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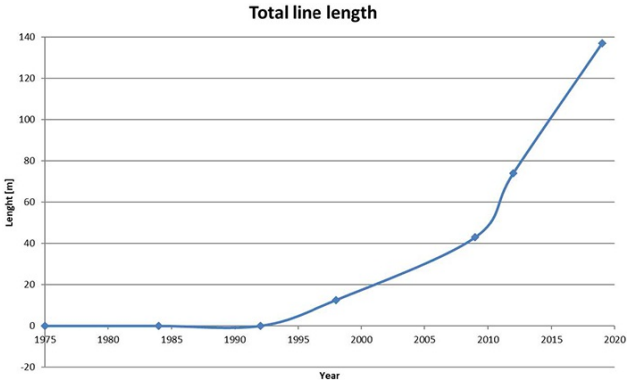
Future of CAN networking in VW's passenger cars

VW has established the Car.Software unit. It is not only responsible for the software development as the name suggests, but also for the in-vehicle networking. CAN is an important communication technology for future VW cars.



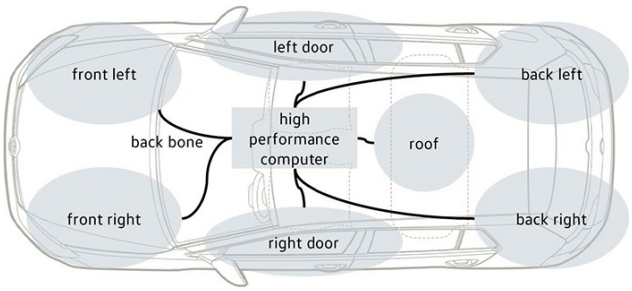
Total network length in Golf cars, which needs to be reduced in future vehicles to save weight (Source: VW)

The complete article is published in the March issue of the CAN Newsletter magazine 2021. This is just an excerpt.

CAN was, is, and will be one of the most important communication technologies used in VW's passenger cars. Historically, the Volkswagen (VW) Group was the inventor of the A-Bus, competing against Classical CAN, in the late 80ties. After the automotive industry decided to use jointly the OEM-independent (original equipment manufacturer) CAN protocol, originally developed by Bosch, VW was and is highly committed to CAN, internationally standardized in the ISO 11898 series. VW is even one of the early CAN FD supporters, and initiated the development of the CAN XL protocol, the third CAN protocol generation.

Carsten Schanze from Volkswagen stated in his iCC 2020 keynote (the conference has been postponed to June 2021, due to the Covid-19 pandemic) that the Golf models are the carriers of new communication technologies: "The Golf was established in 1974 and, until today, more than 35 million vehicles are sold. The requirements for future CAN networks respectively future architectures will be found by looking into the CAN networks of the Golf generations." In the first three Golf generations no CAN network was implemented at all. CAN communication started with the fourth generation of the Golf in 1998 with two CAN networks.

Nowadays, there is the trend to substitute even some LIN networks by CAN networks. "This change is done due to diagnosis requirements," explained Schanze. "The introduction of Ethernet-based communication technologies, e.g. 100Base-T1, in control units shifts the CAN control units one level down. CAN control units are mainly used as sensor respectively actor control units." Furthermore, security reasons necessitate transmitting a signature for certain ECUs (electronic control units).



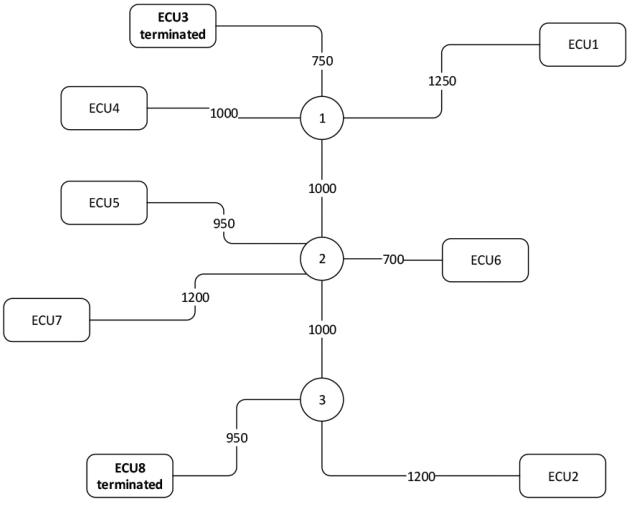
Zone networking architecture example (Source: VW)

In order to reduce the effort of generating such a signature, messages are merged, so that just one signature is needed instead of multiple once for shorter messages. This leads to messages with larger data fields. This is, why VW proposed the CAN XL protocol with payloads up to 2 048 byte. Additionally, this allows an easy integration in a TCP/ IP-based environment using Ethernet-based networks as backbone between different zone control sub-systems with deeply embedded networks.

Carsten Schanze provided in his iCC paper the following future requirements, deriving from an analysis of the past and present in-vehicle networking:

- Clean-up of the wiring harness, in order to reduce the weight, to gain space, and to ensure the signal integrity;
- More scalability, in order to get more bandwidth and to get sufficient payload length.

"The vision for the future is to reduce the different architectures: 'One architecture fits all', stated Schanze. "Zone architectures will solve the first requirement to reduce the weight and gain space for the packaging of control units and the layout of the wire harness. The requirements for the bandwidth are increasing from the senor/actor level to the high-performance computer."



The introduction of zones offers an additional possibility of scaling. As today, the number of ECUs and the bit-rate are scalable. "Furthermore, the number of zones in the car and the communication technology of backbone networks are scalable," Schanze added. "A good approach of a communication technology for such an architecture seems to be CAN XL."

The CAN XL protocol offers a data-field that is able to transmit TCP/IP segments. CAN XL-connected ECUs can be used in a multi-drop topology. The bit-rate of the CAN XL communication is scalable until a net bit-rate of more than 10 Mbit/s. CAN XL can run on high-speed CAN physical interfaces as specified in ISO 11898-2:2016, CAN SIC interfaces as specified in CiA 601-4 as well as CAN XL SIC interfaces as specified in CiA 610-3 (under development). Of course, the CAN XL payload is also scalable from 1 byte to 2 048 byte.

If you would like to read the full article from Holger Zeltwanger

Possible CAN XL topology (Source: VW)

(CAN Newsletter) you can download it free of charge or you download the entire magazine.

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