Tasks and aims of CiA: 20 years of CAN knowledge

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March 1992, eight parties (companies and private persons) established the CAN in Automation users' and manufacturers' group. Today the nonprofit association comprises more than 550 members, companies, universities, and research institutes. The organization has developed more than 10000 DIN A4 pages of specifications and recommendations. In the twenty years, CiA has organized thirteen international CAN Conference and more than 1000 trainings. Since the beginning, distribution of product information was one of the important activities. Another CiA service is testing of CANopen products.

The main objective of the CiA association is, was, and will be to foster the image of the CAN technologies as well as the development of all layers of the ISO reference model for CAN-based networks. CiA is not limited to industrial automation applications, but covers all industries – from transportation (passenger cars, commercial vehicles, railways, ships, and aircrafts) to deeply embedded networks in laboratory equipment and medical devices.

Standardized higher-layer protocols

When the CiA was established in 1992, there was no higher-layer protocol standardized. Even the physical layer was not standardized. In order to achieve compatibility, interoperability, or even changeability of devices with CAN interfaces, it is not sufficient to standardize the CAN data link layer protocol. One of the first standardization, CiA members started with was to agree on data-rates and the related bit-timing rules.

From the very beginning, CiA members were concerned with the development of a generic application layer for CAN-based networks. The first outcome was the CAN Application Layer (CiA 200 series). Unfortunately, this "academic" approach was not suitable for industrial applications. Industrial users require more standardization. They want also to specify the content of the transmitted data in order to achieve interoperability of devices. This means, it is necessary to standardize communication, devices, and interface profiles.

Communication profiles also standardize the network management, the error management, the layer management, and other communication mechanism. Device profiles describe all process data, configuration parameters, and diagnostic information in detail. This includes also the mapping of the application data into CAN messages. Interface profiles are used when a device provides gateway functionality. In some industries, it is not sufficient to standardize single interfaces, but the entire communication in the network. This is done in application profiles.

For historical reasons, several parties started in the early 90's to develop higher-layer protocols for CAN-based networks. The carmakers invented all their own solutions. In the USA, the SAE (Society of Automotive Engineers) standardized the J1939 application profile. It was originally intended for powertrain applications in trucks and buses.

Allen-Bradley and Honeywell Micro Switch developed the DeviceNet respectively the Smart Distributed System (SDS) protocols for factory automation. Both have been international standardized in IEC 62026 (in the

meantime SDS has been withdrawn due to no support).
In a European research project, CANopen was developed. It was based on the CAL from CiA, but introduced the missing specification for communication and device profiles. In 1994, CiA received 60 DIN A4 pages for further development and maintenance. Today, there are more than 10000 pages of CANopen specifications. Originally, the CANopen profiles were intended for embedded machine control. Due to the robustness and reliability of the CAN lower layers, CANopen was accepted in many other industries such as medical devices, rail vehicles, lift control systems, and even in light electrical vehicles (e.g. Pedelecs).
There have been internationally standardized also some dedicated higher-layer protocols and application profiles. This includes solutions for agriculture and forestry machine (ISO 11783 series also known as Isobus), for marine navigation (IEC ????? also known as NMEA2000), and for aircrafts (Arinc ???).

Manufacturer-independent training

CiA provides regularly manufacturer-independent seminars. Skilled CiA trainers educate newcomers in CAN lower layers and CANopen profiles. Besides open seminars scheduled by CiA, companies may also request in-house seminars with dedicated agendas. CiA don't provide CANopen implementation-oriented seminars.
CiA also cooperates closely with universities and other nonprofit institutes in organizing training events. Sometimes, CiA provides trainers for joint education activities with members. In particular hand-on trainings are performed jointly with members.
CiA organizes and co-organizes conferences in order to provide platforms for exchanging CAN knowledge and experiences. The international CAN Conference (iCC) was held thirteen times. The iCC proceedings are an important sources of information for the CAN community. Most of the papers are available in PDF-format for free download from CiA's website. The technical details given in these papers are "prior art" information in respect to patents.

Website, magazines, and catalogs

Already in June 1992, CiA published its CAN Newsletter. This unique source of CAN-related information was in the beginning just a photocopied and hand-stapled publication. Nowadays, it is a available as a technical magazine (in printed and PDF version) as well as online magazine with different content. The quarterly published "printed" CAN Newsletter contains mainly technical articles and application reports with detailed information. The CAN Newsletter Online provides more product-oriented information, which is continuously published. Both publications are highly linked to the Product Guides (CANopen, CAN, and J1939) also published by CiA as well as to CiA's website, which provides generic basic information about CAN technology.
Since this year, CiA has established its cross-media strategy integrating all CiA publications. The process of linking the different publications is ongoing. Also the improvement of CiA's website is ongoing. In particular, the information on CANopen profile needs to be updated and reviewed. Depending on the financial income from advertisements, CiA is able to spend more human resources for the editorial staff in order to increase the quality and quantity of information given in tis publications.

Testing of CANopen products

Open specifications require testing of devices in order to reduce problems during system integration. Unfortunately, CiA has not established a mandato-

ry CANopen conformance certification procedure. Nevertheless, since a long time CiA's CANopen conformance test tool is available. Recently, a new tool has been released. It just tests the conformity to the CiA 301 application layer and communication profile. The new test tool provides the ability to add in the future additional conformance tests for additional functions and device profiles. Conformance testing is like spellchecking in human communication. This means, interoperability is not guaranteed by just testing the conformity. Therefore, CiA has added a new service: Interoperability testing of CANopen devices. Since some years, CiA members have organized so-called CANopen plug-fests in order to prove device interoperability. Unfortunately, not all device manufacturers are ready in time with the scheduled plug-fests. In order to overcome this scheduling problem, CiA has set up in its laboratory a "golden" CANopen network, which is used to test interoperability. In such a test session, the device-under-test (DUT) is integrated into the network, configured by the host controller and/or a configuration tool. This includes proving the PDO configuration functionality. Finally, the DUT will be stressed by means of high busloads and long cables (including not terminated stub-cables).

Future of the CAN technology

In general, the CAN technology is very mature. The lower layers are robust (CAN physical layer) and reliable (CAN data link layer). The CANopen application layer provides sufficient flexibility to address very different application fields. The CANopen profiles guarantee device interoperability requested by most of the industries. Due to the outstanding features of the CAN lower layers and the CANopen application layers including the low price for hardware, software and tools, further industries requires standardized profiles. Recently, the carmakers are developing the CiA 447 profile for add-on devices used in police cars, taxis, ambulances, and vehicles for handicapped drivers. Another profile under development is the CiA 454 for power management first installed in light electrical vehicles (LEV) and in the future in caravans as well as recreation vehicles.

But there are also new requirements regarding the lower layers. The automotive industry is running out-off bandwidth. Most of the high-end cars are using already multiple CAN segments interconnected by means of bridges, routers, or gateways. If they don't filter heavily CAN messages in the network infrastructure components, busloads come to the physical limits of the CAN networks. Also when downloading software, the time can be reduced, if higher data-rates are possible. Bosch has therefore introduced the CAN-FD protocol, which is backwards compatible to the CAN protocol as standardized in ISO 11898-1. CAN-FD networks may use the same physical layer (e.g. ISO 11898-2 compatible transceivers).

In order to save energy, the carmakers are working on solutions for pretended and partial networking. This requires CAN transceiver chips, which are capable to wake up by means of a dedicated message with dedicated data content. Such transceivers are specified in ISO 11898-6. Selective wake-up devices are also suitable for commercial vehicles including off-highway and off-road vehicles.

Artykuł na zasadzie przedruku – nie podlega recenzowaniu.