Technical article

Switches as the basis for future-proof OT networks

Securing and increasing the availability in production

Future-oriented OT network solutions are the basis for further advancing digitalization in industry. Without networks there is no communication and no data exchange between Operational Technology (OT) and Information Technology (IT). To ensure the reliable and secure data exchange between these network worlds, powerful Industrial Ethernet switches with a high number of ports, high data rates, and comprehensive functions are required.

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The increasing networking of machines, controllers, and IT systems in plants is leading to ever more complex networks at the production level. In addition, digitalization calls for more and more nodes to be connected in the network, which often leads to large network structures in industry. To operate these OT networks, efficient switches are needed. Utilizing high bandwidths, Ethernet switches provide for the necessary transmission of data, voice, video, and PROFINET. Applications with redundant communication and real-time communication are also often crucial, for example, to ensure safety requirements for the protection of man and machine.

Managed Layer 2 switches from the SCALANCE X-300 product family of Industrial Ethernet switches are available both as compact models and as 19-inch rack variants. They are usually installed in the control cabinet and support demanding requirements for high port density or high transmission rates in OT networks. Furthermore, models with different input voltages are available, and these can span Ethernet networks via both copper and optical ports. The rack switches are available in variants with single and redundant 230 V AC/DC power supplies for high-availability network structures. There are also variants with different numbers and types of ports or conformal coating for use even under harsh environmental conditions. Thanks to the extensive approvals, worldwide use is possible without any problems. Since there is no active cooling by fans, the SCALANCE X-300 switches are particularly fail-safe and also have a low power consumption. This fanless operation means that the devices consume less energy – thus contributing to reduced operating costs of the data network.

Cloud and edge applications in the network

In today's world, the boundaries between software and hardware in industrial plants are blurring. As a result, more and more software applications (such as anomaly detection, remote access, or even data analysis for preventive maintenance) are integrated into the network. This creates new challenges in order to make this data available to the applications in the best possible way. The so-called function extender interface, which is visible on the side of the compact variant switches, ensures a very convenient and simple installation without any mounting or cabling effort. This allows the SCALANCE LPE (Local Processing Engine) local processing platform to be easily connected to the compact SCALANCE XCM-300 Ethernet switch. This integration also ensures the supply of power. Much more important, however, is to ensure the network connection through the internal, high-performance Ethernet interfaces. Via these interfaces, telegram information, so-called mirrored traffic, or access to participants in the network can be made available. Several applications for cloud or edge computing, predictive maintenance, or anomaly detection can be implemented in this way. The SCALANCE LPE with a high-performance CPU enables the collection, pre-processing, and distribution of data.

Rack variants with different numbers of ports from the SCALANCE XR-300 or SCALANCE XRM-300 product series (left) and compact switches SCALANCE XC-300 or SCALANCE XCM-300 (right) revolutionize OT networks.

Future-proof hardware platform for functions such as TSN and seamless redundancy

With the well-known functionalities from the familiar portfolio of SCALANCE network components, the most diverse applications are possible. Flexible Layer 2 network structures can be configured as a star or ring with up to 10 Gbps. In the future, the setup of the SCALANCE X-300 product line will be extended successively by further innovations such as Time-Sensitive Networking

(TSN), additional edge functions, or seamless redundancy. The special feature is that the hardware remains the same, only the operating system inside the switches needs to be changed depending on the desired application. With regard to the requirements, the right switch can thus be selected from the rack and compact form factors of the SCALANCE X-300 product family. With this strategy of migrating operating systems, the switches offer more flexibility for the future and protect the investment already made. This is enabled by using equivalent hardware for all launched compact or 19-inch variants of the SCALANCE X-300 switch family from 2022 onwards. This means that no devices have to be replaced when changing to a different operating system. With this flexible and industrial-grade SCALANCE X-300 platform, today's installations can be set up to easily meet tomorrow's requirements such as TSN or a 5G fronthaul/backhaul infrastructure. Future-proofing and sustainability thus go hand in hand.

The function extender interface is attached to the right of the SCALANCE LPE processing platform and to the left of the SCALANCE XCM-300 Ethernet switch. This makes it easy to integrate the LPE into the network (the switch) – the devices are mounted on the DIN rail and the connection works without any cabling effort.

Where do the requirements for ever increasing data rates come from?

Strong drivers for higher data rates in industrial communication are, for example, camera applications, large software updates in the production, or upcoming virtualization solutions.

IP cameras are increasingly used in the production for the monitoring and optimization of processes as well as for quality assurance. This also includes very data-intensive applications with cameras that measure production elements in 3D. In industry-related applications, high-resolution cameras are used, for example, for the precise control of cranes and in tunnel applications for live monitoring. More and more products that provide data, such as high-performance, high-resolution cameras, are being used at all kinds of places in the production. As a result, increasing data rates are unavoidable – meaning that the requirements for ever higher gigabit bandwidths in the production network will only increase. IP cameras as communication participants generate considerably larger amounts of data compared to sources of pure automation and control data. Therefore, a high-performance and flexible network infrastructure is required, in which the switches must have 1 Gbps or even 10 Gbps ports. This ensures that the data can be forwarded quickly and efficiently.

To handle the increasingly complex networks, greater functionality and comprehensive diagnostic capabilities are required in addition to the data rate. These are offered by the SCALANCE XC-300/XCM-300 and SCALANCE XR-300/XRM-300 in the form of managed Industrial Ethernet Layer 2 switches. They feature Virtual LANs (VLANs) for the structured division of large networks into smaller, logical subnetworks.

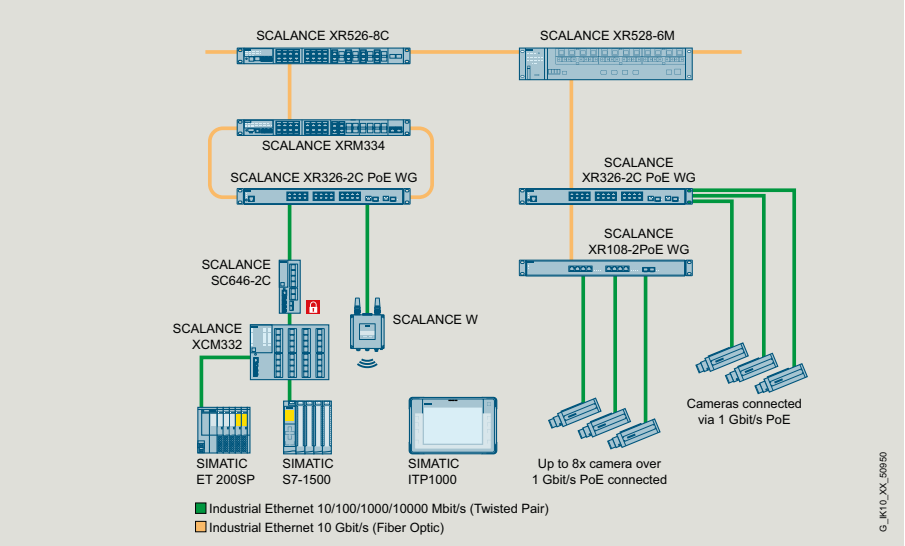
Security information

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept. For more information about industrial security, please visit **www.siemens.com/industrialsecurity**

Published by
Siemens AG

Digital Industries
Process Automation
Östliche Rheinbrückenstr. 50
76187 Karlsruhe, Germany

PDF
Technical article
DI PA-2223-10
PDF 0423 4 En
Produced in Germany



Many participants can be connected to the network via the new switches with high port density – ensuring high data throughput even over long distances.

Addressing current challenges with an eye toward the future

In ever shorter innovation cycles, the focus on current challenges may not be lost. This is illustrated by the expectations of some users, such as:

- the so-called janitor case
  (easy replacement of devices while maintaining the configuration)
- meeting of industrial temperature requirements while at the same time providing more performance for new functions
- easy integration into existing networks
- and much more

The new SCALANCE X-300 series combines both: existing requirements are met, continuously optimized, and at the same time new possibilities are created for the users. These include, for example, better integration of edge and cloud applications into the network or new, powerful network functions. TSN as well as the connection and integration of 5G infrastructures are currently the latest trends.