Difference Between CAN And J1939: Complete Guide

Controller Area Network (CAN) and SAE J1939 are two essential technologies used in automotive and industrial applications for communication between electronic control units (ECUs). While J1939 is built on the CAN protocol, there are key differences that set them apart. This tutorial provides a comprehensive comparison of CAN and J1939, covering their architecture, applications, and features.

Difference Between CAN and J1939

01. Overview

CAN (Controller Area Network)

- Developed by: Bosch (1980s)
- Standard: ISO 11898
- Purpose: General-purpose communication protocol for ECUs.
- Key Features:
  - Supports multiple ECUs.
  - Uses a multi-master, message-oriented architecture.
  - Provides real-time communication.
  - Maximum Data Rate: Up to 1 Mbps.
  - Frame Types: Data, Remote, Error, and Overload frames.

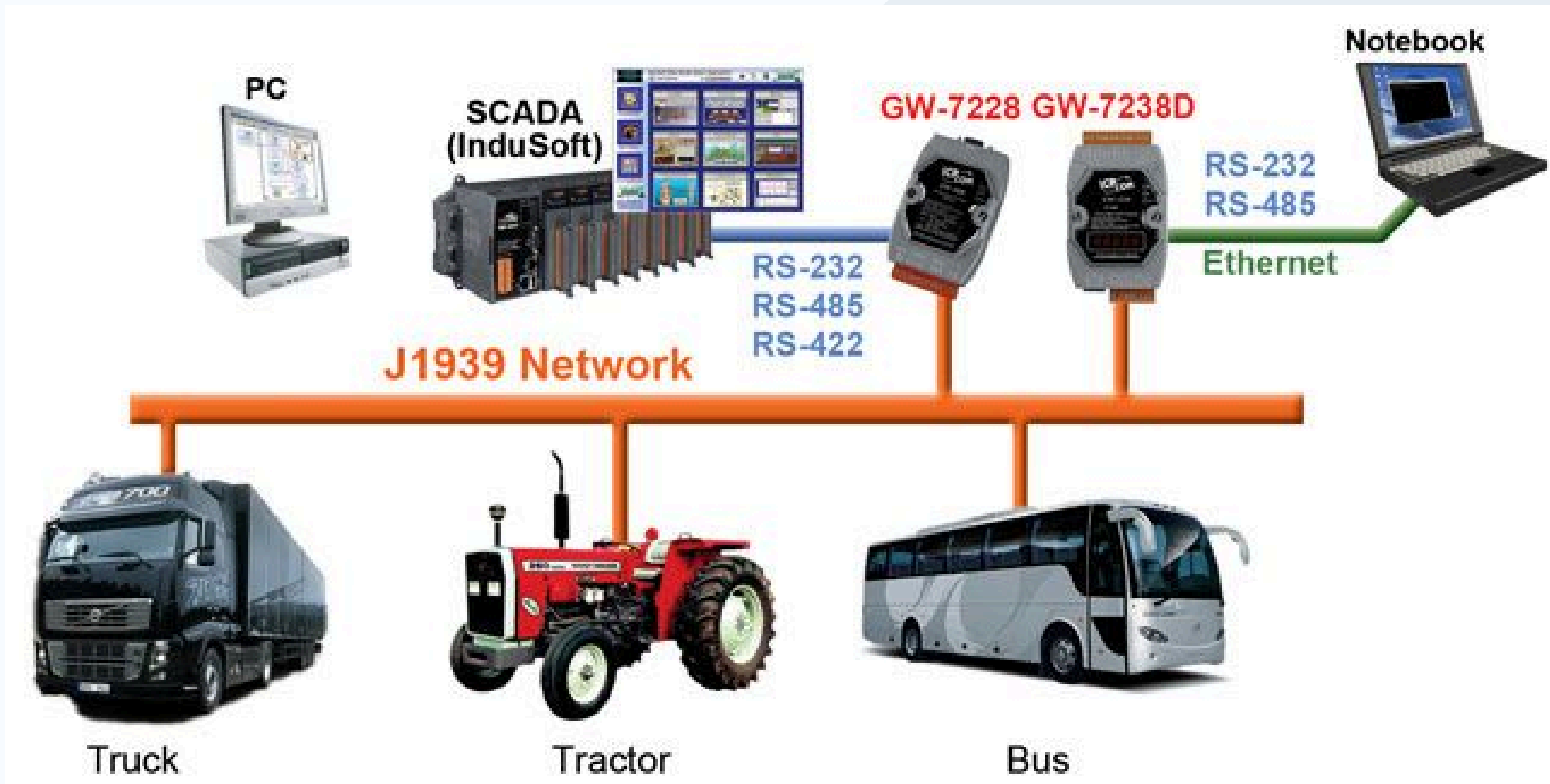
J1939

- Developed by: SAE (Society of Automotive Engineers)
- Based on: CAN protocol.
- Standard: SAE J1939 (ISO 11898-2 as the physical layer).
- Purpose: Designed specifically for heavy-duty vehicles and machinery.
- Key Features:
  - Focuses on diagnostics, control, and communication in heavy vehicles.
  - Provides higher-level protocols and a predefined message set.
  - Maximum Data Rate: 250 kbps or 500 kbps.
  - Standardizes message structure with Parameter Group Numbers (PGNs).

Difference Between CAN and J1939

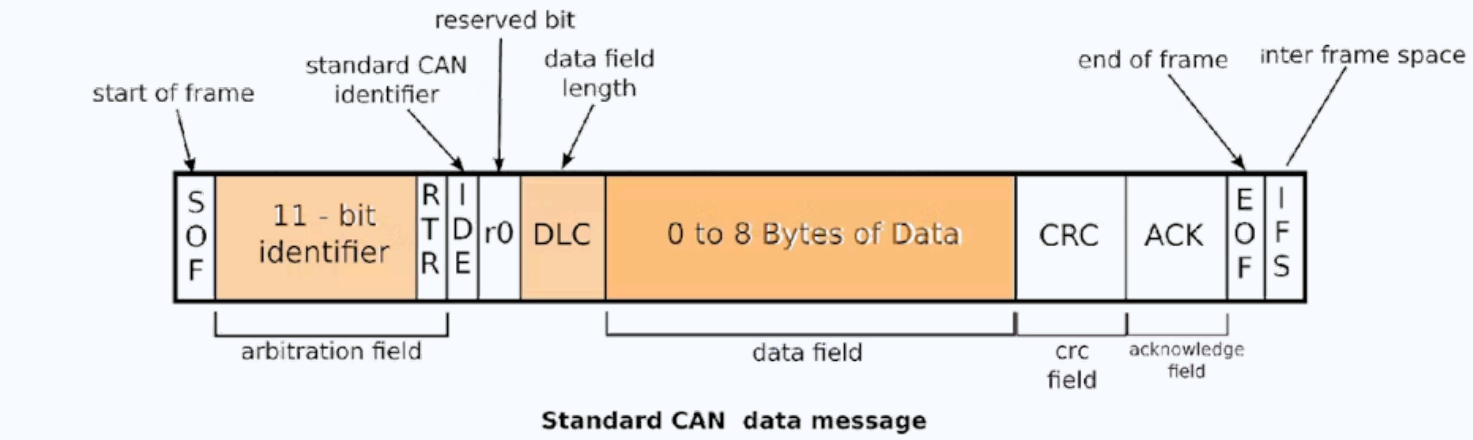
02. Key Differences Between CAN and J1939

Aspect	CAN	J1939
Purpose	General-purpose communication protocol.	Designed for heavy-duty vehicles and applications.
Layer in OSI Model	Data Link Layer (ISO 11898).	Application Layer protocol over CAN.
Communication Rate	Up to 1 Mbps.	Typically 250 kbps (500 kbps in newer systems).
Message Identifier	11-bit or 29-bit identifier.	Uses 29-bit identifier exclusively.
Standardization	Flexible, user-defined messages.	Predefined message structure (PGNs and SPNs).
Physical Layer	ISO 11898-1/2/3.	ISO 11898-2.
Applications	Automotive, industrial automation, robotics, etc.	Heavy-duty vehicles, agriculture, construction.

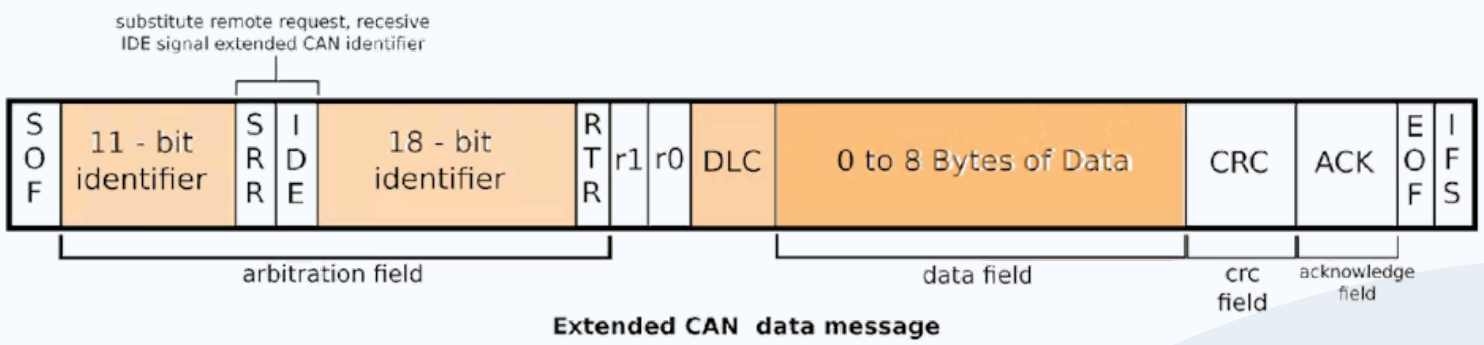


Difference Between CAN and J1939

03. CAN Protocol Basics



Standard CAN data message



Extended CAN data message

Message Frame Types:

1. Data Frame
2. Remote Frame
3. Error Frame
4. Overload Frame

Arbitration:

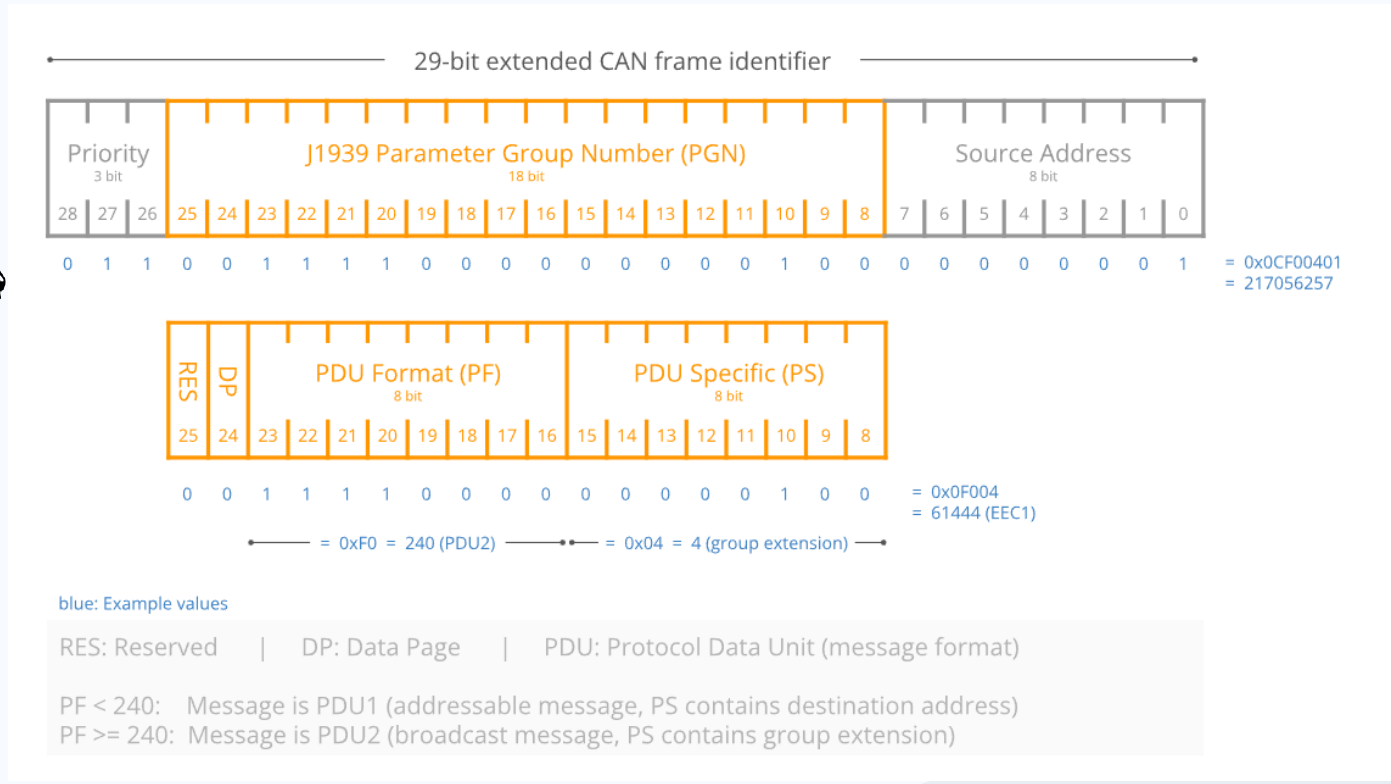
- Uses a non-destructive priority-based mechanism.
- Lower identifier value = higher priority.

Applications:

- Automotive ECUs (e.g., engine control, ABS, transmission).
- Industrial machinery.
- Medical devices.

Difference Between CAN and J1939

04. J1939 Protocol Basics



PGNs (Parameter Group Numbers):

- Unique identifiers for specific messages.
- Examples: Engine speed, vehicle speed, fuel rate.

SPNs (Suspect Parameter Numbers):

- Define individual data elements within PGNs.
- Examples: Oil pressure, and coolant temperature.

Key Features:

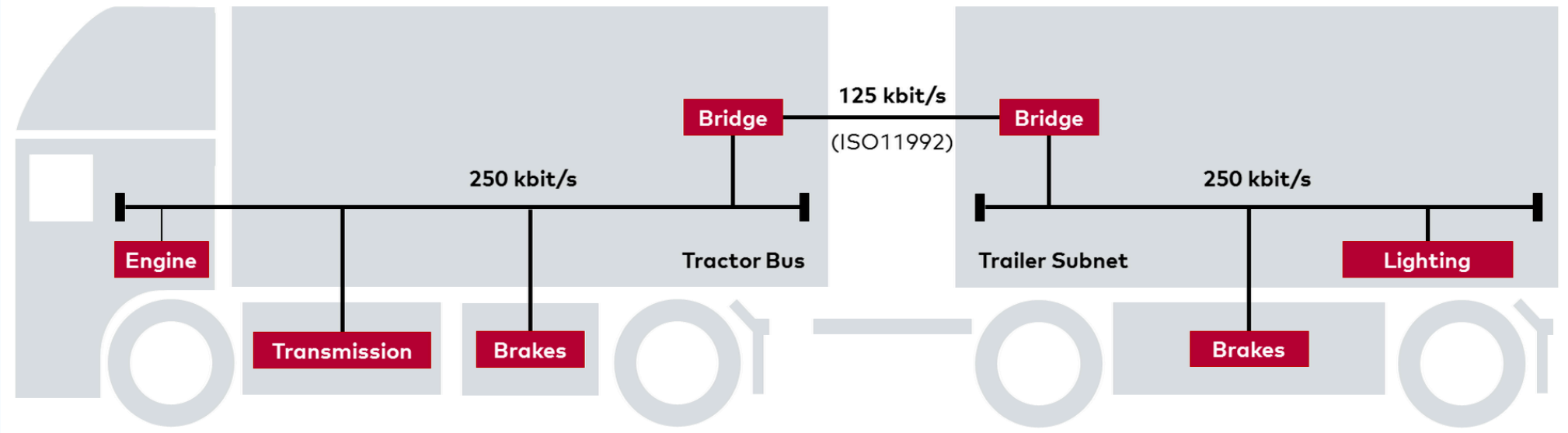
- Provides diagnostics and fault codes (DM1, DM2).
- Supports transport protocol for large messages.

Applications:

- Heavy-duty trucks.
- Agricultural and construction machinery.
- Marine vessels.

Difference Between CAN and J1939

05. Key Advantages of J1939 Over CAN



Predefined Standards:

- J1939 provides a standardized message set, reducing development time.

Extended Message Identification:

- 29-bit identifier allows for more detailed messages.

Diagnostics Support:

- Built-in diagnostics like DM1 and DM2.

Large Message Support:

- Transport protocol allows for multi-packet data transfer.

Interoperability:

- Ensures compatibility between ECUs from different manufacturers.

Difference Between CAN and J1939

06. Physical Layer Comparison

Feature	CAN	J1939
Cable Type	Twisted pair.	Twisted pair.
Termination Resistance	120 Ω at each end.	120 Ω at each end.
Voltage Levels	Differential signaling.	Differential signaling.
Bus Length	Depends on bitrate.	40 m at 250 kbps.

07. Limitations of J1939

Lower Data Rate:

- Limited to 250 kbps or 500 kbps compared to CAN's 1 Mbps.

Complexity:

- It is more complex due to predefined PGNs and SPNs.

Limited to Heavy Vehicles:

- Not suitable for general-purpose applications.

Difference Between CAN and J1939

In summary, while both CAN and J1939 are critical for communication in automotive and industrial systems, they cater to different needs. CAN is a general-purpose protocol offering flexibility, whereas J1939 provides standardization and diagnostics for heavy-duty applications. Understanding their differences helps you select the right protocol for your application.

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