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CAN History

In February of 1986, Robert Bosch introduced the CAN (Controller Area Network) serial bus system at the SAE congress in Detroit. Mid 1987, Intel delivered the first stand-alone CAN controller chip, the 82526. Shortly thereafter, Philips Semiconductors introduced the 82C200. Today, almost every new passenger car manufactured in Europe is equipped with at least one CAN network. Also used in other types of vehicles, from trains to ships, as well as in industrial controls, CAN is one of the most dominating bus protocols. To date, chip manufacturers produced and sold more than 500 million CAN devices in total.

Although CAN was originally developed to be used in passenger cars, the first applications came from different other market segments. Especially in northern Europe, CAN was already very popular in its early days. Beginning of 1992, the users and manufacturers established the 'CAN in Automation' (CiA) international users and manufacturers association. One of the first tasks of the CiA was the specification of the CAN Application Layer (CAL). Although the CAL approach was academically correct and it was possible to use it in industrial applications, every user needed to design a new profile because CAL was a true application layer. Since 1993, within the scope of the Esprit project ASPIC, a European consortium lead by Bosch had been developing a prototype of what should become CANopen, the CAL-based profile for embedded networking in production cells. In 1995, CiA released the completely revised CANopen communications profile. The CANopen profile family defines also a framework for programmable systems as well as different device, interface and application profiles. This is an important reason why whole industry segments (e.g. printing machines, maritime applications, medical systems) decided to use CANopen during the late 1990s.

In the early 1990s, engineers at the US mechanical engineering company Cincinnati Milacron started a joint venture together with Allen-Bradley and Honeywell Microswitch regarding a control and communications project based on CAN. However, after a short while, important project members changed jobs and the joint venture fell apart. But Allen-Bradley and Honeywell continued the work separately. This led to the two higher layer protocols 'DeviceNet' and 'Smart Distributed System' (SDS), which are quite similar, at least in the lower communication layers. In early 1994, Allen-Bradley turned the DeviceNet specification over to the 'Open DeviceNet Vendor Association' (ODVA), which boosted the popularity of DeviceNet. Honeywell failed to go a similar way with SDS, which makes SDS look more like an internal solution by Honeywell Microswitch. DeviceNet was developed especially for factory automation and therefore presents itself as a direct opponent to protocols like Profibus-DP and Interbus. Providing off-the-shelf plug-and-play functionality, DeviceNet has become the leading bus system in this particular market segment in the US.

With DeviceNet and CANopen, two standardized (EN 50325) application layers are now available, addressing different markets. DeviceNet is optimized for factory automation and CANopen is especially well suited for embedded networks in all kinds of machine controls. This has made proprietary application layers obsolete; the necessity to define

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application-specific application layers is history (except, perhaps, for some specialized high-volume embedded systems).

Of course the more than 50 semiconductor vendors who have implemented CAN modules into their micro-controllers and ASICs are mainly focused on the automotive industry. Since the mid 1990s, Infineon Technologies (formerly Siemens) and Motorola have shipped large quantities of CAN controllers to the European passenger car manufacturers. As a next wave, Far Eastern semiconductor vendors have also offered CAN controllers since the late 1990s. Since 1992, Mercedes-Benz has been using CAN in their upper-class passenger cars. Now nearly all new European passenger cars are equipped with several networks, some high-end cars implement up to five CAN networks.

Although the CAN protocol is now 15 years old, it is still being enhanced. In the last two years an ISO task force defined a protocol for a time-triggered transmission of CAN messages. The TTCAN extension will add about five to ten years to the lifetime of CAN. When taken into account that CAN is still at the beginning of a global market penetration, even conservative estimates show further growth for this bus system for the next ten to fifteen years. This is underlined by the fact that the US and Far Eastern car manufacturers are just starting to use CAN in the serial production of their vehicles over the next few years. Furthermore, new potentially high-volume applications (e.g. entertainment) are in the pipeline – not only in passenger cars but also in domestic appliances, automatic building doors.

Several enhancements regarding the approval for different safety-relevant and safety-critical applications can be expected for the higher-layer protocols (HLP). The German professional association BIA and the German safety standards authority TÜV have already certified some of the proprietary CAN-based safety systems. CANopen-Safety and DeviceNet Safety are the first standardized CAN solutions to earn a tentative TÜV approval. Approval of the CANopen framework for maritime applications by one of the leading classification societies worldwide, Germanischer Lloyd, is in preparation. Among other things, this specification defines the automatic switchover from a CANopen network to a redundant bus system.

In the future, CiA members will define several CANopen application profiles. An application profile specifies all device interfaces used in a specific application. This includes direct communication between dedicated devices overcoming the master/slave PDO communication as usual in standard device profiles. The first CANopen application profiles will be for automatic building doors, lift control systems, road construction machinery or light railways.

Historia CAN

Streszczenie: Artykuł prezentuje historię powstania sieci CAN oraz jej rozwój aż po dzień dzisiejszy. Przedstawiony został udział organizacji CiA w pracach nad CAN oraz dalsze działania na przyszłość w tej dziedzinie. Przedstawione zostały również obszary stosowania sieci CAN.

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