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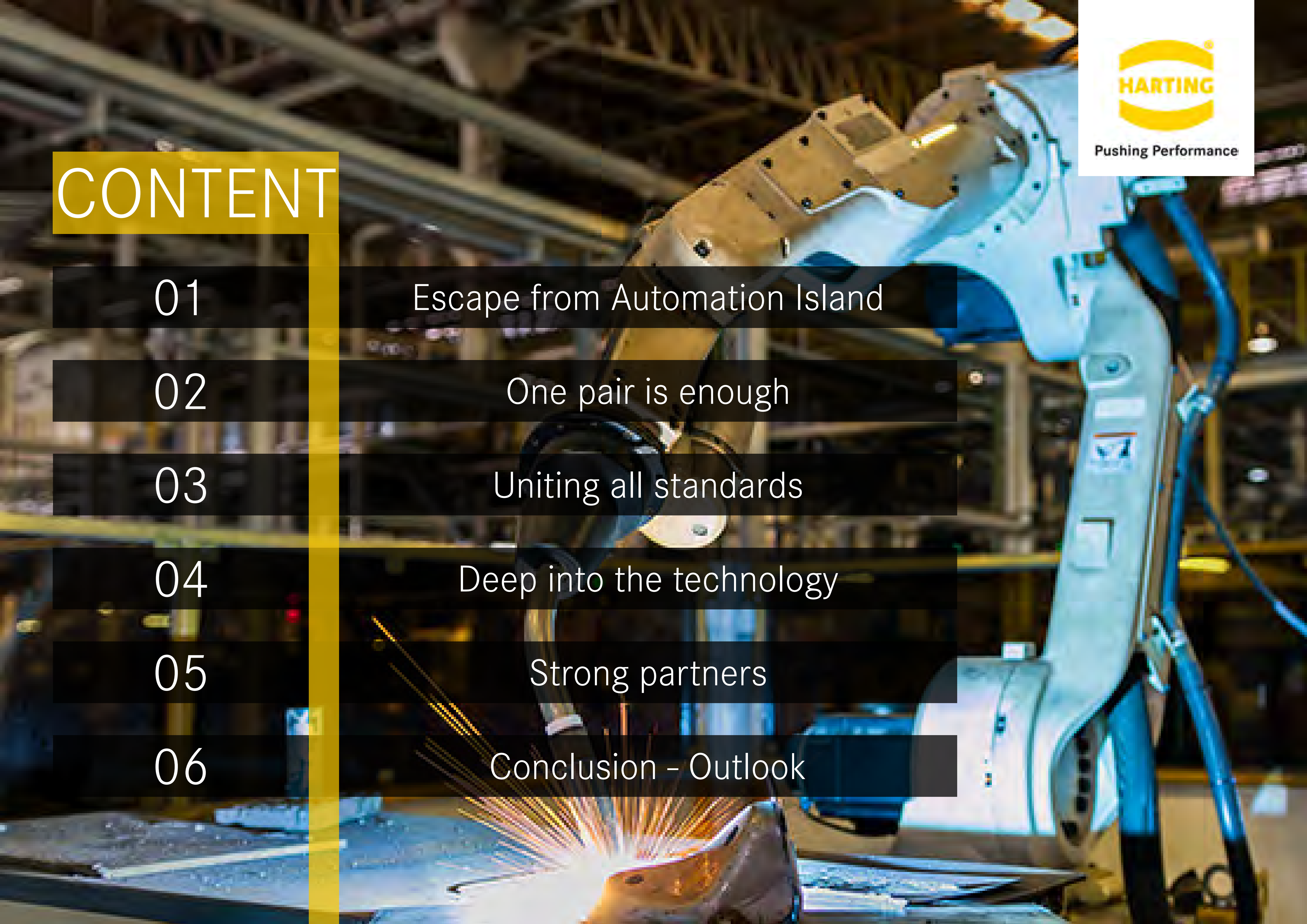
Single Pair Ethernet

The infrastructure for IIoT

BE SMART.
ENABLE IIOT.

People | Power | Partnership



CONTENT

1. Escape from Automation Island

IoT – the Internet of Things – describes the networking of virtual and real physical objects in order to make them work together using information and communication technologies. Objects in our daily lives acquire digital skills. Thus, they become real physical objects that can also participate in digital networks. This process also takes place in industrial applications, where it is called the Industrial Internet of Things (IIoT).
More and more industrial components are also becoming smart, intelligent participants. These are no longer limited to internal company networks, but are also becoming part of the internet. The increased collection, evaluation and use of data creates the need for more powerful infrastructure. At the same time, this infrastructure is expected to take up less space and use less resources. Efficiency is the key word here, as more and more sensors with their increasing bandwidth requirements become network participants. New technologies are required.

In the automation world, the phrase "Automation Island" has been coined to refer to the entire range of independent and proprietary (yet analogue) networks that dominate the field level. This classic system schism between Ethernet/Internet and analogue Fieldbus systems should now be broken up and eliminated. The goal is to extend Ethernet from the cloud to every sensor. Each sensor will be smart and capable of being evaluated individually – and therefore an essential step on the road to IIoT. However, the appropriate infrastructure is still missing. Current networks are based on 2-pair or 4-pair cables and connectors. However, this conventional infrastructure is too large and too expensive when you think about the sheer number of sensors and actuators that have to be connected in the field. BUS cables are designed to be space-saving and economical for a reason.

The solution is called Single Pair Ethernet

The solution for a high-performance Ethernet infrastructure is based on a single pair of twisted copper wires:

Single Pair Ethernet – the infrastructure for IIoT

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2.

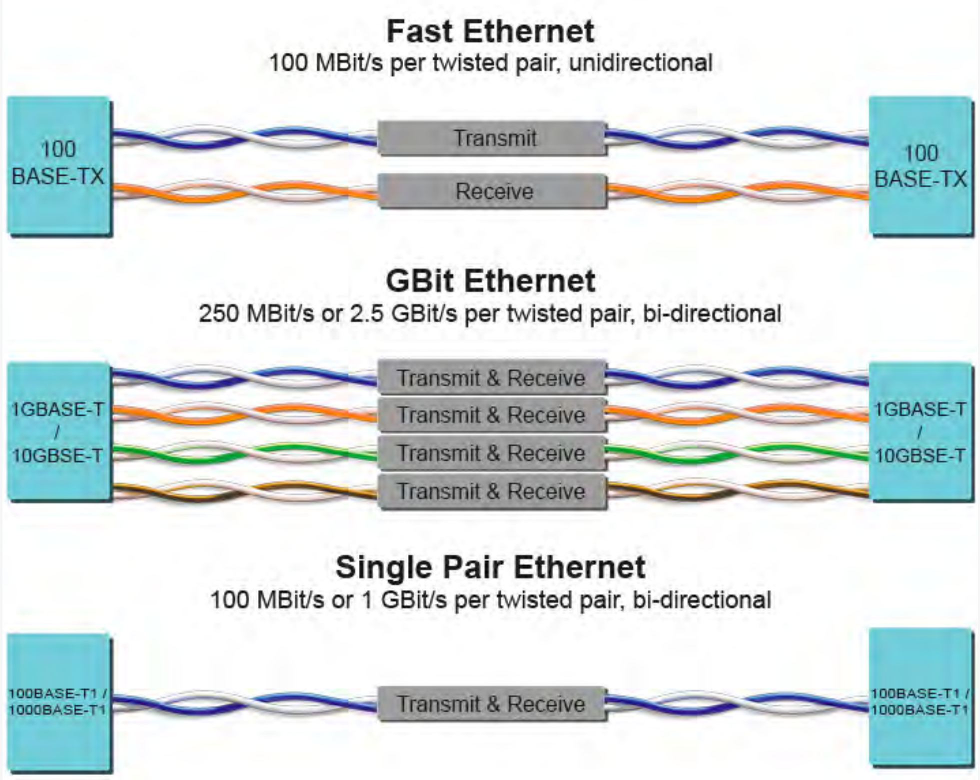
One pair is enough – SPE makes the field level smart

From the cloud to the sensor: this is a claim that has been heard more often recently in the automation environment. This claim was normally made in connection with mega-trends such as IIoT and I4.0. It refers to continuous TCP/IP-based communications based on Ethernet, which currently mostly ranges from cloud applications down to the distribution level in manufacturing. Where previously there was a classic break in communication systems between Ethernet and BUS systems, modern components can now bring fast Ethernet (up to 1 GBit/s) to the smallest application using just one twisted wire pair. Thus, SPE enables consistent usage of the TCP/IP protocol for the first time. And that drives the development of new devices and application fields, especially for sensor/actuator networks. The sensor becomes "intelligent" and a part of the overall network. This speeds up parameterisation, initialisation and programming. When using SPE – whether with a simple state sensor or a modern vision system consisting of a high-resolution camera – the Internet of Things becomes reality and the field level becomes smart.

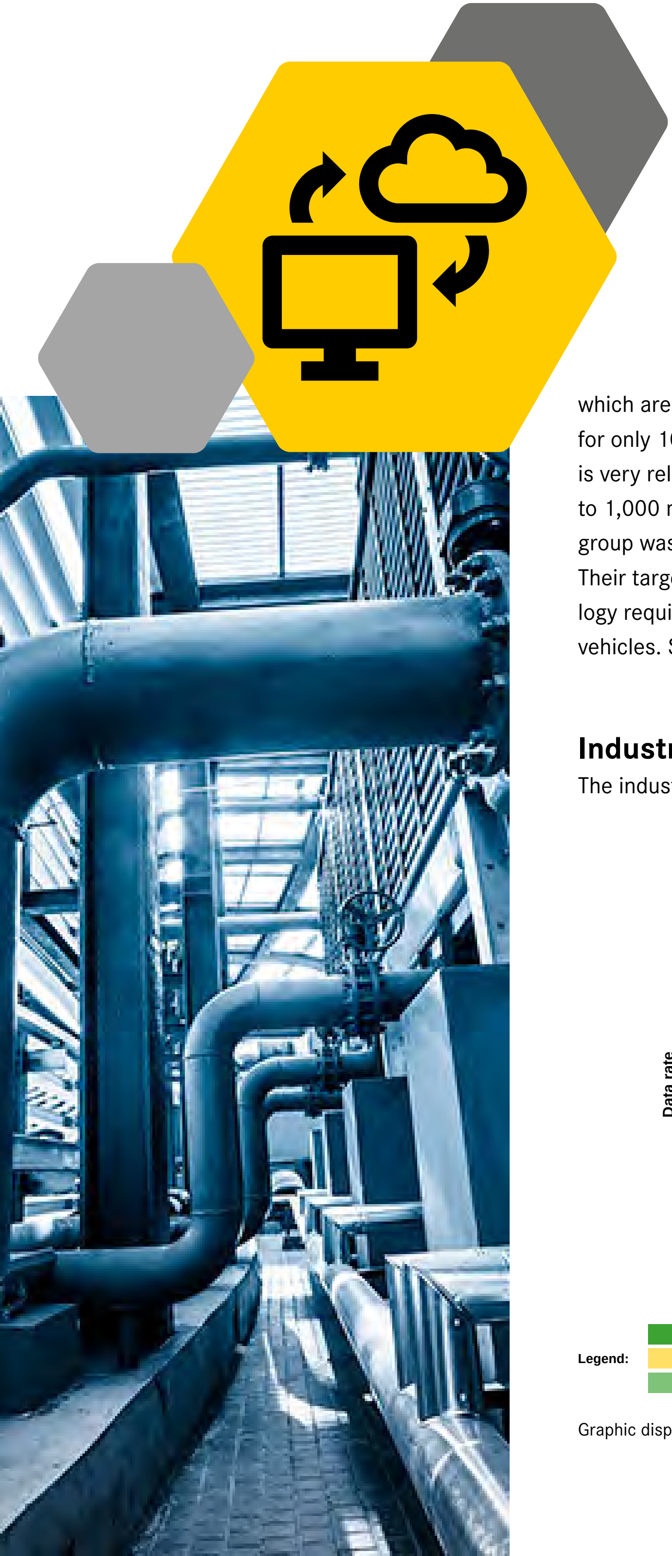
The roots

After the automobile industry, which needed a replacement for the CAN bus, identified this new TCP/IP-based transmission method, the IEEE 802.3 working group released the first SPE standard as the standard 100BASE-T1 in IEEE 802.3bw-2015 clause 96. Self-driving or semi-autonomous driving, however, requires even higher data rates. So, after the first SPE standard for 100Mbit/s, a Gigabit version followed quite quickly. Ethernet technology based on IEEE 802.3bp 1000BASE-T1 is already available today and delivers 1 Gbit/s transmission speeds using only one pair of copper wires. IEEE is currently working on a further standard for even higher data rates up to 10 Gbit/s (IEEE 802.3ch),

MPE VS. SPE



MPE stands for Multi Pair Ethernet, which uses two or four wire pairs

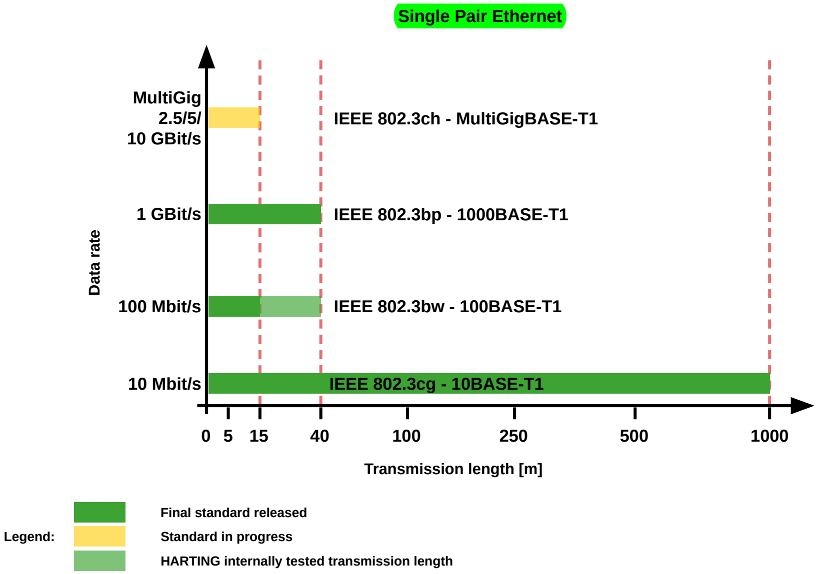


"Companies are currently enormously interested in the Internet of Things (IoT)."

which are required for high-resolution sensors and video transmissions. A standard for only 10 Mbit/s (IEEE 802.3cg) was published in February 2020. This standard is very relevant for many industry sectors, as it allows transmission distances of up to 1,000 meters and can therefore replace almost all Fieldbuses. Another working group was set up in March 2019 to deal with transmission rates above 10 Gbit/s. Their targets are 25 Gbit/s and 50 Gbit/s. These high data rates are the technology required for autonomous driving and new zonal computer architectures within vehicles. SPE is the ideal technology for this.

Industrial automation has recognised this potential

The industry (production and automation) has a similar problem as the automotive



Graphic display of range and transmission speeds for the current IEEE 802.3 SPE standards

industry in that it demands integrated industry, meaning the integration of the field level (sensor/actuator networks) down to the tool and workpiece within automated production. It requires a network strategy that can be used universally while also being sustainable well into the future. In other words, IT solutions are needed which are not propriety and provide the availability and security standards that are common in the industry. SPE is the right technology for this.

SPE – using new cabling or existing infrastucture?
SPE offers many advantages:

- End-to-end TCP/IP communications as an alternative to proprietary bus or power interfaces
- High security and 100% availability
- Enormous range from a few metres up to more than 1000 metres
- Minimal space required for cables and distributors
- Easy to install
- Simultaneous power supply for end devices and sensors using Power over Data Line (PoDL)
- Rechargeable and non-rechargeable batteries are not needed, which is an important environmental consideration.
- Reduces costs with better operational reliability

Thus, SPE is a technology that removes most of the restrictions of wired communications. It also compensates for the disadvantages of cable compared to other technologies (such as wireless) – based on the types of applications considered here. In summary, SPE highlights the advantages of copper over fibre optics as a transmission medium. Wireless communication is also facing new competition.

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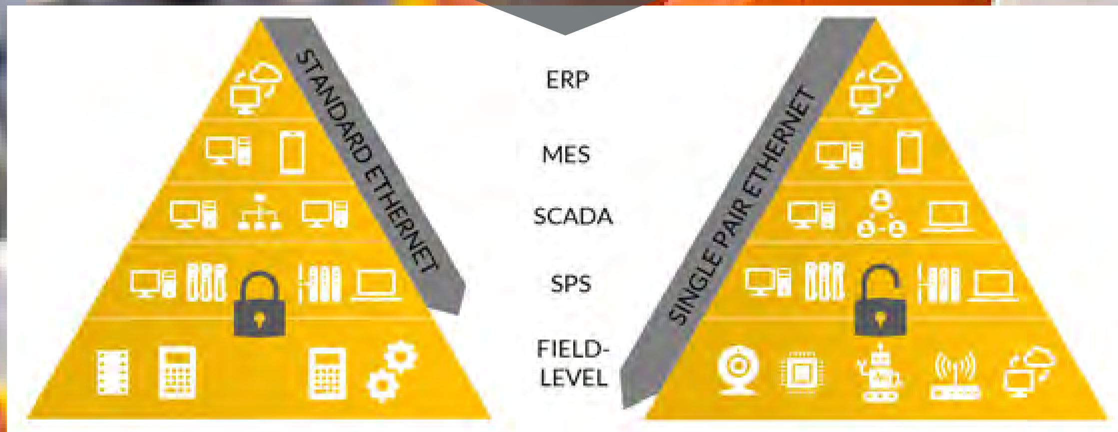
An overview of the SPE advantages

- OPEN COMMUNICATION PROTOCOL
- ENABLER FOR IIOT
- REAL-TIME COMMUNICATION WITH TSN
- UP TO 10 GBIT/S FOR AUTOMATION NETWORKS
- REMOTE POWER SUPPLY USING PODL - POWER OVER DATA LINE
- A STANDARDISED INTERFACE ENABLES SECURE PLANNING

Applications

Ethernet is represented through all types of industrial applications, from the company headquarters to the control level. This is where converters and gateways are currently used to establish a connection to Fieldbus systems. However, as more sophisticated and powerful sensors and actuators are also finding their place at the field level, there is a clear need for Ethernet at the field level. A large number of field devices can be supplied with Ethernet in a space-saving and cost-effective manner when SPE is used. This makes converters and gateways obsolete since every sensor IP can be addressed in a deterministic manner (with TSN). Simply speaking, MPE can be used all the way to the field level and then continuously with Ethernet directly in the field level. Using SPE, the claim "From Sensor to Cloud" becomes reality and HARTING components provide the infrastructure for I4.0 and IIoT.



"Up to 50 W at the end device."

Power over Data Line – PoDL

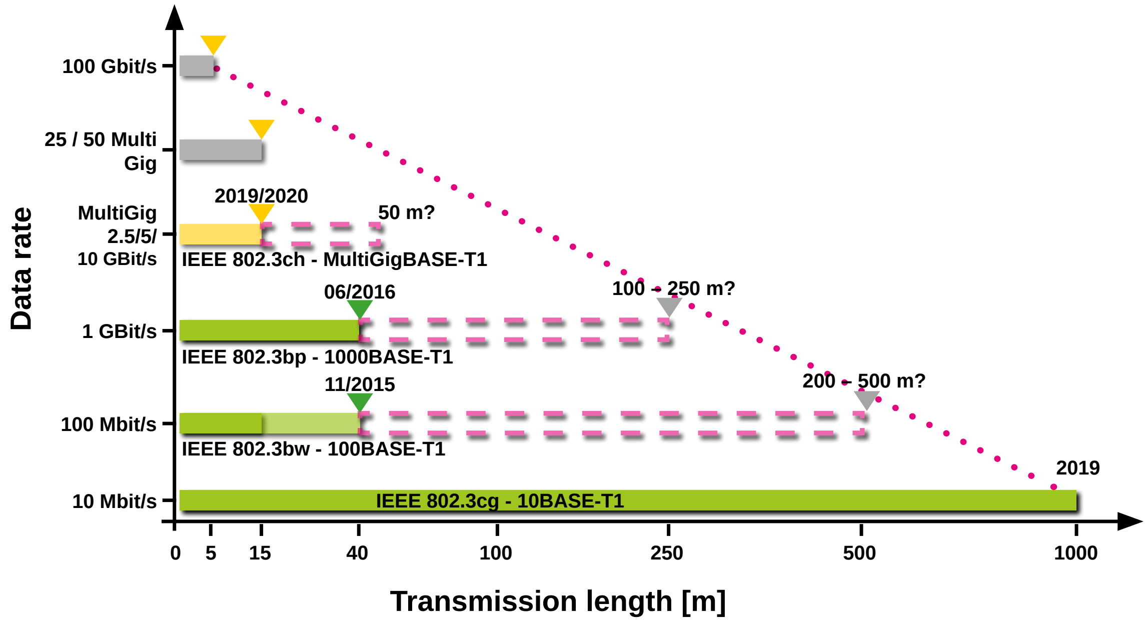
Similar to multi-pair cabling, there is a new standard for remote power supply for SPE that is analogous to Power over Ethernet (PoE); it is called PoDL = Power over Data Line (IEEE 802.3bu). This combination of data and power using very small plug-in connectors and single-pair cables helps to support the trends towards miniaturisation, higher data rates and modularisation for more complex systems. These are all prerequisites for the rapid development of non-vehicle SPE applications in industry, smart cities, buildings, etc.

Ethernet over copper for over 1000 meters? Yes! With SPE.

SPE technology has already achieved the same performance as today's predominant "Multi-Pair Ethernet" (MPE) within a very short period of time. Currently, the only limitation is the limited range for 100 Mbit/s and Gigabit SPE (15 m and 40 m respectively), which results from the requirements of the main target group in the automotive industry.

Experts agree that greater transmission lengths can also be achieved here. The adjacent chart shows the extended transmission lengths that are technically possible. However, in order for these extensions of the SPE standards to be covered by IEEE 802.3 and, in particular, for the semiconductor industry to invest in the development of these new chip sets, it is necessary to define the new target applications and suitable market potential. This requires the open cooperation of all interested parties for the extended SPE ranges. The first presentations at IEEE 802.3 have already been published and were well received. Further supporters for these target standards are very welcome.

**Single Pair Ethernet
Transmission length and speed**



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3. T1 Industrial Style: All standards united in support

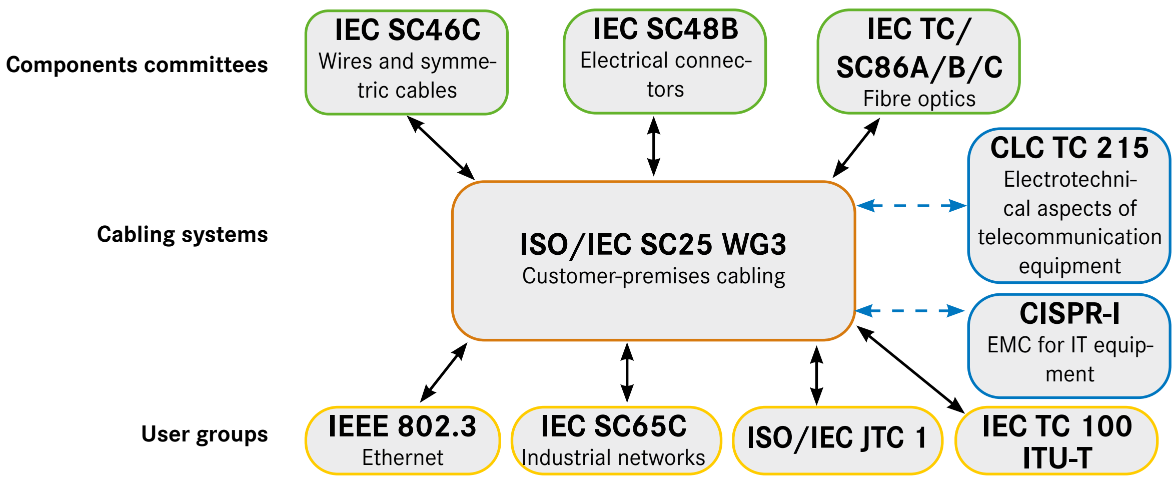
There is still a long way to go before the SPE infrastructure and its associated potential are firmly established. Currently, several solutions and different standards are being discussed on the market, with a particular focus on the interfaces for SPE. Users are now rightly asking whether manufacturers will develop a consistent and compatible solution based on a uniform standard, or whether there will be multiple solutions and incompatible mating faces. Thus, it is necessary to take a closer look at the cooperation of various standards committees and their work relating to Ethernet communication.

ISO/IEC SC25 WG3
ISO/IEC JTC 1/SC 25/WG 3 plays a central role in the standardisation. This is where the cabling standards in compliance with ISO/IEC 11801 are created and maintained.

IEC SC46C
Committee for cabling components:
Copper data cables

IEC SC48B
Committee for cabling components:
Connectors

IEEE 802.3
Cable-based Ethernet protocol standards



IEC 61156-x – Standardisation of Single Pair Ethernet cables

Within the IEC SC46C working group for the standardisation of data cables as bulk goods, the following standards are currently in progress:

- IEC 61156-11 – SPE data cable up to 600 MHz bandwidth for fixed installations (final published)
- IEC 61156-12 – SPE data cable up to 600 MHz bandwidth for flexible installations (CD available)
- IEC 61156-13 – SPE data cable up to 20 MHz bandwidth for fixed installations (CD available)
- IEC 61156-14 – SPE data cable up to 20 MHz bandwidth for flexible installations (planned)

Further standards projects, for example for higher bandwidths to support data rates above 1 Gbit/s, will be processed in the future.

IEC 63171-6 Standardisation of Single Pair Ethernet connection technology

The first draft standard for the SPE connector was submitted to SC48B by HARTING as early as 2016 and published as IEC 61076-3-125 up to the CD document. In 2017, the company CommScope submitted another SPE mating face for standardisation and decided to create the IEC 63171 series of standards for all SPE connectors. Accordingly, the project team PT63171 was set up at SC48B and commissioned with the task of preparing these new series of standards. The standards already in work up to this point will be completed as self-contained documents and later integrated into this new series of standards as revisions.

The following standards projects are currently in progress:

- IEC 63171: Base standard with all necessary specifications and test sequences (CDV available)
- IEC 63171-1: SPE connectors from CommScope based on LC interlock, for M1I1C1E1 applications (FDIS available)
- IEC 63171-2: SPE connectors from Reichle & De-Massari for M1I1C1E1 applications (CD available)
- IEC 63171-3: SPE connectors from Siemon based on a pair of the well-known Tera connectors for M1I1C1E1 applications (withdrawn)
- IEC 63171-4: SPE connectors from BKS for M1I1C1E1 applications (NP available)
- IEC 63171-5: SPE connectors from Phoenix Contact based on the IEC 63171-2 mating face for M2I2C2E2 and M3I3C3E3 applications (CD available)
- IEC 63171-6 (previously IEC 61076-3-125): SPE connectors from HARTING and TE Connectivity for M2I2C2E2 and M3I3C3E3 applications (published since 23.01.2020)

Note: IEC 63171-1 (LC Style) and IEC 63171-6 (Industrial Style) are complete standard documents with all necessary specifications and test sequences. All standards started after this refer to the base standard IEC 63171 and describe only the different mechanical versions.

The cabling standards for SPE

SPE and its standardised connectors are incorporated into the current cabling standards. Internationally, this applies primarily to the series of standards for structured cabling according to ISO/IEC11801:2017 and, in a similar way, to the European series of standards in CENELEC according to EN50173. Here, SPE will first be included in Part 3 of Industrial Cabling in the annex (amendments). The central document for these annexes is the ISO/IEC 11801 TR9906 "TECHNICAL REPORT: Balanced single-pair cabling channels up to 600 MHz". The implementation of SPE in the ISO/IEC 11801 documents is very important, as this is the only standard to describe the cabling channels with all the necessary parameters (length, number of connections, bandwidth and the complete set of technical transmission-related parameters including NEXT, FEXT, shielding properties, etc.) in relation to the MI-

CE-specified environment, so that this can be tested with measurements after the installation Parallel to this, the industrial installation standards as a basis for the cabling of automation solutions according to IEC 61918 (IEC SC65C) will be adapted. It remains to be seen to what extent this will affect the automation profiles themselves. What is certain is that PI (with PROFINET according to IEC 61784-5-3) and ODVA (with EtherNet/IP according to IEC 61784-5-2) are actively involved in the further development and implementation of standards for SPE.
In conjunction with the component standards for connectors and cables, all users of SPE can receive clear guidelines for the construction and testing of appropriate transmission paths. For 1 Gbit/s SPE, this cabling is initially limited to a range of 40 m. For the 10 Mbit/s variant, ranges of 1,000 m and beyond can be implemented.

Further documentation on SPE cabling relevant to the USA, Canada and Mexico are being prepared at ANSI/TIA-568.5 and TIA TR42.7. This is updated in the TIA42 documents as an Addendum: TIA-1005-A-3. The content of all these additions is largely identical.

These cabling standards provide the user with information on the structure of the cabling, the cabling components that should be used to achieve the performance specifications, and the limit values for testing the cabling. Thus, they are the most important instrument for setting up and commissioning SPE cabling systems. They also ensure compatibility between devices and cabling by providing references to component standards (e.g. connectors according to IEC 63171-6). This compatibility is a basic prerequisite for the proper functionality of networks and connections based on SPE and, thus, the foundation of IoT/IIoT. The use of cabling components other than those specified in ISO/IEC 11801-3 Amendment 1 would be theoretically possible. However, these would no longer conform to the standard and would risk incompatibilities and loss of functionality.
For this reason, at the start of 2018, ISO/IEC JTC 1/SC 25/WG 3 and TIA42 started an international selection processes to define uniform interfaces. These two selection processes were co-initiated by IEEE 802.3, which requested a recommendation for a SPE MDI (SPE device interface) from ISO/IEC and TIA.

More than 20 national expert panels participated in this selection process. Two connector mating profiles emerged from this selection process as the preferred choices:

- For building wiring, the mating face according to IEC 63171-1. This mating face is based on the proposal by CommScope
- For industrial and applications adjacent to industry (M2I2C2E2 and M3I3C3E3), the mating face according to **IEC 63171-6** (formerly the IEC 61076-3-125). This mating face is based on the proposal made by HARTING T1 Industrial.

The selection process at TIA 42 has confirmed the results of ISO/IEC and as such there is significant global consensus on the SPE interfaces. These selected mating faces are now being incorporated into the corresponding international cabling standards. IEEE802.3 has also specified these SPE interfaces in the IEEE 802.3cg as the recommended Media Dependent Interface (MDI).

This is required for large-scale usage. Thus, it is also required to successfully market SPE technology along with the consistent compatibility of devices, cables and connectors throughout different types of applications. This provides planning security for all market participants.

Glossary – MICE describes environmental conditions for installations. It also provides planners and users with valuable information for specifying technical equipment and cabling. The requirements for mechanical robustness (M), IPxx degree (I), chemical and climatic resistance (C) and electromagnetic safety (E) are described for this. In the broadest sense, $M_1I_1C_1E_1$ describes an environment similar to that inside an office building. $M_3I_3C_3E_3$ describes a fairly extreme environment such as that found in industry or outdoors.

4. Deep into technology

Even if twisted pairs of wires are required for existing 4-pair data cabling as well as for SPE, the requirements for cabling and connection technology are quite different. This is the especially the case for transmission lengths with the currently available SPE transmission standards as well as the RF (radio frequency) requirements, which are particularly evident for these required bandwidths.

	Four-pair Ethernet cabling (MPE)		Single Pair Ethernet (SPE)	
Data rate	Bandwidth (Cat.)	Transmission length	Bandwidth (Cat.)	Transmission length
10 Mbit/s	16 MHz (Cat. 3)	100 m	20 MHz	1000 m
100 Mbit/s	100 MHz (Cat. 5)	100 m	166 MHz	40 m
1000 Mbit/s	100 MHz (Cat. 5)	100 m	600 MHz	40 m
10 Gbit/s	500 MHz (Cat. 6_A)	100 m	4-5 GHz tbd.	15 m

Migration from multi-pair cabling (MPE) using SPE (cable sharing)

High data rates are possible over one pair of wires – so why not combine four SPE paths in your existing infrastructure? This idea of using four-pair cabling for SPE by means of "cable sharing" is quite straightforward. This is possible for special cases, but it doesn't really make sense technically and economically. On the one hand, SPE cabling requires higher bandwidths compared to MPE, especially for cross-talk. Also, compared to MPE with 100 metre transmission length, so far SPE has only shorter transmission lengths of 40 metres at 1000BASE-T1 for shielded cables. For this migration scenario, the user must check each path of the installed cabling for SPE. Thus, the actual economic viability of such usage strategies is questionable. For example, in order for an installed Cat. 6_A cabling to qualify for 1000BASE-T1, the transmission length must not exceed 40 meters and the corresponding RF parameters must be qualified for up to 600 MHz. If all this matches perfectly, you could then transmit four times 1 Gbit/s over SPE, even though this Cat. 6A cabling path could also support 10 Gbit/s MPE.

The connection technology for Single Pair Ethernet

Individual connector types are inseparably linked to a specific application and have been, of course, internationally standardised. Well-known examples of this are the RJ45 connectors for Ethernet and the concise HDMI or DVI connectors for video transmission. Thus, standardised interface connectors are required in order to have a successful market launch for new network technologies such as SPE. This is because only with standardised interfaces is it possible to network a wide variety of devices in a uniform data network. The design of the SPE connectors (according to IEC 36171-6) was based on the specifications of the associated IEE 802.3 standards and other market requirements.

Overview of the electrical characteristics

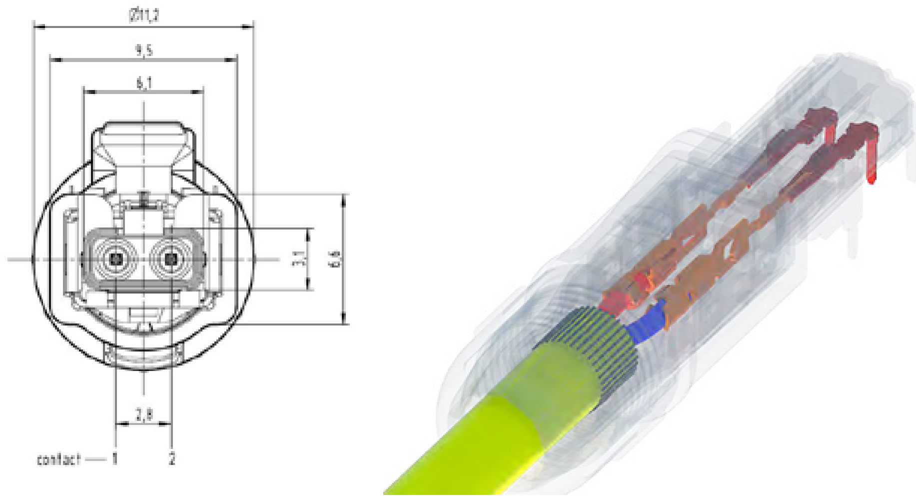
Nominal voltage

A differential voltage signal of +/- 1 V is usually used for pure Ethernet transmissions. When determining the nominal voltage of an SPE connector, however, the parallel use of the two wires must also be considered for the remote power supply. The method used for this in SPE is called Power over Data Line (PoDL); it is standardised according to IEEE 802.3bu. Similar to PoE, the maximum rated voltage is 48 V DC, resulting in a maximum supply voltage of 60 V DC to the power sourcing equipment (PSE). In contrast to PoE, PoDL defines additional typical on-board voltages of 12 V and 24 V DC which are used in vehicles.

Insulation voltage:
Even though the IEEE80.3 SPE standards do not define explicit specifications for insulation requirements pertaining to the largest group of users in the automotive industry, the same requirements are applied for normal applications in building and industrial cabling as exist for four-pair Ethernet with 1.5 kV (rms) contact-to-shield and 1.0 kV (rms) contact-to-contact (refer to Section 126.5.1 IEEE 802.3cr).

Rated current:
The PoDL requirements are also decisive when determining the rated current. In the current standard, Table 104-1 IEEE 802.3bu specifies the maximum feed-in power as 63.3 W, which corresponds to a maximum supply power at the Powered Device (PD) of 50 W. This results in 1.36 A at 48 V at the minimum permissible supply voltage. However, a rated current of 4 A DC has been selected to maintain a sustainable interference level into the future.
Background: According to the National Electric Code (NEC) for the North American market, the maximum power for NEC Class 2 devices is limited to 100 W; this is also the maximum remote power supply power for the PoE standard IEEE 802.3bt. This means that future PoDL expansions will remain below 100 W and the 24 V supply voltage used in industrial automation will result in a rounded max. rated current of 4 A.

RF transmission parameters
For transmitting data, SPE uses a full-duplex connection on a differential wire pair with an impedance of 100 Ohm. In order to achieve lower interference sensitivity (especially for the use in electric vehicles), a lower coding with PAM3 up to 1000BASE-T1 and PAM4 for 2.5/5/10GBASE-T1 was chosen for SPE. This increases the bandwidth requirement enormously compared to the multi-pair Ethernet (MPE) standards. For example, IEEE802.3ch for multi-Gigabit SPE up to 4 GHz at 10GBASE-T1 (compare with 10GBASE-T of only 500 Mhz) is currently being discussed. Therefore, the RF requirements for cable and connection technology are increasing and a very symmetrical connector design is necessary to reliably meet these stricter RF requirements. For this reason, the contacts of the T1 Industrial connector are arranged symmetrically in a completely closed shield housing. The coupling capacitances and inductances of both conductors to the shielding or the printed circuit board are identical and there is no interference with the differential data transmission. This means that the signal path is identical in both conductor paths and differences in the signal propagation time are avoided.



Symmetrical design of the mating face according to IEC 63171-6

Technical design of the SPE connection technology in compliance with IEC 63171-6

The aim of the design for the SPE interface was to take into account all the electrical parameters already explained above with sufficient reserve for future higher bandwidths, the requirements regarding a remote power supply (PoDL), and the variety of housing designs already accepted and widely used on the market. Multiple factors were important here: a balanced relationship between the market demands for miniaturised interfaces and high robustness, as well as good handling and a well-designed termination area to match the wire and cable diameters to be used. Following these design objectives, 0.5 mm contacts with a contact gap of 2.8 mm were chosen for the contact system. The contact spacing is matched to fit with the cable cross-sections to be connected. For the short transmission distances with 100BASE-T1 and 1000BASE-T1, AWG 26 or AWG 22 conductors with wire core diameters of approx. 1 mm or 1.6 mm diameter can be used. For the 10BASE-T1L 1.000 m with longer range, however, AWG 16/18 conductors with a typical wire core diameter of approx. 2 mm are required; thus, a 2.8 mm contact distance is optimal.

According to the IEEE 802.3 standards, longer ranges can only be achieved with shielded transmission paths. For this reason, and to ensure secure transmission even in harsh industrial environments, a shielded design has been consistently implemented. At the same time, these shielding plates also provide the robust mechanical interlocking for the IP 20 version. The metallic latch lever also eliminates the problem of the broken latching mechanism – a common criticism with RJ45. M8 and M12 circular connectors have established themselves for usage in industrial applications. Accordingly, screw-type, snap-in and PushPull interlocks have been added for the M8 construction types of the new SPE mating face to make them a uniform "data container". The M12 designs with screw and PushPull interlocks are also standardised, in order to accommodate the large cable cross-sections for the 1,000 m 10BASE-T1L channel. This means that the same mating face is used in all designs, and IP20 connectors can also be connected to the IP65/67 interfaces for parameter configuration or testing. Usage of the widely accepted M8/M12 types ensures good market acceptance while also reducing the necessary investment costs, since many suppliers have the corresponding housing designs already available. The use of identical socket and plug-in connector inserts ("data containers") throughout all construction types guarantees that there are uniform technical characteristics in all the product series. This makes it easier to implement cost-efficient production through economies of scale. Thus, the SPE interfaces according to IEC 63171-6 provide an internationally standardised mating face that optimally supports the future usage of SPE in industrial applications. By using this standardised SPE data container, it is also easy to integrate this IEC 63171-6 mating face into other designs, such as the connector system with internal M12 PushPull interlock that is currently being developed as a new standards project.

SPE connector variants according to IEC 63171-6: as IP65/67 as well as IP20 versions (upper row from left to right: M12 PushPull, M8 PushPull, M8 SnapIn and IP20 connectors / upper row from left to right: M12 socket with screw and PushPull interlocks, M8 socket with SnapIn and PushPull interlocks, angled IP20 PCB socket)

For 75 years, HARTING has stood for quality and innovation

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5. An ecosystem of strong partners

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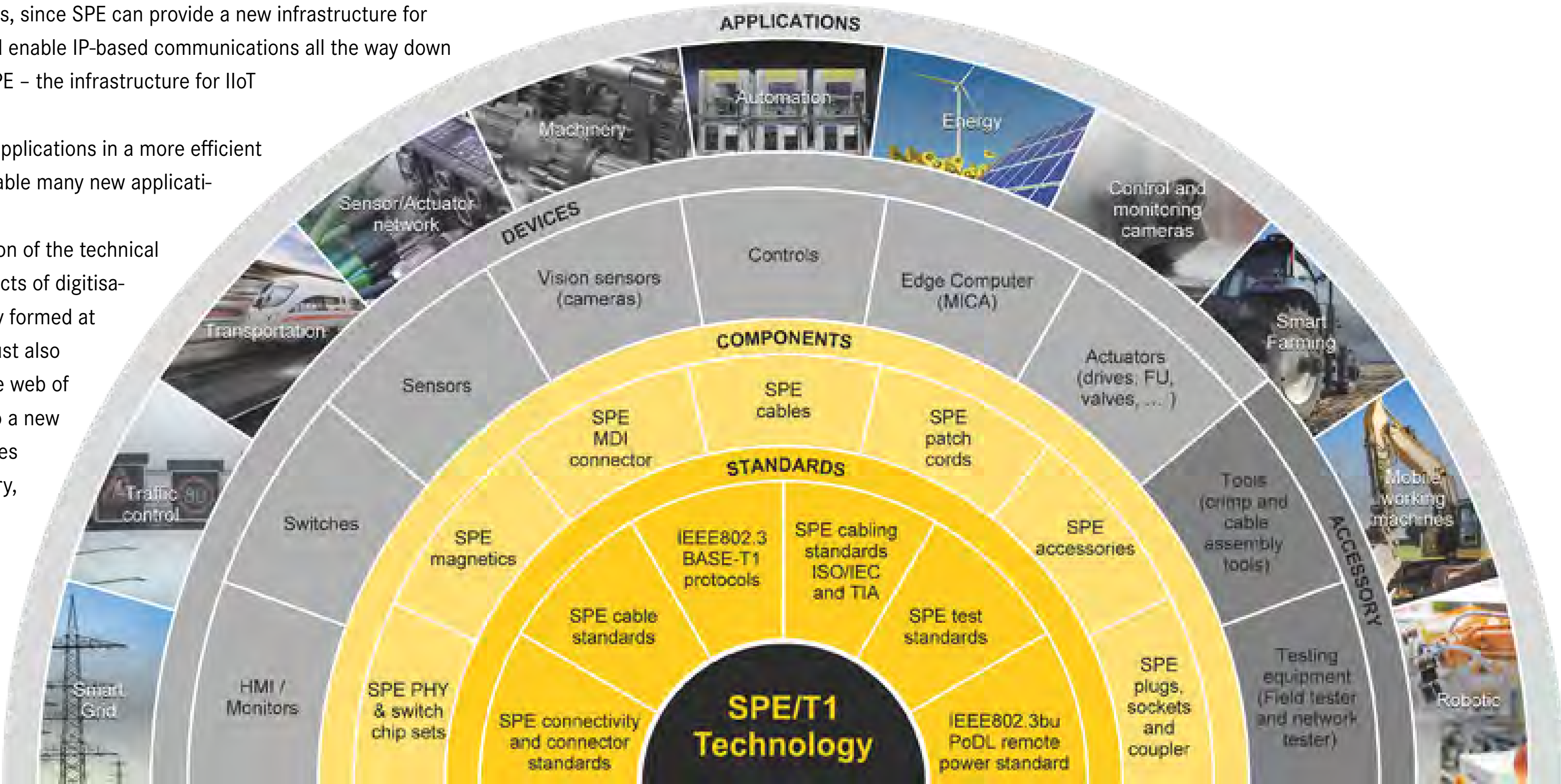
Industrial Ethernet is becoming widespread in automation and I4.0 applications. More and more devices and solutions from a wide range of sectors are becoming "smart" – for this, they need the right Ethernet infrastructure. The SPE ecosystem shows us how technology, standards, infrastructure components, devices and test equipment logically build on and support each other. They ultimately provide a solid foundation for the digitisation of multiple different markets.

That is why HARTING has worked actively in the field of standardisation and developed an infrastructure suitable for industrial usage. HARTING now actively supports device manufacturers as they implement SPE.

All partners together wish to provide the building blocks for the SPE ecosystem. They see themselves as partners for the Industrial Ethernet user groups, since SPE can provide a new infrastructure for these protocols (such as PROFINET), which would enable IP-based communications all the way down to the field level. Just as the slogan promises: "SPE – the infrastructure for IIoT

This means that SPE will not only support many applications in a more efficient environmentally friendly manner SPE will also enable many new applications.

In addition to the currently predominant discussion of the technical side of digitisation, the social challenges and effects of digitisation on our democratic societies, which were only formed at the beginning of the first industrial revolution, must also be discussed throughout society. In his book "The web of digitisation: humanity in upheaval – on the way to a new worldview", published in 2018, Ulrich Sendler gives a detailed overview of the development of industry, technologies and society. This is a book that is certainly worth reading, with many suggestions about the steps required to ensure that digitisation succeeds socially and serves the well-being of mankind.



SPE

INDUSTRIAL
PARTNER
NETWORK

HARTING Pushing Performance

TE connectivity

HRS HIROSE ELECTRIC EUROPE B.V.

MURR ELEKTRONIK stay connected

WÜRTH ELEKTRONIK

LEONI

optimize! softing

molex

igus

DEHN

ESCHA

LÜTZE TECHNIK MIT SYSTEM

HELUKABEL

Perinet Seamless IoT Connectivity

EKF SYSTEM

Amphenol ICC

ZHAOLONG

COMMITTED TO IEC 63171-6

6. Where are we headed? Conclusion and outlook

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New applications fields – such as autonomous driving, IoT and IIoT – require new and more powerful network technologies. SPE is one such technology. The ability to simultaneously supply power and data to devices with only one connection is a huge advantage over wireless solutions. The remote power supply via PoDL makes batteries and accumulators superfluous – a big advantage for environmental compatibility and sustainability. Cable-based transmission methods have the additional advantage that there are no regulatory restrictions regarding the usable frequency ranges; thus, no license fees are incurred for the necessary frequency bands. Since frequency bands are not allocated uniformly (even internationally), equipment with radio interfaces must always be adapted to different market requirements. This is not necessary for cable-based transmission methods. Thus, uniform devices can be developed which can be used globally.

Together with the time sensitive network (TSN) standards developed in IEEE 802.1, Ethernet technology is being expanded along with all necessary mechanisms in order to implement determinism for data communications – this is a prerequisite for all real-time applications.

SPE, therefore, qualifies as a perfect infrastructure solution and "enabler" for IoT and IIoT, making it an important building block for integrated industry.

In order for SPE to fully develop this potential within an ecosystem, the partners from different industrial sectors must work together intensively and make this vision possible. This starts with the joint international standardisation in IEEE 802, ISO/IEC and TIA. It continues with the development and production of the necessary components starting with semiconductors, magnetic components, connectors/cabling components and measurement technology. Only when the standards and components are available (at least in initial sample quantities), will users be able to equip their multitude of possible devices with SPE transmission technology and open up a wide range of new applications.

Single Pair Ethernet

The infrastructure for IIoT

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Matthias Fritsche is product manager and Ethernet connectivity expert at HARTING. He keeps an eye on the latest trends and developments in industrial Ethernet communication for HARTING. He also sits on various standards committees and actively promotes standards and norms for users. The author has both accompanied and driven the topic of Single Pair Ethernet for several years and sees it as the future infrastructure for industrial networks.

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