CAN XL plugfest in April


(Source: CiA)

CAN in Automation (CiA) has organized the third CAN XL plugfest, it took place in Troy, Michigan. IP cores from Bosch, Kvaser, and Vector were tested on interoperability as well as CAN SIC XL transceivers from Bosch, Infineon, NXP, and Texas Instruments.

Across from the SAE office in Troy, CiA members tested CAN XL nodes on interoperability. About 30 attendees started early in the morning of April 24 to setup their CAN XL products. After some difficulties to configure the same bit-timing, the morning session started with testing the CAN XL protocol. The FPGA implementations by Bosch and Vector had been tested successfully in the first two plugfest in Nuremberg in 2021 and 2022. In these previous plugfests also the IP core by Fraunhofer/Cast was successfully participating. This time, the IP core by Kvaser was the newcomer. “The CAN XL plugfest was not just about connecting first prototypes of protocol controllers and transceivers from different vendors around the world. The general objective was to test protocol features, the performance of physical layer implementations and potential network designs. It is also an initial and very important step towards the interoperability of CAN XL and a platform to connect engineers with different backgrounds, opinions, and ideas," explained Patrick Isensee from the C&S group.

Morning session: CAN XL protocol testing

Dr. Arthur Mutter (Bosch) led the plugfest. He is also the chairperson of the CiA SIG (special interest group) CAN XL developing the CAN XL specifications. In the plugfest preparation meeting, different bit-timing settings were agreed as well as a 2-pin AKL connector. The selected cable was a twisted Flexray-style cable with a 100-Ohm impedance. The C&S group provided the cable with connectors.

After all nodes to be tested were connected, the morning session started. The tests included receive error cases and transmit error cases. These tests were performed with error signaling enabled as well as disabled. Each bit of the valid CAN XL frame was corrupted and the transmitting node as well as the receiving node reaction was proofed on correct behavior. All three IP core implementations behaved accordingly to the CAN XL specification (CiA 610-1). In the meantime, CiA 610-1 has been integrated into the ISO DIS 11898-1 standard, which will be voted, soon.

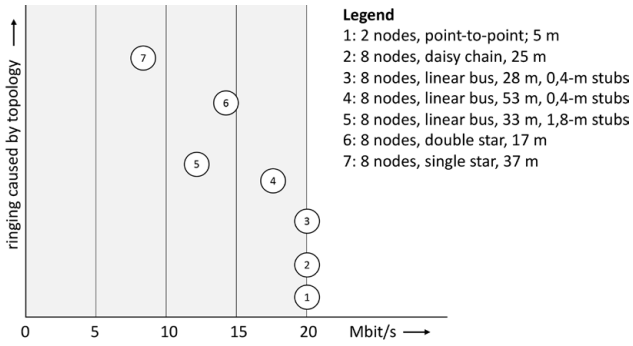

Figure 1: The maximum data phase bit rate depends on the ringing caused by the topology – the more ringing limits the data phase bit rate (Source: CiA)

Afternoon session: CAN XL physical layer testing

In the afternoon several topologies were used. The maximum achieved data phase rate bit-rates are shown in the figure. The arbitration bit rate was 500 kbit/s. The tested CAN SIC XL transceiver compliant with the CiA 610-3 specification were provided by Bosch, Infineon, NXP, and Texas Instruments. NXP used its 2nd generation stand-alone transceivers. The selected topologies (see the figure) were calculated and simulated in advance. The calculated, simulated, and measured results for the selected topologies were nearly identical. This confirmed the robustness and reliability of CAN XL communication.

For the first time, the CAN SIC XL transceivers by Texas Instruments were tested in a CiA plugfest. The results are impressing: 20 Mbit/s seemed to be possible for linear bus topologies with short stubs connecting eight nodes with heterogenous transceivers. But even, if more challenging topologies are needed (i.e. stars and double-stars) high data phase bit rates can be achieved. The wiring harnesses used in plugfest were not optimized. To be serious, the 20 Mbit/s bit rate is the limit for the specified PWM (pulse-width modulation) coding.

Oscilloscopes from different suppliers (Keysight, Pico Technology, Rohde & Schwarz, and Teledyne) were used to decode the CAN XL frames and to measure the bit waveforms on the network lines. All these products provided trigger and decoder functionality. In addition, Vector used its CAN XL tools to analyze the protocol and to generate erroneous CAN XL frames.

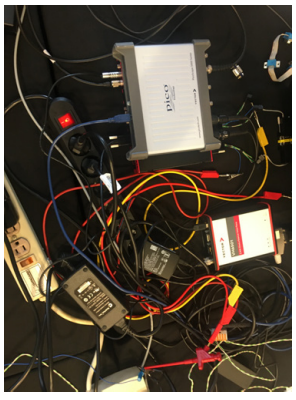

Figure 2: Even though the cabling looks chaotic, the performed interoperability tests worked fine (Source: CiA)

The participating companies were more than satisfied. Dr. Arthur Mutter (Bosch) stated: "It was a great success, as it showed that a significant number of implementations are available and all are interoperable! We successfully performed extensive layer-2 tests (reaction on transmit and receive errors) and layer-1 tests."

"The plugfest proved that the interest in CAN XL and the ecosystem of controllers, transceivers, and tools are developing quickly", said Teun Hulman from NXP. "Our 2nd generation of CAN SIC XL prototype transceivers once again proved to be a robust implementation and able to reliably achieve bandwidths up to 20 Mbit/s in complex topologies, also in combination with other implementations. This paves the way for adoption of CAN XL technology in future vehicle and industrial networks." Vikas Thawani from Texas Instruments (TI) added: "We have successfully demonstrated our 8-pin stand-alone CAN XL transceiver performance in multiple topologies. TI's transceiver supports low-power standby mode and highest bus fault (±58 V) compared to other solutions currently available."

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