Welcome CAN XL

CAN XL, the next generation CAN-based data link layer, will be introduced officially beginning of this decade. Its usage is intended as in-vehicle network and in non-automotive applications.

The button is pushed: The new decade has started with a lot of challenges deriving from megatrends (Source: Adobe Stock)

The 20th year of the 3rd millennium, the 20th year of the 21st century, and the 1st year of the 2020s decade is just a few days old. Nobody knows what the next decade holds for us. In 2010, there was no indication that CAN FD is on the decade's agenda. This year, CAN FD continues its way into passenger cars and will continue to migrate into in-vehicle network architectures. Step-by-step nearly all automakers will release passenger cars implementing CAN FD within the next years. Especially, Chinese brands are in development phase of e-cars using CAN FD.

In the next decade, in-vehicle architectures are migrating from the historical flat network approaches to the domain-related approach. Of course, automakers will also implement mixed architectures using brand-specific migration paths. Already the next approach is knocking at the door: the so-called zone-oriented architecture. It is suited for distributed computing. Additionally, it is an optimized solution for reducing cabling, because different application domains can share the backbone networks as well as the local network segments. This approach enables also user-defined cars, which follows the megatrend of individualization. Individualization is not just a trend on single-person solutions, but also on tribes and communities.

For zone-oriented in-vehicle network architectures, common standardized higher-layer protocols are needed. They should be as far as possible independent on the lower-layer protocols. This would allow using dedicated technical and commercial feature of different communication technologies. Of course, to support TCP/IP Classical CAN and CAN FD are not the best lower-layer approach. Therefore, CiA and its members have started to develop CAN XL with a physical layer supporting 10 Mbit/s and perhaps a little bit more. This does not mean that TCP/IP is the best transport/network layer approach. But DoIP is already standardized in ISO.

The CAN XL specification is not yet finalized. There are still some open issues. Already decided is the data field length of up to 2048 byte and the 11-bit priority field. Additionally, the protocol provides an 8-bit indicator for the used next higher protocol. This is so-to-say an embedded layer-setting parameter not fitting in the classic OSI reference model. Such embedded layer-setting parameters would be also helpful for the other higher-layer protocols, to simplify multi-protocol stacks. Nowadays, there are too many different higher-layer protocols standardized, which are not completely independent of the used lower-layer protocols. Some ISO experts like to overcome this.

CAN XL will be officially introduced during theinternational CAN Conference (iCC), which will take place in Baden-Baden (Germany) mid of March. Later on this year, when the CAN XL specifications have been released and related plugfests have proofed the interoperability of first implementations, CiA will submit them to ISO for international standardization.

CANopen FD is under review and will be updated to support also payloads of up to 2048 byte. This means, CAN XL can be used as a lower-layer approach for the CiA 1301 CANopen FD application layer and CiA's profile specifications.

"CAN XL with a transmission rate of up to 10+ Mbit/s closes the gap between the multi-drop CAN FD network with 2 Mbit/s and the 100-Mbit/s Ethernet backbone network," said Holger Zeltwanger, CiA Managing Director and convener of the ISO TC22 SC31 working group 3. CAN XL is scalable regarding payload length (1 to 2048 byte) and bitrate (below 1 Mbit/s to 10+ Mbit/s). This gives the system designer flexibility to adjust the network to the application needs.

Other megatrends supported by CAN

There are other megatrends, which can be supported by CAN-based networks. This includes a growing population (demography change) with the challenge to provide sufficient food and drinking water. The CAN-based Isobus protocol used in agriculture machines is one small mosaic tile of the future picture of precision farming. Additionally, CAN XL can help to improve the embedded control system used in autonomous farming machinery. Similar control system requirements appear in construction and mining machines.

Harvesting robots and autonomous driving agriculture machines are candidates for CAN-based control networks including CAN XL (Source: Adobe Stock)

Another megatrend is the silver society. People become increasingly older and need support. It is expected that 8,5 billion people are living on our planet in 2030 (2015: 7,3 billion people). About 1 billion of them will be over 65 years. This means, there will be not enough young people to serve all these elder ones. Service robots can solve this problem by helping elder people in their everyday lives. Many of these robots could use embedded CAN networks for different purposes. One of the key elements is ros_canopen, an open-source software package running a CANopen protocol stack with the Robot Operating System (ROS). The ISO TC299 working group 6 standardizes service robot modules and its interfaces. "If this standardization activity is successful and applicable," stated Zeltwanger, "service robot design could be simplified. Standardized but configurable building blocks could be produced in higher volumes for lower prices." Perhaps, there are additional synergy effects with other application domains such as agriculture robots.

Our planet needs some help

Everyone talks about the climate crisis and the limiting resources of raw material. We need to reduce energy consumption and waste production. These means more sophisticated control technologies are required. Of course, we also can only consume goods, which we really need. Besides avoiding energy consumption and unnecessary garbage, we can control actuators more efficiently, in order to limit energy consumption. CiA has already developed some CANopen specifications to support this. The CiA 458 CANopen device profile for energy measurements is one example. Unfortunately, it was not implemented frequently. One exception is the energy metering module by White Bream, which can be connected by a gateway to the Internet.

This is also a megatrend: connectivity. CiA is prepared to support this by means of the CiA 309 series specifying TCP/IP gateways for CANopen. Part 5 of this specification series standardizes the mapping of RESTful (representational state transfer) Web services and Web sockets. "This specification will be implemented increasingly in the next years," said Zeltwanger. It could support condition monitoring, which enables saving of resources and improving actuator efficiencies.

"We are looking forward to a decade of new CAN applications," forecasts the CiA managing Director. "I hope as Dave Robins from CiA member Intrepid that the roaring 20's are returning. We need new ideas and smart brains to apply CAN technologies." Actuators might become sensors, in order to save resources. Smart transportation systems might reduce CO_2 pollution, and so on. The CES tradeshow starting on January 7 gives us hopefully some more brainchildren for CAN applications.

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