SAE 2009 **On-Board Diagnostics** Symposium

Update on Light and Heavy Duty Vehicle

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A Comparison of J1939 & ISO15031

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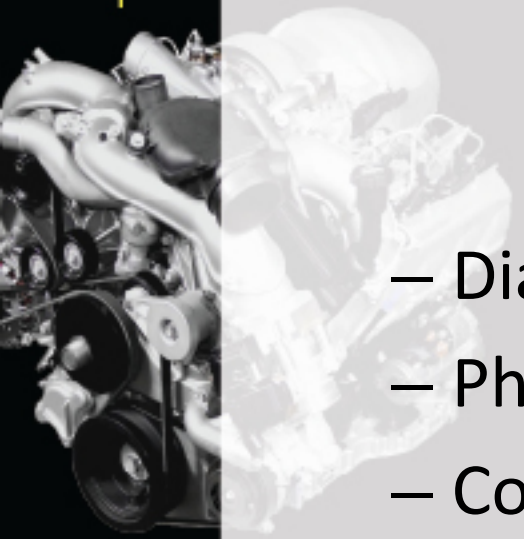


Agenda

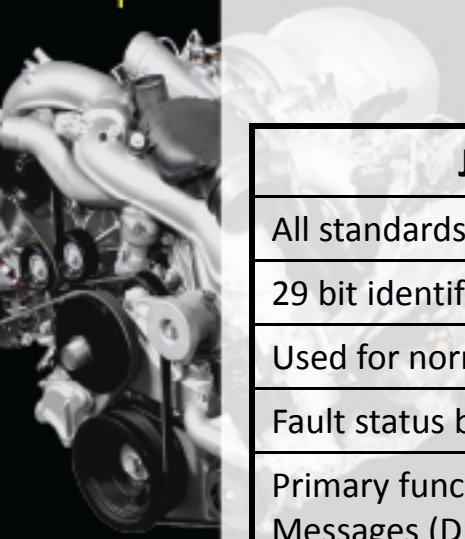
- Diagnostic Standards
- Physical Interface
- Connectors
- Terminology
- Protocol Overview
- Fault Codes

History Lesson

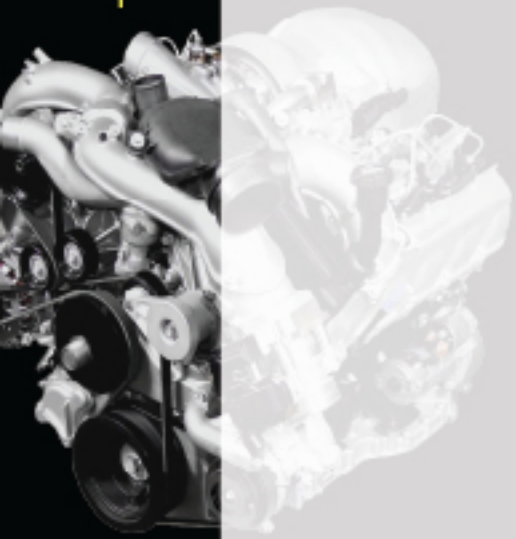
- What is this??

- 1980's Automotive Diagnostic Tool

Major Differences



J1939 (MD & HD Truck)	ISO 15031 (Pass Car & LD Vehicles)
All standards defined in SAE J1939 parts	ISO 15031 is harmonized with several SAE stds.
29 bit identifiers	11 bit identifiers
Used for normal communications & diagnostics	Used only for diagnostics
Fault status broadcast regularly (e.g. DM1)	No broadcast messages
Primary functionality defined using Diagnostic Messages (DMs)	Primary functionality defined using unique communication Service IDs (SIDs)
3 byte fault codes + occurrence counter	3 byte fault codes
Four warning lamps defined	One warning lamp defined
250 Kbps bus speed	500 Kbps bus speed
Nine pin diag connector standard (J1939-13)	Sixteen pin diag connector standard (ISO15031-3 /J1962)



Diagnostic Standards

Diagnostic Standards: Car/Truck – SAE/ISO

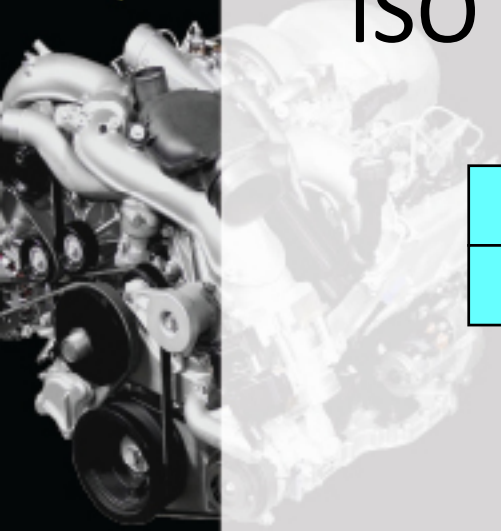
	SAE	ISO
Pass Car & LD Veh	J1930 - terms & defns J1962 - connector J1978 - scan tool J1979 - diag services J2012 - fault codes J2186 - link security J2534 - pass thru J1699 - OBD conformance	ISO11898 (5 parts) - CAN ISO15765 (4 parts) - Diagnostics on CAN ISO15031 (7 parts) - Legislated OBD on CAN
MD & HD Veh	J1939 (Multiple parts) J2403 - terms & defns	N/A

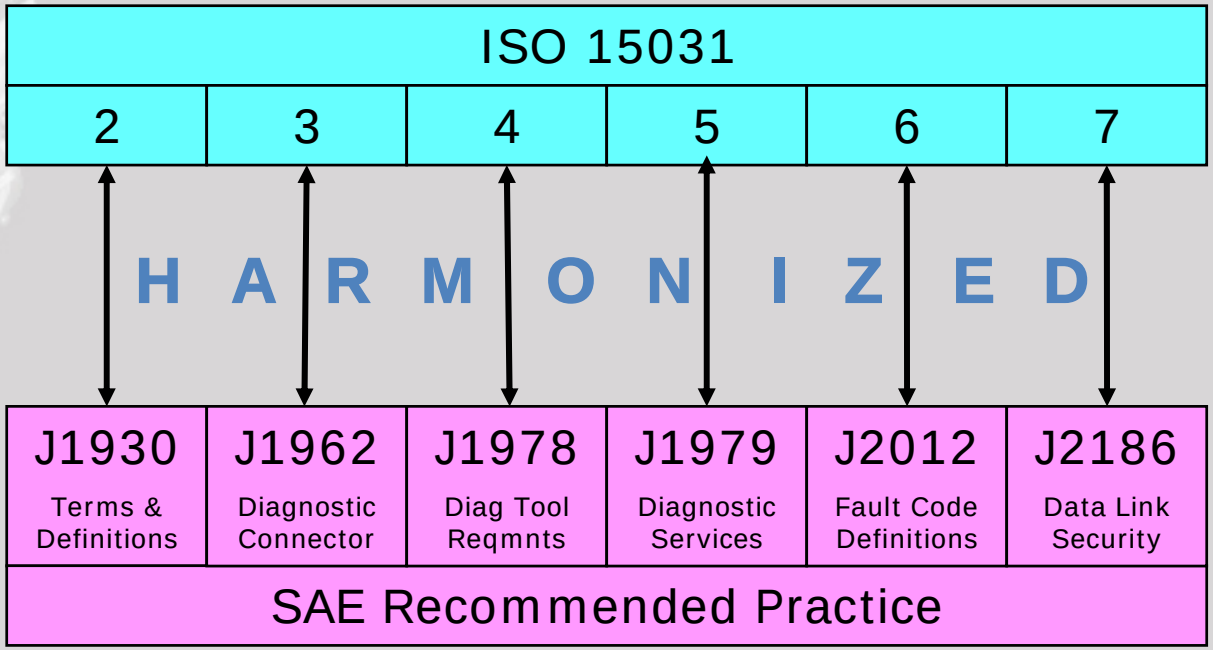
In some cases multiple standards will be mixed on the same vehicle

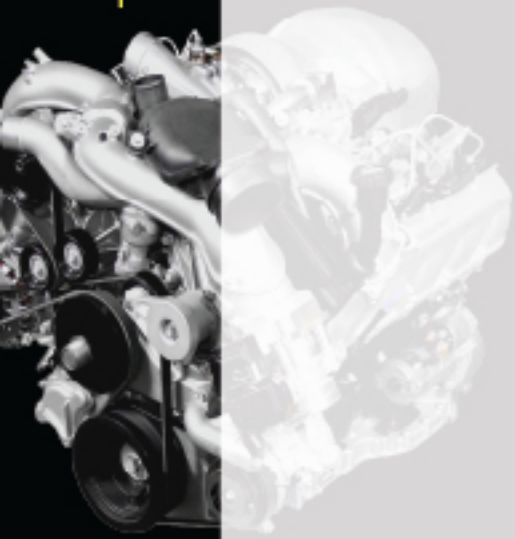
Apples – to - Apples

OSI Layer		MD & HD Standards & OBD Legislated	Pass Car & LD OBD Legislated
N/A	Diagnostic Connector	SAE J1939-13	ISO 15031-3
7	Application	SAE J1939-71/73 SAE J1939-81	ISO 15031-5 (SAE J1979)
6	Presentation		ISO 15031-5 (SAE J1979)
5	Session		ISO 15765-4
4	Transport Protocol	SAE J1939-21	ISO 15765-2
3	Network Layer	SAE J1939-31	ISO 15765-4
2	Data Link	SAE J1939-21 (ISO 11898-1)	ISO 15765-4 (ISO 11898-1)
1	Physical Layer	SAE J1939-11/15	ISO 15765-4 (ISO 11898-2)

ISO 15031 Mapping to SAE Standards



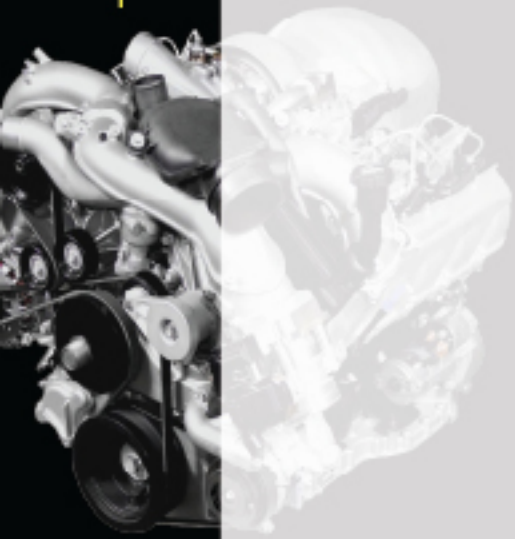




Physical Interface

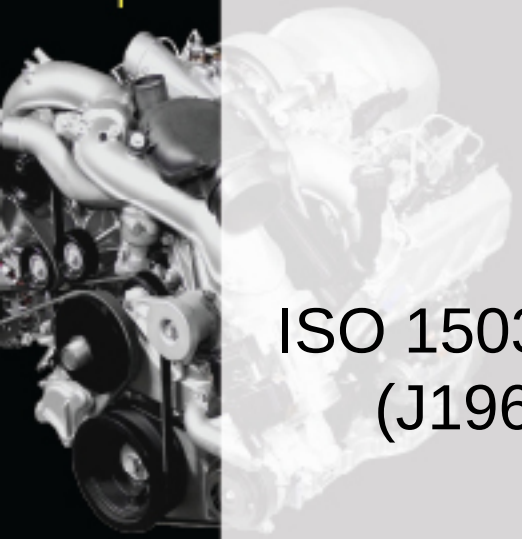
Physical Interface

J1939 – 11 or 15	**ISO 15031-3, ISO 11898-2 & ISO 15765-4**
250 Kbps	500 Kbps
Twisted Shielded Pair (11) Twisted Unshielded Pair (15)	Twisted Pair – no shield
Max 30 ECUs (11) Max 10 ECUs (15)	No Max Defined
40 m Total NW Length	40 m @ 1Mbps – Longer allowed at lower speeds
1 m Stub Length (11) 3 m Stub Length (15)	.3 m @ 1Mbps – Longer allowed at lower speeds



Connectors

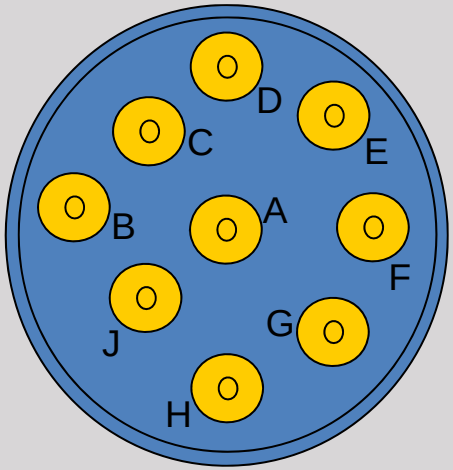
Connectors

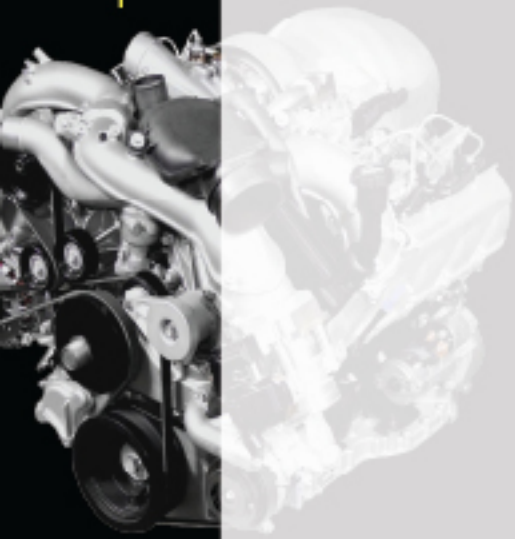


ISO 15031 – 3
(J1962)

1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16

J1939 - 13

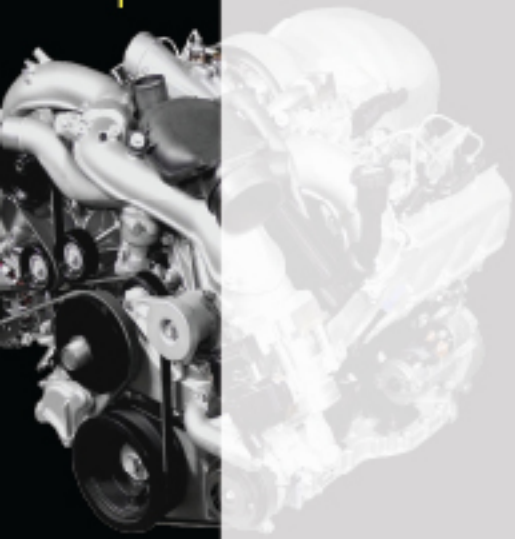




Terminology

Terminology – Just a Few

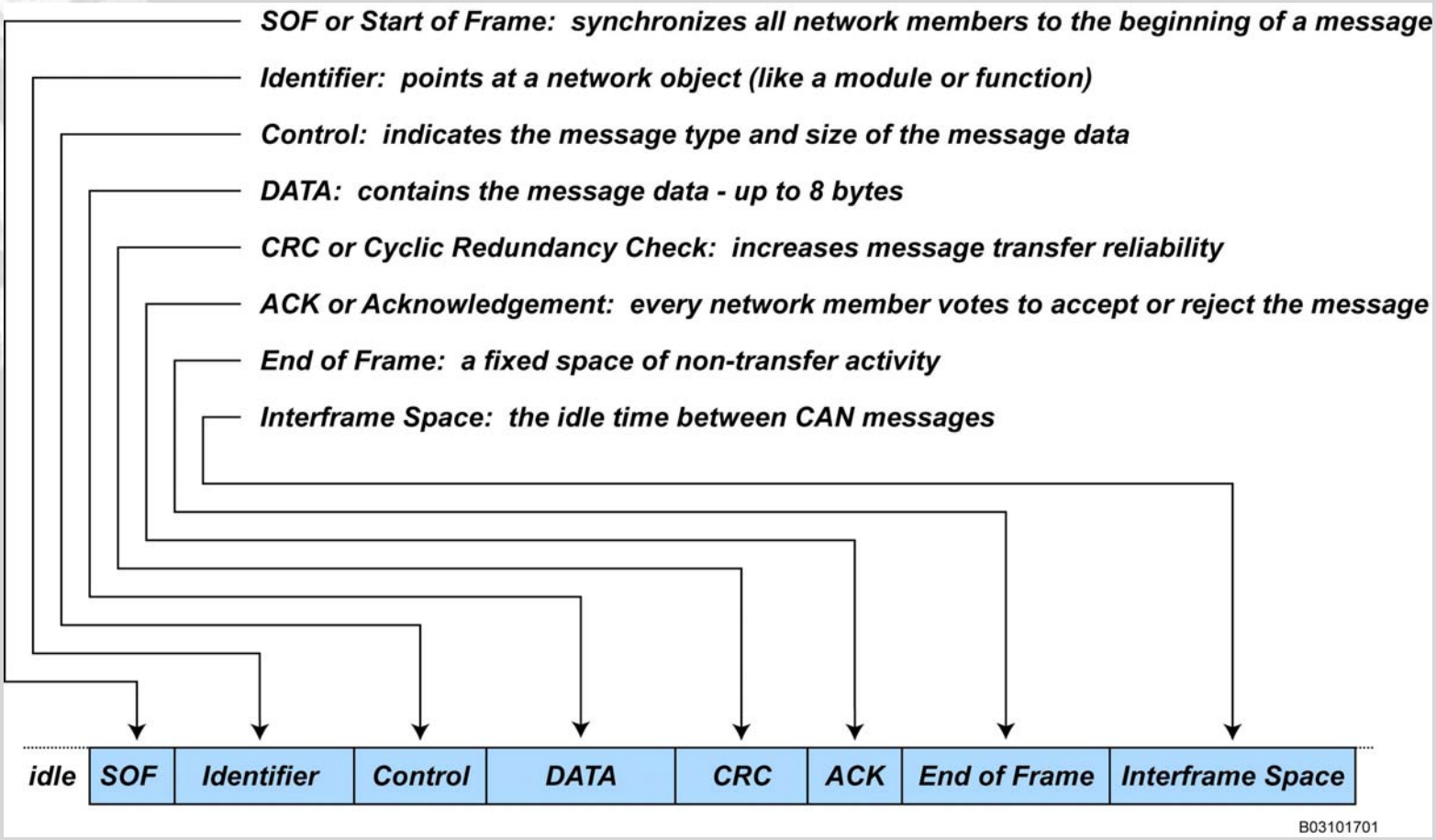
J1939	ISO 15031
ACL = Address Claiming	DLC = Data Length Code
BAM = Broadcast Announce Message	DTC = Diagnostic Trouble Code
DM = Diagnostic Message	ECM = Engine Control Module
DP = Data Page	ECU = Electronic Control Module
DTC = Diagnostic Trouble Code	FTB = Failure Type Byte
ECU = Electronic Control Unit	KWP = Key Word Protocol (ISO 14230)
EDP = Extended Data Page	MIL = Malfunction Indicator Lamp
FMI = Failure Mode Identifier	NRC = Negative Response Code
NACK = Negative Acknowledgement	PCI = Protocol Control Information
PDU = Protocol Data Unit	PID = Parameter ID (similar to DID or LID)
PG = Parameter Group	SID = Service ID
PGN = Parameter Group Number	
SLOT = Scaling, Limit, Offset & Transfer	
SPN = Suspect Parameter Number	



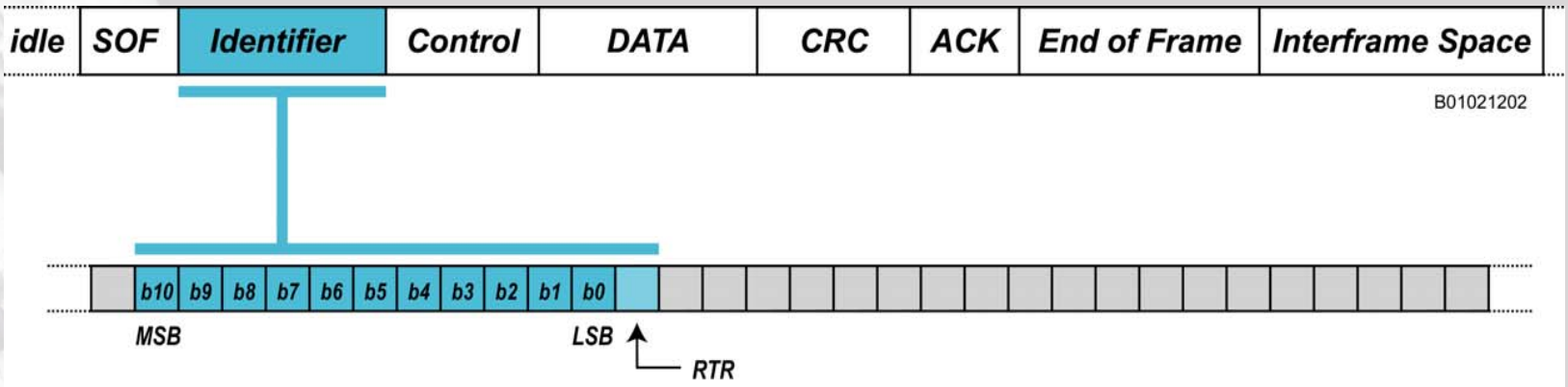
Protocol Overview

CAN Message Structure

11 bit or 29 bit

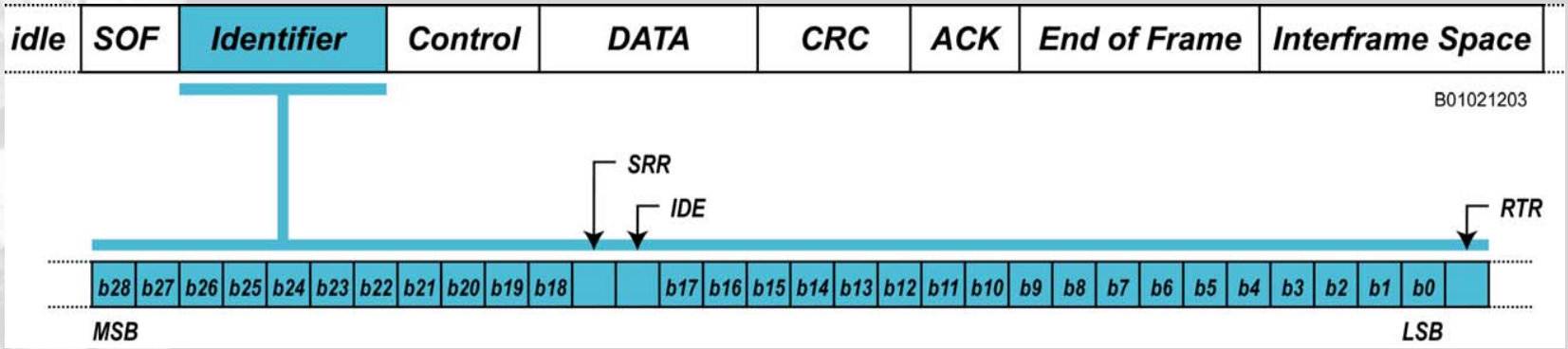


Standard CAN Format: 11-Bit Identifier



- Usage for OBD: ECU Identification
  - ❑ Functional Request ID for OBD diagnostic requests (source address not required since only one diagnostic tester is allowed on the bus at one time)
  - ❑ Source ECU ID for diagnostic responses
  - ❑ Most OEMs have their own ID assignment standards

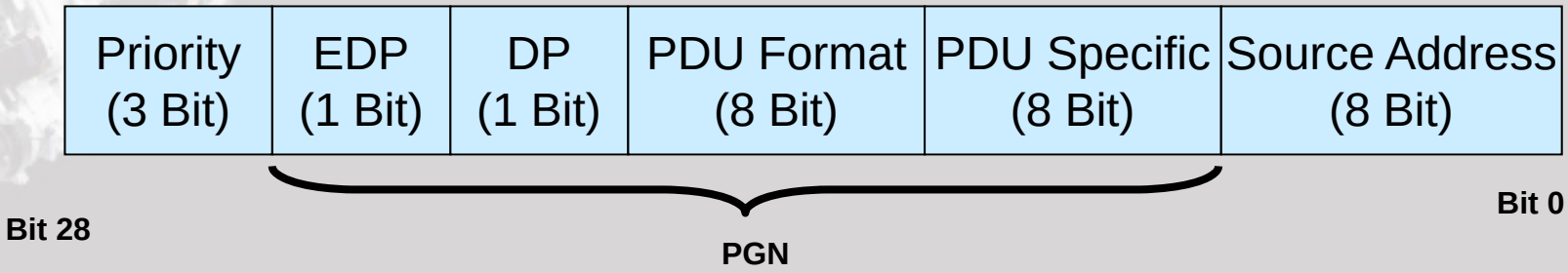
J1939 Extended CAN Format: 29-Bit Identifier



- Three Components – as defined by J1939:
  - ❑ Message Priority
  - ❑ Parameter Group Number (Defines the data in the DATA area – SAE standardized & proprietary PGNs possible)
  - ❑ Source Address

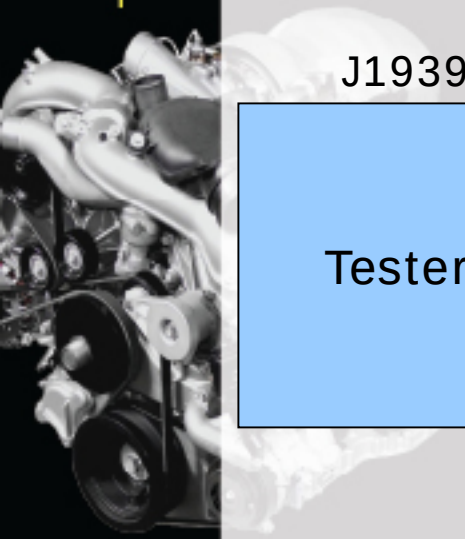
J1939 29-Bit Identifier Defined

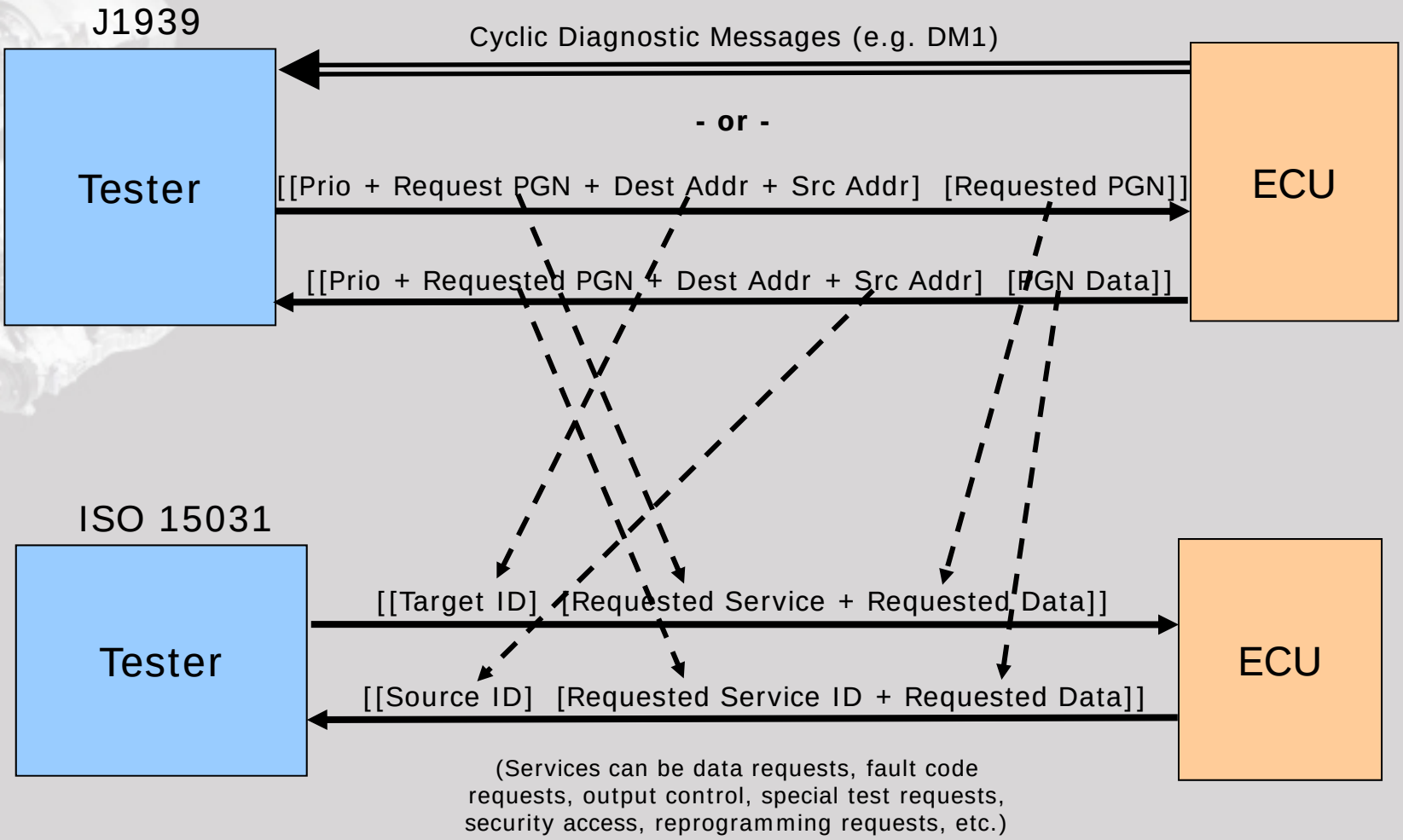
- Interpretation of 29 Bit CAN Extended Identifier in J1939

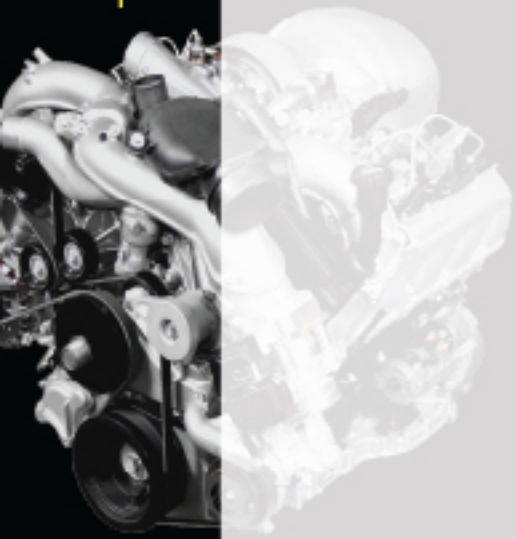


- PDU Format < 0xF0 defines message as Peer-to-Peer. PDU Specific will be a Destination Address
- PDU Format => 0xF0 identifies message as broadcast. PDU Specific will be a Group Extension

Diagnostic Message Structure Comparison

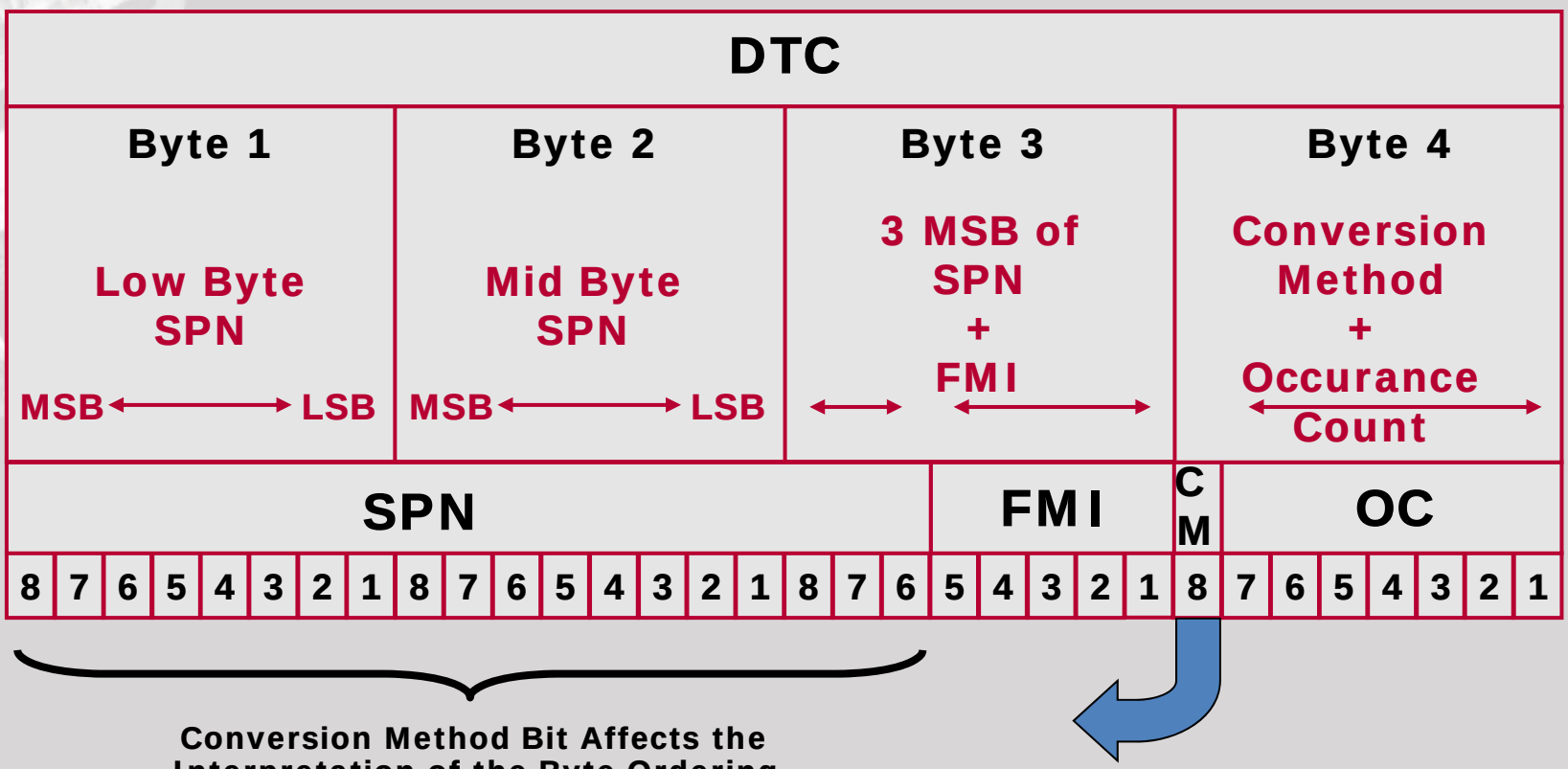




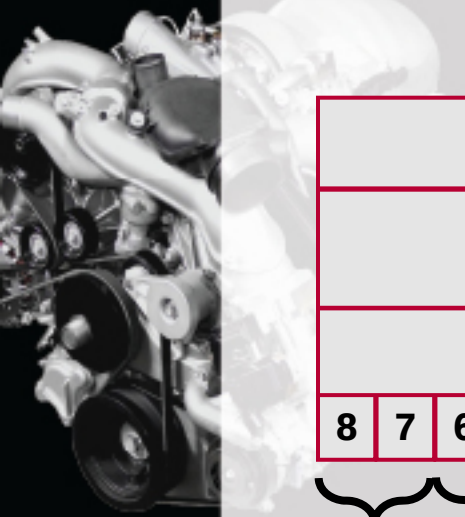


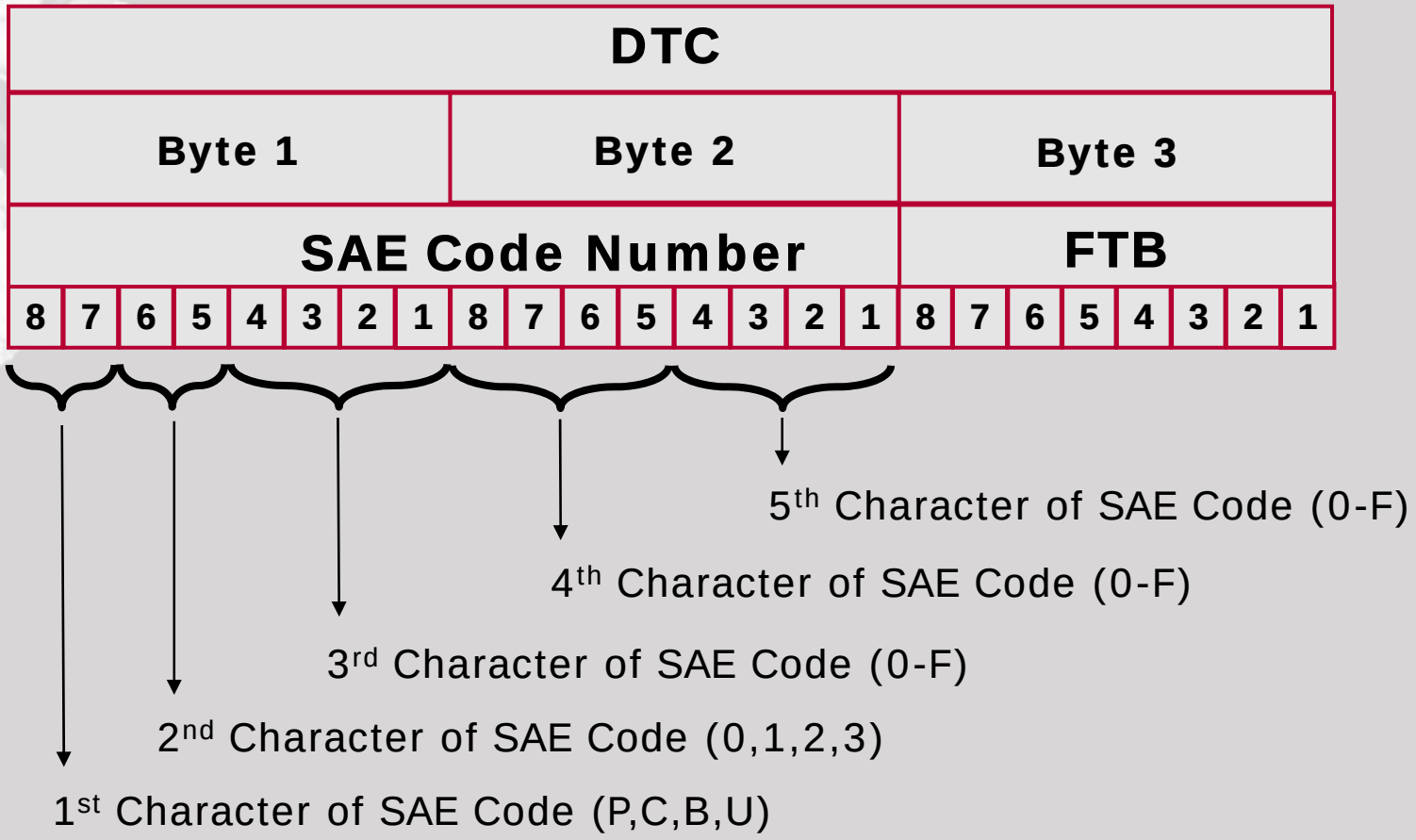
Fault Codes

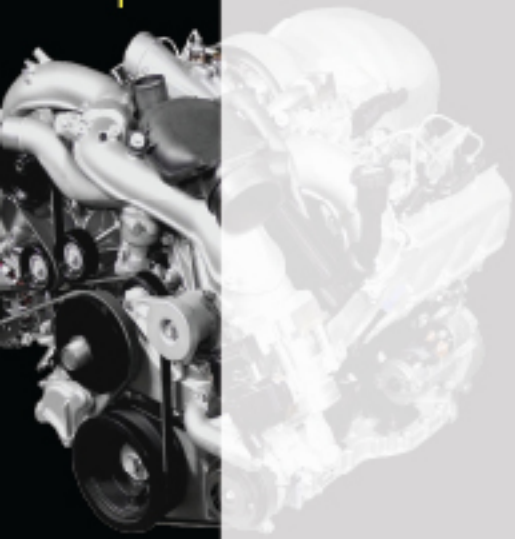
J1939 Diagnostic Trouble Code



ISO 15031 Diagnostic Trouble Code







Thank You

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