

Vehicle Networking Moves Toward Global Harmonization

By Mark Zachos, President, DG Technologies

Global Standards Tie Together Existing Standards, Strengthen the Forward Path for Vehicle Networks

The global economy has caused an increase in worldwide competition. Because of this, vehicle component suppliers can no longer manufacture a component focused on a single market. The level of interoperability required to meet the needs of multiple markets and OEMs cannot be achieved without standards.

A standard is an agreement among stakeholders to serve a larger purpose. While the “give and take” can be lengthy and uncertain, standards provide a high degree of certainty that the best solution will be adopted.

There are several standards bodies in our industry:

- ❖ The Society of Automotive Engineers (SAE)
- ❖ The Technology and Maintenance Council (TMC) of the American Trucking Associations (ATA).
- ❖ International Standards Organization (ISO)

Legislation Forces Standards Adoption

In the 1990s, the US Environmental Protection Agency (EPA) and the California Air Resources Board (CARB) began instituting environmental requirements for vehicles. Reducing emissions was the first facet, and the second was On Board Diagnostics (OBD). OBD focused on the use of generic hardware devices to ensure the emissions control devices were meeting regulations. Europe soon implemented its own set of standards, called European OBD (EOBD).

This legislation brought component manufacturers together to develop standards for networking of active vehicle components, as well as providing access to various vehicle parameters and emissions-related data. Some of the standards used today include:

- ISO 15765-4 – Diagnostics on CAN for emissions related components
- SAE J1962 – OBD Diagnostic Connector
- SAE J1979 – Diagnostic Message Structure
- SAE J2012 – Diagnostic Trouble Code (DTC) Definitions
- SAE J1930 – Terms & Conditions

Mandated Off-board Standards

ISO15765

Over the years, new emissions requirements forced the industry to look at faster alternatives. CAN was the obvious choice and was adopted as ISO 15765 (Diagnostics on CAN – DoCAN). The current mandate, OBD-II requires CAN on all 2008 and newer automobiles in the United States.

SAE J2534

Along with ISO15765-4, EPA/CARB also mandated a specific PC Application Programming Interface (API) called SAE J2534 so that OEMs could write reprogramming software allowing independent repair facilities to use off-the-shelf hardware to reprogram ECU's. This eliminated the need for shops to buy proprietary hardware for every vehicle manufacturer or to send the vehicle to a dealership.

J1939/TMC RP1210

When Heavy-Duty OBD (HD-OBD) was legislated, J1939 was the obvious choice. The J1939 committee was easily able to plumb all emissions compliance testing and parameters into the standard. An API was the only area not discussed and CARB/EPA settled on TMC RP1210 since the majority of suppliers were already using it for their diagnostic applications.

For light-duty vehicles, ISO15765 and J2534 must be implemented. For heavy-duty, an OEM can choose either ISO15765 and J2534, or SAE J1939 and TMC RP1210.

The Move Toward Global Harmonization

The great thing about standards is that there are so many to choose from! EPA and CARB have been driving emissions in the US while Europe took their own path with two standards called Euro5 and Euro6.

The good news is that there is a concerted effort to harmonize the SAE and the respective ISO standards for the global market. The question is how do we get there? The answer is called World Wide Harmonized (WWH) and is documented in ISO 27145. It not only includes CAN/ISO15765, but also includes a potential network, well known but new to in-vehicle use: Ethernet.

Figure 1 shows the 3 OBD Scan Tool protocol stacks that must now be supported, Light-Duty OBD SAE J1979, Heavy-Duty OBD J1939, ISO15765-4 and services, and a new ISO 27145 Standard for Road vehicles – implementation of World-Wide Harmonized On-Board Diagnostics (WWH-OBD) communication requirements.

The Need for Speed

As we work toward WWH-OBD, the number of active nodes on a vehicle now exceeds 100,

making networking speed matter even more. There are several technologies that are being used or developed for vehicle application, namely:

- J1939 will double in speed from 250 Kbps to 500 Kbps.
- FlexRay, supporting time or event triggered events with redundancy and fault tolerance at speeds to 10Mbps.
- The use of Ethernet as an in-vehicle network with a range of speeds from 10Mbps to 10Gbps.
- Both automotive and heavy-duty engineers are looking at a new CAN standard developed by Bosch called CAN with Flexible Data Rate (CAN-FD).
 - The basics of CAN remain the same such as the vehicle wiring, however, the data throughput can be increased to an effective speed of 1.5 to 12 Mbps.
 - CAN-FD interoperates with CAN, and could easily be added to existing SAE or ISO standards, including WWH.

Standards – A Solid Forward Path

We will see significant advances in vehicle network technology in the very near future like faster networking (CAN-FD, Ethernet, FlexRay), Vehicle to Vehicle communications (V2V), Vehicle to Infrastructure communications (V2I), as well as other safety and security-related components. The best thing for the OEM, the component manufacturer, or diagnostics & maintenance for consumers is that most of these proposed changes already have an SAE or ISO standards committee looking at how to best support new functionality, interoperability, and diagnostics in a global standard.

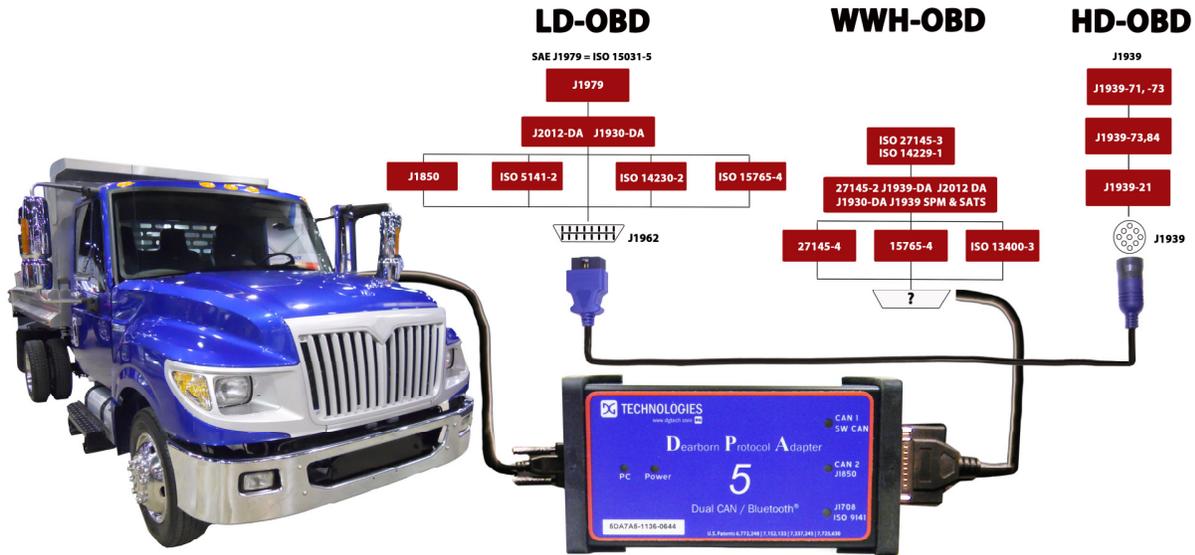


Figure 1 – Three Scan Tool Protocol Stacks, Light Duty, World-Wide Harmonized, and Heavy-Duty OBD

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