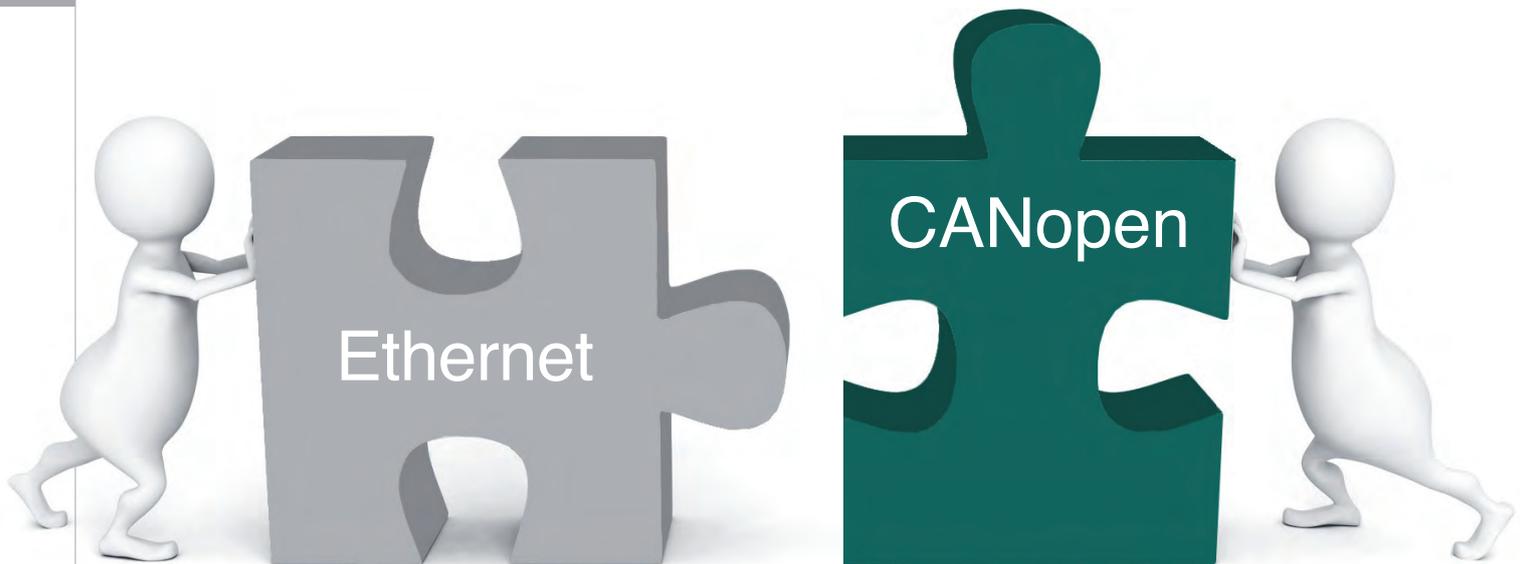


# Combining Ethernet and CANopen

Whenever data needs to be communicated between a serial bus system and Ethernet, gateways provide the bridge. This solution is controlled via TCP/IP and supports CANopen PC cards as DIN-rail mountable devices.



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## CAN Newsletter Online

CANopen in industrial automation



**N**ethost, the latest gateway from Hilscher, offers a totally different approach to conventional solutions. Controlled via native TCP/IP, it supports the full feature set of Hilscher's standard CANopen PC card in accordance to CiA 301 but as a DIN-rail mountable device.

„It controls 1000 CANopen I/O's within a millisecond without requiring an own designated CANopen connection“, would be a convincing advertising message for a PLC system offering only an Ethernet interface by design, while still providing full access to CANopen nodes devices. Nethost is „hosting“ the missing CANopen interface as an Ethernet node. Thanks to the simplicity of the TCP/IP protocol and the high transmission range of 100 Mbit, this is a suitable

replacement for conventional integrated serial bus system solutions.

## Ethernet and so-called fieldbus hand in hand

The use of Ethernet for establishing a modern communication infrastructure offers high potential savings. Transparency of the system, uniform wiring standards, simple redundancy concepts to avoid downtimes and short processing cycles in combination with high deterministic are only some of the advantages of the Industrial Ethernet. Unfortunately though, machine designers have to choose between 6 different Industrial Ethernet protocols competing on the market in the meantime. Implementing and supporting any of them calls for high up-front investments in order to gain just a high-

er level of performance not often needed.

„Does it always need to be industrial-standard Ethernet? In most cases, maintaining the serial bus system still in combination with the simple office-standard Ethernet results in a sufficient solution too,“ commented Armin Beck, product manager for gateways at Hilscher, on the seemingly inevitable change. Indeed, it can make sense to continue using the potential of the already available serial bus system. For example, strict real-time response is usually only required by motion control applications. In more than 95 % of all other applications it is completely irrelevant. Processing cycles lower than a millisecond is only in very few cases required. Nethost is a feasible solution for all applications, where machine control via serial

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bus system has proved to be a reliable concept and now intended to be operated remotely via Ethernet. It offers latency as low as 1 ms and the support of simple TCP/IP. The bandwidth of the 100 Mbit Ethernet is sufficient to allow safe simultaneous addressing of up to five such devices via one Ethernet line, which was proven by measurements.

### Protecting investments in serial bus system devices

When looking at its sales history, Hilscher observes a clear trend towards Ethernet. Demand has risen considerably especially during the past two years. Yet, with a market share of over 70 %, serial bus system technology still holds a strong position and will continue to exist for many years. This also means that machine manufacturers will need to support both systems for quite some time, which the company took as a special challenge. „When discussing the concept for the new product, protecting investments was of primary importance to us,“ stated Beck and added: „It was therefore not our goal to simply replace the serial bus system with industrial Ethernet. Instead, we wanted to combine both technologies in a simple way to address a wider market and allow customers to continue using proven field devices.“ The ideal of a gateway based upon TCP/IP was born.

The CiA organization as well took account of the Ethernet trend and developed the standard CiA 309 dealing with the subject of “Interfacing CANopen with TCP/IP”. As an immediate result, a few Ethernet to CANopen gateway servers emerged on the market redirecting and forwarding TCP/IP coded CANopen commands to the underlying CANopen system

one by one, enabling its remote control over Ethernet. Nethost, however is different and not just a simple server. It includes a fully featured CANopen master that runs autonomously and takes care of all configured transmit- and receive-PDOs of its nodes by itself. All these PDOs then are offered in a compressed process data output and input image, a single Ethernet service grants access to. With the simplicity of this interface a Nethost user needn't care about all the CANopen services, the protocol handling and the configuration. This enables the effortless integration into conventional PLC systems used to operate with cyclic IO images anyway. Nethost furthermore maintains no CANopen object dictionary to be configured over CiA 309 services. Much simpler: the configuration is done as a whole and in one step with a graphical configuration tool.

Apart from the PDO transmissions the CANopen Nethost supports various CANopen specific services as well that can be instructed over Ethernet.

Supported are SDO communications and NMT master operations. Nodes emergency messages are collected node wise in diagnostic buffers requestable by the Ethernet application as well. If necessary is it also possible to transmit and receive pure CAN telegrams to the network at any time by using COB-ID filtering.

### Short time-to-market

TCP/IP as such takes care of safe transmission from and to the Nethost. The transparently transmitted telegrams are coded and classified depending on their purpose, adding only a few bytes to the header of the telegram. The coding is Hilscher specific. Using the standard proposals CiA 309-2 or CiA 309-3 for encoding the services over Modbus TCP or ASCII does not go far enough. Nethost is pursuing a global and serial bus system independent approach over all its supported serial bus systems such as Profibus, DeviceNet and CANopen. A Nethost supports a watchdog function, which for

example CiA 309 does not cover, bringing the underlying CANopen system into a safe state when the Ethernet application dies.

The coding logic is provided by Hilscher as part of a C source code. It is projected to a socket interface and is therefore compatible with any TCP/IP stack. On the side of the application, it is abstracted to a simple procedural serial bus system independent API interface. Simple functions, such as open, close, reset, send, receive or I/O-exchange guarantee a fast learning curve to allow shortest-possible integration times. Based upon the RPC principle, functions are decoded inside the device and processed remotely. In order to make it easy for embedded programmers as well, a DLL allows immediate use of the Nethost under Windows, while a C toolkit shows a sample implementation under Linux.

The Nethost's API access functions confirm to the Hilscher platform strategy and follow the basic principle „once installed – everything works“ just like ▶



Figure 1: The Nethost enables PC card 'slot-less' compact industrial PCs or other embedded systems connectivity to and control of serial bus systems over Ethernet (Photo: Hilscher)

with Hilschers PC cards. For example, exchanging the Windows PC cards DLL against the Nethost DLL allows exchanging both product ranges without any need to change the application program. Both DLLs have the same API. Whatever was formerly controlled locally over a PC, can now be controlled remotely via Ethernet directly from the process control level. „Using the same API turns Nethost into a dedicated PC card for the switching cabinet. For systems without PC card slots, it even turns into a direct replacement for PCMCIA PC cards for example,“ Beck commented on the access via the Ethernet and added: „And if a system already supports our PC cards, it will automatically also support the operation of a Nethost.“

Hilscher was able to win two of its long-standing customers to integrate Nethost into their solutions. For many years, these companies had ordered high quantities of PC serial bus system cards to control their peripheral components. After 15 years, however, both of them announced to work on a new generation control solution, which offered more compact dimensions in combination with increased flexibility, but could only be addressed via standard Ethernet interfaces. Yet, they did not want to give up support of established serial bus system technology and looked for a migration path to their new product generation. Using a conventional TCP/IP stack and a standard Ethernet controller, while utilizing existing programming experience, these companies were able to offer system integration within a minimum of time. Today, they are in a position to serve both the existing base of serial bus system customers, as well as new Ethernet customers.

### Future steps

The next step of the development of Nethost is already under way. In the 3<sup>rd</sup> quarter of the year, Hilscher will present three new models of its Nethost range on the market. The already existing models for CANopen, Profibus, and DeviceNet will be complemented by models for Profinet, Ethercat and Ethernet/IP Master. In this way, Hilscher reacts to an increased demand for TCP/IP applications in the real-time Ethernet world. In general all models are configured via a serial bus system-independent uniform FDT/DTM-based configuration tool. In situations, where an engineering tool of the target system already exists, open configurations via standardized XML files are an alternative offering increased transparency. XML schemes turn the configuration data into the correct format and can be loaded into the Nethost after conversion into a binary file. In this way, the device can be fully integrated into any target system. ◀

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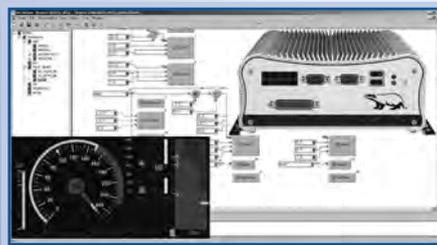
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