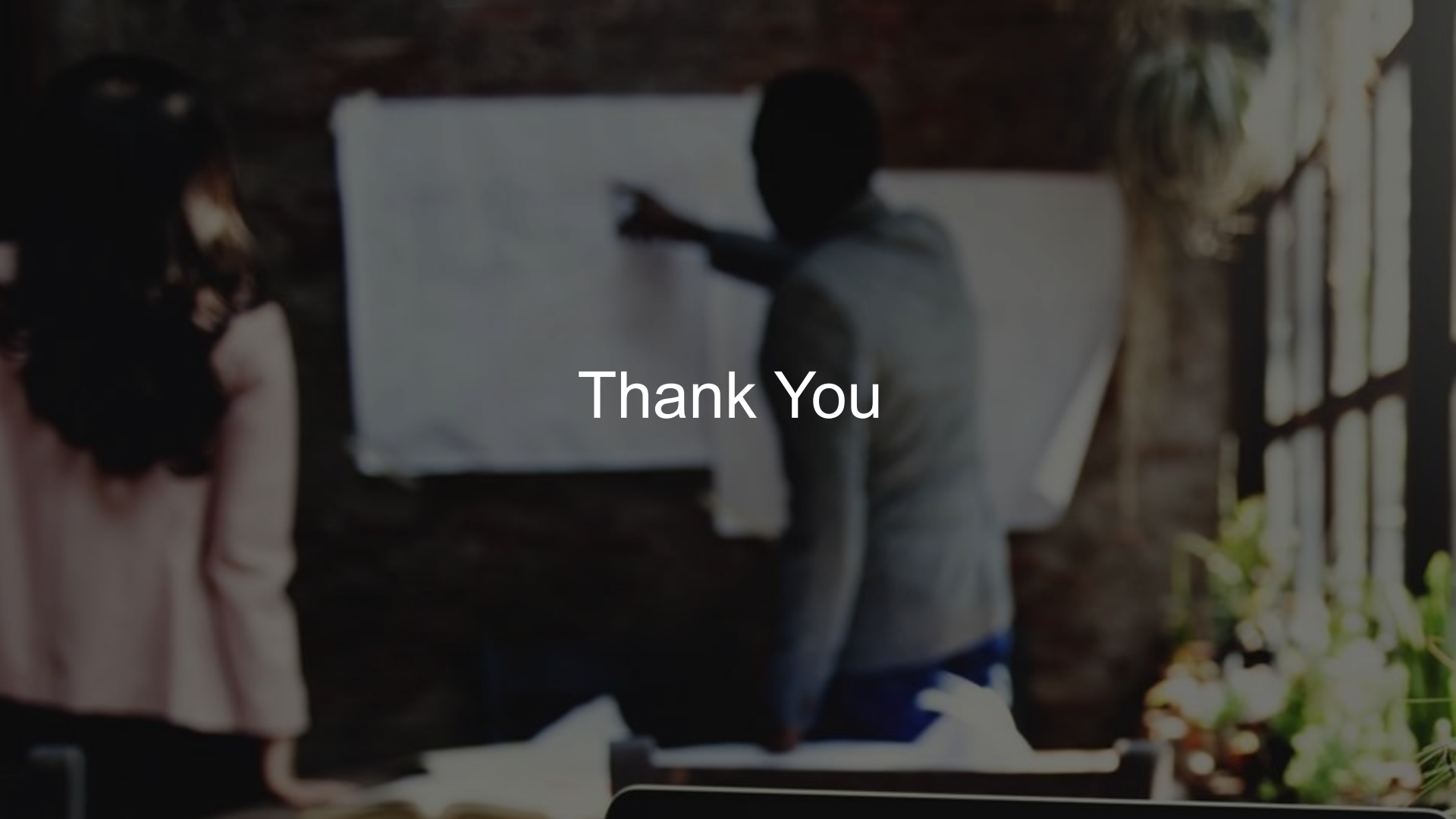
Thank You