(Source: Adobe Stock)

The future of CiA – CAN XL ecosystem and CiA profiles

The 30th anniversary year comes to its end. Time to look to the future. CAN in Automation (CiA) is going to continue developing the CAN XL ecosystem. The nonprofit association is also committed to provide profile specifications to enable off-the-shelf interoperability between devices.

Regarding lower CAN layers, CiA maintains all three generations: Classical CAN, CAN FD, and CAN XL – not forgetting the sideline CAN FD Light. CAN XL is an approach with data link layer add-on functions, such as CANsec, a security protocol, and frame fragmentation providing a quality-of-service (QoS) option. Frame fragmentation is suitable to decrease the network latency time needed when there are hard real-time requirements.

Additionally, the CAN XL protocol embeds besides DLL management features (e.g. priority ID) also higher OSI layer management features. One is the service data unit type (SDT). It is an 8-bit field, which indicates the used higher-layer protocol or the "tunneled" protocol (e.g. Classical CAN, CAN FD, or IEEE 802.3 MAC frames). The CiA 611-1 document defines the SDT codes and specifies the SDU (service data unit). But this is just the first piece of the CAN XL ecosystem. CiA develops a whole bunch of documents to support the usage of CAN XL and to simplify the CAN XL network design by means of recommendations, implementation and user guidelines as well as application notes. This will keep CiA members busy in the next years.

The adaptation of CAN XL by CANopen and J1939 is another topic, which CiA has on its to-do list. But currently, CiA struggles with the acceptance of CANopen FD. One of the hurdles is the design of longer networks. CAN FD is already rather successful in the passenger car business. But in applications requiring network length of 250 m and more, appropriate experiences are missing. The users – in particular, those with low-volume applications – have not the resources for the basic research. CiA is committed to support them. In cooperation with researchers, CiA is going to set up an evaluation project for CAN FD communication in larger topologies. CiA members are also developing a CAN XL simulation approach, in order to check the feasibility of a CAN XL network design before building network prototypes.

To promote CAN XL, CiA members have established the Marketing Group (MG) CAN XL. First actions include the organization of a CAN XL plugfest in Detroit area next year. Other marketing opportunities are application notes, demonstrators to be shown at trade shows, etc.

Interoperability is the objective

Compatibility is nice to have. It can be tested by means of conformance tests. However, conformance testing is the same as spelling and grammar checking in human communication. It increases the possibility of understandability (in technical communication: interoperability), but does not guarantee it. Even properly-spelled information can be mis- ▷

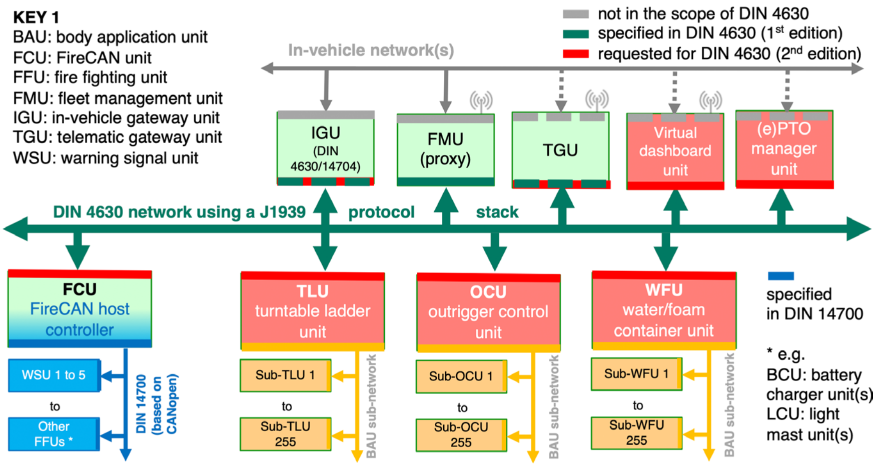


Figure 1: Example of a fire-fighting vehicle body application with multiple Classical CAN networks with different application layers (Source: CiA)

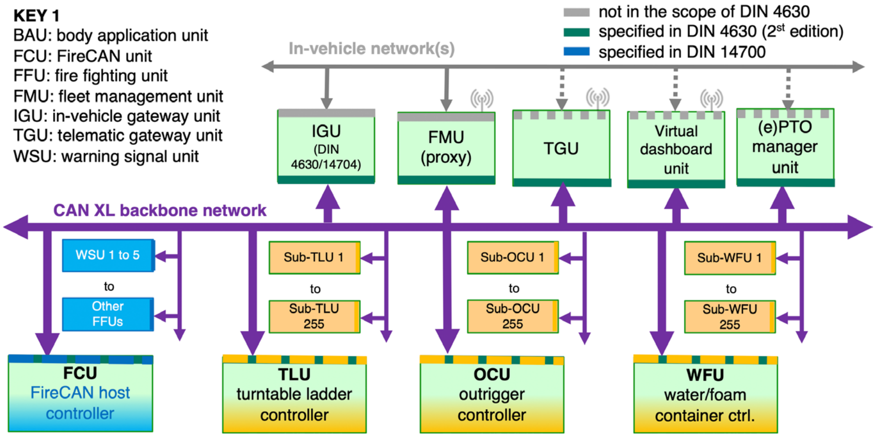


Figure 2: Example of a future fire-fighting vehicle body application using a single CAN XL backbone network implementing virtual networks (Source: CiA)

understood or misinterpreted. To prove the interoperability of implementations can be done by means of so-called plugfests or a "golden" system. Testing the ITU (implementation under test) in a "golden" system with already proven implementation is an option, CiA uses this approach for interoperability testing of classic CANopen devices.

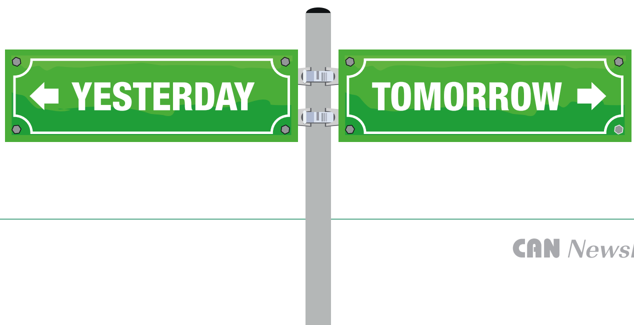
Since its early days, CiA organizes plugfests to test the interoperability of devices and components. In such plugfests, several implementations are connected to one network. CiA had organized multiple CAN FD plugfests for CAN FD controllers. One of the most frequent plugfests are organized for CANopen Lift (CiA 417 series): often twice a year such test sessions are scheduled.

This year, CiA members checked the first CAN XL protocol controller implementations and CAN SIC XL transceivers. CiA will continue to organize such CAN XL plugfests proofing the interoperability of controller and transceiver implementations as well as topologies.

To test interoperability of devices on the application level, requires profile specifications. Profiles specify the content of messages. In CANopen and CANopen FD, this includes the object dictionary and PDO (Process Data Object) specification. CiA has developed many device, application, and interface profiles. CiA will continue this, enabling device suppliers to develop products with off-the-shelf plug-and-play capability. Not all existing CiA profiles have been upgraded for CANopen FD communication. There are still many CiA profiles limited to classic CANopen usage. The first CiA profiles have been adapted to J1939 meaning they support J1939-based application layers.

Device and network scalability is the goal

In some applications, multiple and different communication tasks are demanded: This can include remote control and remote diagnostics, local control, cloud communication (Internet of Things), etc. In order to provide network scalability, logical units and logical controllers need to be specified. They can be mapped to different network architectures. CANopen and CANopen FD as well as CiA application profiles support such an approach. Typical examples are the CiA 417 application profile for elevator control systems and CiA 422 application profile for refuse collecting vehicles. Recently, CiA initiated the Special Interest Group (SIG) fire-fighting developing a framework for body applications on fire-fighting trucks. A similar approach is the development of application profiles for rolling stock.



In all these applications, CAN XL can overcome the limitations, when mapping them to Classical CAN or CAN FD networks. CAN XL provides with the 8-bit VCID (virtual CAN network identifier) field the possibility, to virtualize different networks on the same cable. This can save a lot of wiring and enables scalability of network architectures depending of the needed bandwidth. A side effect is the saving of CAN hardware interfaces as well as hardware bridges and switches.

With CAN XL, there are new design options to backbone multiple communication applications. This is already supported in classic CANopen, but with the limitation of an 8-byte data field and up to eight logical devices. One of the first approaches was the CiA 407 application profile for passenger information systems developed end of the 1990ties. This is internationally standardized in the EN 13149 series (CANopen-based passenger information system for public transportation). With the 2048-byte data field provided by CAN XL, you can implement a multi-PDU (protocol data unit) solution supporting such approaches much smarter as you could do with Classical CAN and CAN FD networks.

With these new features of the CAN XL data link layer in mind, CiA members can specify new virtual application profiles within the next years. Especially, applications with network scalability requirements can now be satisfied more easily. Interoperability of devices and scalability are two sides of the same coin, which can be achieved by means of CiA application profiles. The CiA Task Force CAN XL application, established recently, will provide success stories, how you can achieve this.

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PCAN-Diag FD
New **J1939** Add-in

■ PCAN-Diag FD: CAN & CAN FD Diagnostic Device

The PCAN-Diag FD is a handheld device for the diagnosis of CAN and CAN FD buses at physical and protocol levels.

- High-speed CAN connection (ISO 11898-2)
  - Complies with CAN specifications 2.0 A/B and FD
  - CAN bus connection via D-Sub, 9-pin (CiA® 303-1)
  - Switchable CAN termination for the connected bus
- Power supply via rechargeable batteries or a supply unit
- Clear listing of the CAN traffic with various information
- Transmitting individual messages or CAN frame sequences
- Configurable, readable CAN ID and data representation
- Recording of incoming CAN messages
- Playback of trace files with optional loop function
- Measurement of the CAN bus load and termination
- Voltage check at the CAN connector for pins 6 and 9

Oscilloscope

- Function specially designed for CAN for a qualitative assessment of the signal course on the CAN bus
- Two independent measurement channels, each with a maximum sample rate of 100 MHz
- Display of the CAN-High and the CAN-Low signals as well as the difference of both signals
- Trigger configuration to various properties of CAN messages like frame start, CAN errors, or CAN ID

Now available with J1939 support

The new J1939 Add-in extends the functional range of the diagnostic device by the support for the SAE J1939 standard. The CAN data traffic is interpreted according to the included J1939 database and is represented in a way that is understandable for the user.

Features

- Representation of J1939 data interpreted according to PG and SP definitions
- SAE J1939 database with all definitions and the included parameters
- Decoding of multi-packet messages with payload data up to 1785 bytes
- Support for address claiming
- Display of DM and DTC diagnostic data

The J1939 Add-in is activated with a device-bound license which can also be purchased afterwards for a PCAN-Diag FD.

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