NEWS

SPS/IPC/Drives and SCS 08 exhibitions: POWERLINK stand draws impressive number of visitors

Numerous promising leads and many visitors with a great interest in implementation and application issues – that, in a nutshell, is what was in this year's recent exhibitions (the SPS/IPC/Drives in Nuremberg and the SCS, which took place in Paris for the first time) for the EPSG. "We are very satisfied with the results," says the POWERLINK User Organization's Managing Director, Rüdiger Eikmeier. "For one thing, we were able to convince many interested visitors that POWERLINK is an ideal solution for their requirements. Also, we have seen a multitude of questions regarding the initial deployment as well as enhancements of POWERLINK networks, which gives us a better understanding of just how solidly POWERLINK is established on the market, and how it continues to take hold." The new brochure, "POWERLINK Basics," was also well received; consequently, many visitors took a copy home with them. A publication whose release was scheduled to coincide with the industry show, the brochure provides an overview of POWERLINK technology and functionality. For further information, please refer to the following article.

"POWERLINK Basics" booklet now available for download

The EPSG has published "POWERLINK Basics", a concise 24-page brochure that explains all things POWERLINK in simple terms. The "POWERLINK Basics" booklet is available for download free of charge as a German or English language PDF file from the EPSG website at www.ethernet-powerlink.org.

Featuring an appealing and user-friendly layout, the brochure's five sections make generous use of graphics to give readers a quick grasp of key information. An introduction provides basic information on real-time communication systems and a preliminary definition of Industrial Ethernet. The first proper section then gives an overview of POWERLINK's basic functional principles. The second

Figure: The "POWERLINK Basics" brochure gives users a concise, easy-to-understand briefing on POWERLINK

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section goes on to describe POWERLINK's specific features and notable advantages in automation applications. The following section explains why POWERLINK technology is freely available, makes clear how the POWERLINK user organization EPSG operates, and includes a brief look back at POWERLINK's history and creators. The last chapter gives potential users hands-on know-how: readers interested in integrating the technology into their applications will find information on various venues of implementation and their specific advantages. This short, but thorough introduction to the world of POWERLINK concludes with an outlook to future developments. "With POWERLINK Basics, we provide an easy-to-understand, concise overview containing everything important for all interested parties," explains the EPSG's Managing Director, Rüdiger Eikmeier. "Readers who take the short time to read the brochure will learn what POWERLINK is all about, and which specific user benefits they stand to gain from it."

CANopen upgrade: Network migration from CAN to POWERLINK

Data volumes in automation applications are continuously increasing, the number of drives per machine is rising rapidly and sensors and actuators deliver a more and more powerful performance. Thus, applications are becoming increasingly complex and generate more data traffic. Moreover, a safety technology whose safety functions can be optimally adapted to the requirements of resource-saving production is increasingly used in automation applications, requiring considerably higher data traffic capacities. CANopen's underlying CAN transport protocol, however, limits the extension of CANopen networks. CAN merely provides a transfer rate of 1 Mbit/s in networks with an overall cable length of 25 m or less. If longer cables are required, the transfer rate must be further decreased in proportion to the distance.

Migrate to POWERLINK in four steps:

1. exchange CAN stack for POWERLINK stack
2. hardware adaptation: exchange CAN controllers for standard Ethernet controllers, exchange wiring for standard Ethernet cables
3. if required, integrate communication interface with co-processor support
4. adapt configuration

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continued: **CANopen upgrade:**

Network migration from CAN to POWERLINK

When is migration to POWERLINK recommended?
Users requiring higher capacities than those provided by CAN who whish to keep using CANopen's advantages are advised to migrate their network from CAN to POWERLINK. POWERLINK, which uses all CANopen mechanisms, is also called "CANopen over Ethernet". It provides a 100 Mbit/s transfer rate and allows for a maximum cable length of 100 m between two nodes. Additionally, glass fiber cables can be used, just like in standard Ethernet applications. This allows for a maximum line length of 2 km, thus creating the basis for virtually unlimited network extensions. Further POWERLINK features include hot plugging, multiplexing and cross-traffic. The real-time protocol is an ideal basis for POWERLINK Safety. More-over, POWERLINK enables users to implement high-performance, high-availability network structures.

Only the transport protocol is affected by the transition
In POWERLINK networks, the application layer carries all CANopen mechanisms. It uses the same device description files as CANopen, the same object dictionaries and the same communication mechanisms, such as process data objects (PDO), service data objects (SDO) and network management (NMT). Just like CANopen, POWERLINK includes direct cross-traffic among its key features. All CANopen applications and device profiles can be directly used via POWERLINK: from the point of view of the application, there is no difference between the two protocols. Basic-ally, a migration from CAN to POWERLINK means exchanging the transport layer. Both CAN and Ethernet, on which POWERLINK is based, specify only the two low-level layers. The application layer is not affected by exchanging the transport protocol.
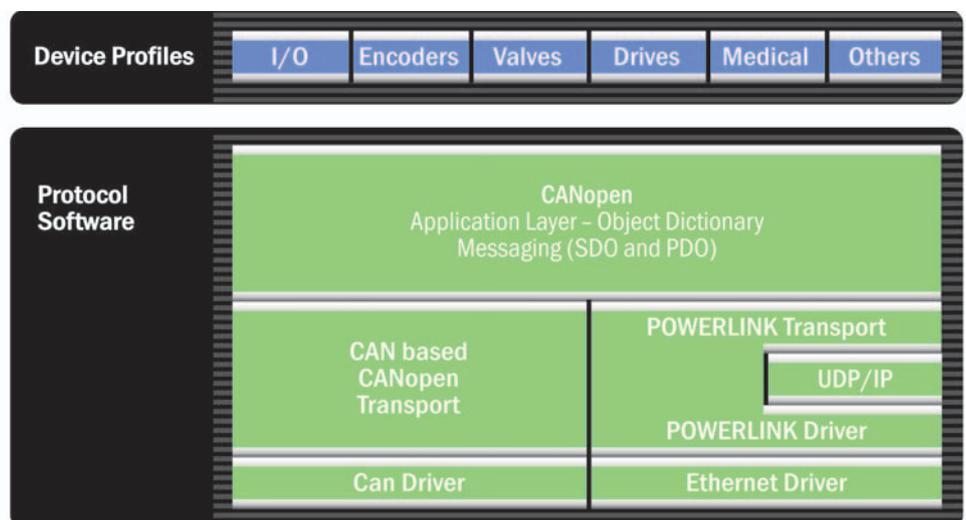

Figure 1: Comparison of CAN and POWERLINK. It is obvious that CAN and Ethernet merely establish the transport layers. The application layer, which carries the CANopen mechanisms, is independent from the transport protocol.

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Network migration from CAN to POWERLINK

Differences between CAN and POWERLINK communication

The migration mainly involves exchanging the CAN stack for the POWERLINK stack. After the migration, data transmission is altered. While CANopen transfer is event-based, sending 8 Byte process data objects without protocol overhead, POWERLINK's transfer method is cyclical and based on Ethernet frames. Several PDOs are combined in the user data area of a POWERLINK frame, which can contain up to 1,500 Byte. The fact that PDOs are no longer sent individually, but "en bloc", does not result in any disadvantages thanks to POWERLINK's extremely short cycle times. PDOs are sent during the synchronous phase, SDOs and NMT data during the asynchronous phase of the POWERLINK cycle. All POWERLINK devices are synchronized by the Start of Cycle signal, which the POWERLINK master (Managing Node) sends to all network nodes at the beginning of each cycle.
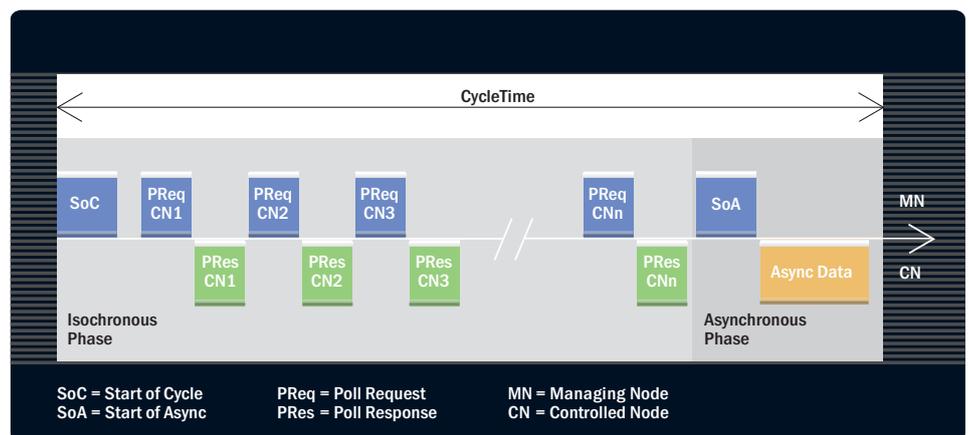

Figure 2: In POWERLINK networks, PDOs are sent during the time-critical isochronous phase, SDOs and NMT objects are sent during the non-time-critical asynchronous phase. Large data packets are distributed over the asynchronous phases of several cycles.

Which hardware changes are required?

Since CAN and Ethernet-based POWERLINK use fundamentally different transport mechanisms, migration requires exchanging the CAN controller for an Ethernet controller and replacing the wiring with standard Ethernet cables. As POWERLINK is 100% Ethernet standard compliant, standard cable and controller hardware can be used. If the existing application processor is supposed to handle all communication routines, it will require sufficient capacities. Processors in existing CAN applications, however, often do not provide enough performance for fast POWERLINK communication, which would result in inacceptable reaction times. Due to POWERLINK's high performance, users are recommended to employ interface solutions with a co-processor which supports the application processor in handling communication tasks.

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Network migration from CAN to POWERLINK

Adapting the configuration

After migration, application objects must be integrated. However, the configuration of a POWERLINK network does not differ greatly from that of a CANopen network in most processes. Therefore, many CAN experts also provide POWERLINK network installation services.

For device descriptions, POWERLINK uses the new XML standard, which was developed in cooperation with CAN in Automation. XML provides a wide range of new possibilities which could not be implemented by means of the formerly used EDS format. These include, amongst others, multi-language support, an option for text descriptions and the characterization of

Figure 3: XDD editor from _port_

parameters and measured values through physical units and scaling functions. As standard XML editors are only suitable for the manual generation of these device description files, users are recommended to employ the XDD editor (XML Device Description), a special configuration tool for Windows and Linux operating systems which greatly facilitates generating XML device description files. Import options for communication and device profiles render repetitive, error-prone activities obsolete. Existing CANopen EDS or XML files can be easily imported.
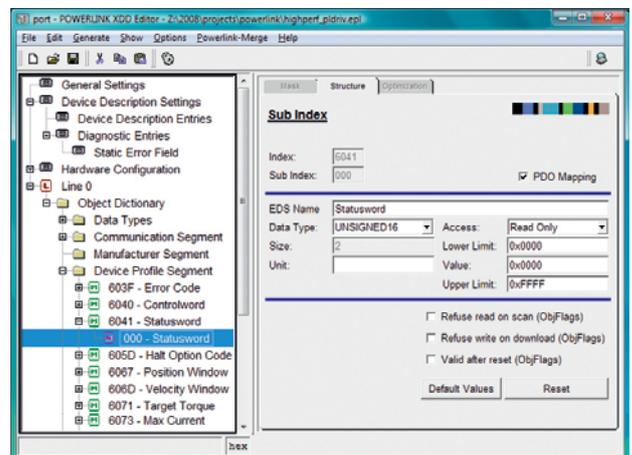
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