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Industrial communication

Whitepaper: Managed switches for high-performance data networks in production

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Future-ready machines and plants are interconnected

Communication networks are the backbone of the digitalization that is rapidly overtaking industrial environments. As the number of network participants and the variety of data-based applications grows, so does the need for powerful network technology and functionality. Nevertheless, machine and plant builders (OEMs) in particular are still relying on unmanaged switches for their networking, because these switches are supposedly easier to use and seem to be more cost-effective. First of all, however, managed switches can be installed as easily as unmanaged switches with no initial configuration. Secondly, additional investment costs have dropped over the past few years. And finally, by changing from unmanaged to managed switches, OEMs can offer their customers – the operators of their machines and plants in the discrete industries – a number of immediate and long-term benefits that will pay off this investment. Significant added value is achieved through high transparency, availability, and IT security as well as excellent usability and comprehensive support.

Economical solutions are drawn from a hardware and software portfolio that is scalable to different requirements.

Machines equipped with managed switches are integrated directly into existing network structures. Their expanded functionality ultimately contributes to higher productivity as well as process and product quality.

The web server integrated into managed switches enables efficient diagnostics, thereby contributing to maximum network availability

Focus on availability

Rapid diagnostics provide transparency and efficiency

Every fault that is quickly detected and located reduces downtime and costly production outages. With unmanaged switches, status LEDs on the devices are the only provider of fault diagnosis. To read them, maintenance personnel need to stand directly in front of the device. Valuable time can be saved when an error is precisely located with the help of a monitoring system; maintenance personnel can directly head for the right location within the factory. And remote access may even eliminate the trip completely.

Managed switches from Siemens are engineered and configured either via a web browser (web-based management) or in the Totally Integrated Automation Portal (TIA Portal). The latter also contains detailed PROFINET diagnostics that can be used to determine and centrally visualize the status of all participants.

Diagnostics via the managed switches' integrated web server are detailed and therefore highly meaningful. They are clearly displayed on web pages and can be retrieved from within the network via a web browser and via the Internet when appropriately configured.

In addition, accesses and error frequencies can be subsequently analyzed and appropriate conclusions drawn on the basis of automatically maintained log tables and port statistics.

Autonomous network management systems like SINEC NMS and SINEMA Server from Siemens are available to manage and diagnose complex networks with very high numbers of participants.

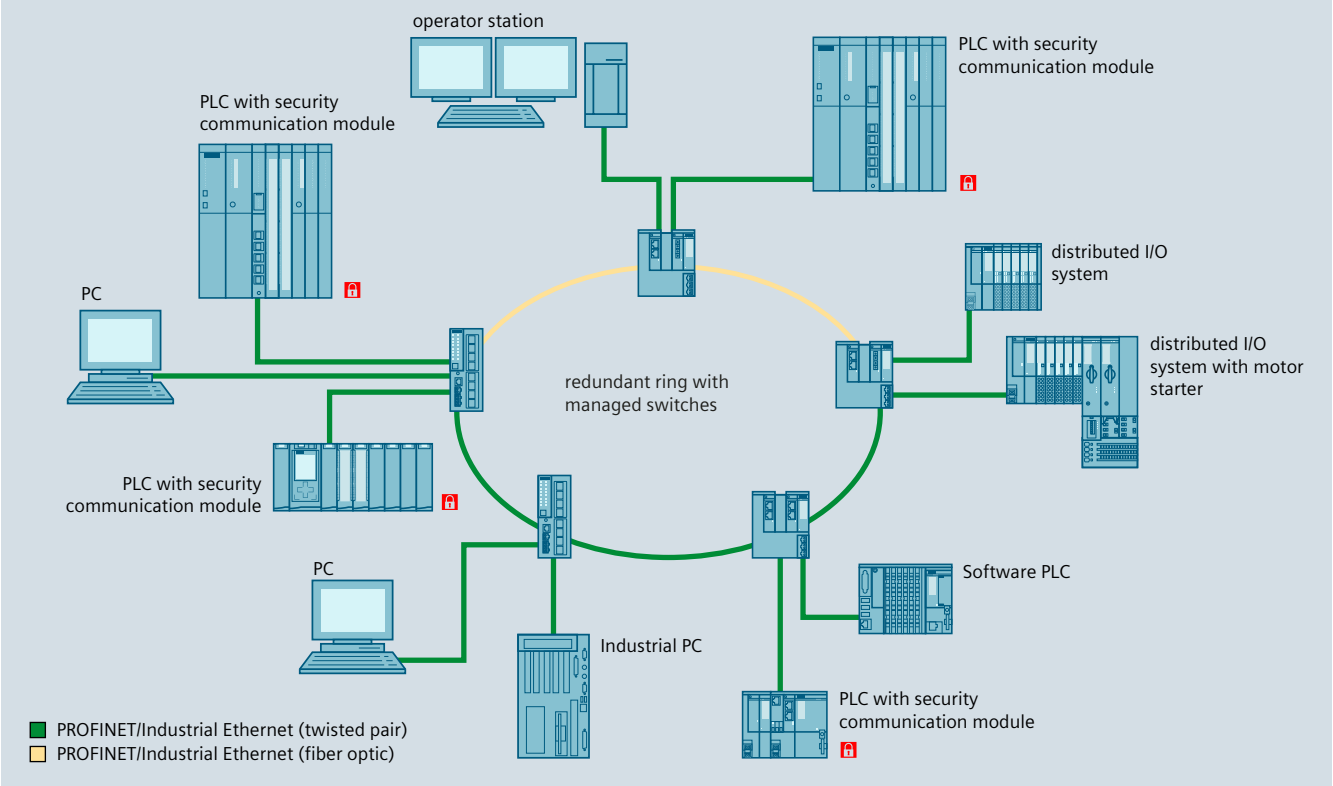
Redundancy increases availability

One of the fundamental advantages of managed switches is the option to connect them as a ring topology. Path redundancy is achieved for all participants by simply installing one additional line. A redundancy manager in the defined master monitors the consistency of this ring and, in the event of an interruption, switches to an alternative transmission path within a fraction of a second. The redundancy mechanisms are easy to set up and significantly increase network availability. An intact network is a prerequisite for plant diagnostics if an error occurs.

The Media Redundancy Protocol (MRP) is a standardized Layer 2 ring redundancy protocol based on IEC 62439-2. It is part of the PROFINET standard and therefore implemented in both devices and network components. With up to 50 devices in a ring, a convergence time of under 200 ms is achieved.

State-of-the-art cybersecurity

Companies that want to take lasting advantage of these many benefits cannot neglect security. This means protection from unauthorized access to devices and their configuration as well as production data – It starts as simple as the assignment of a new password, instead of using the preset default password for access. Another option is access control via access control lists (ACLs) on the devices. In this case, only the users listed are granted access rights.



Managed switches support redundant structures that make networks more robust against failures.

The segmenting of networks by means of virtual local area networks (VLANs) significantly boosts cybersecurity. VLANs act as broadcast blockers and only permit data traffic between defined participants, meaning that potential cyber attacks can affect only a small number of participants, if any.

Another way to protect against unauthorized access is to disable unnecessary ports and configurable alarms when connecting new participants. The authentication process based on IEEE 802.1X, usually in conjunction with a RADIUS server, is an option for larger plants.

Managed switches are a basic requirement for meeting high cybersecurity requirements – for example, according to IEC 62443. This is how machine builders lay the foundation that allows their customers – the operators – to implement the standard's requirements.

Convenient handling and use

Simple, convenient handling and usability of both the hardware and the associated software are crucial for high user acceptance. At Siemens, this includes a setup tool for assigning device names and IP addresses. The devices can then be accessed via the network for actual management tasks. One simple but useful function is Flash LED: A switch's LEDs can be actively set to continuous flashing so that a specific device can be immediately identified in the control cabinet.

The automatic loop detection function of managed switches detects and reports loops in the network and, among other things, prevents circulating telegrams – a feature that has proven its worth in developed networks in particular.

Once device configurations have been optimized, they are stored on a plug-in storage medium called a C-PLUG. This makes the exchange of defective devices much faster and easier, because all that's necessary is to plug the C-PLUG into the replacement device to automatically load the latest configuration and engineering data. It also greatly simplifies the commissioning of multiple, identical series machines on the network side.

Scalable solutions for universal use

A coordinated device portfolio with a scalable number of ports as well as scalable performance and functionality makes it possible to design custom solutions that are always economical – networks ranging from the simple to the highly complex, horizontally and vertically integrated, across all levels.

More than just hardware

Siemens offers a comprehensive portfolio of managed switches for solutions that are individually scalable and always economical

The SCALANCE X switches from Siemens comply with all accepted standards and as such are approved for a wide variety of applications in various industries and countries – including established PROFINET or EtherNet/IP technologies.

The web-based selection tool makes it easy to select and order the right components.

A KEY-PLUG can be used to enable special expansions at specific SCALANCE X switches, such as Layer 3 functions for additional IP routing.

Support from the design phase to stable operation

The requirements for network technology in industrial environments are different from the requirements for the office and the IT world. To help meet these specific demands, Siemens supports both system integrators and operators with expert consulting and IT training for automation engineers.

On request, Professional Services provides custom service and support for the design and implementation of industrial communication networks – from customized network design and detailed location analyses to implementation services for fast, trouble-free commissioning.

Well-equipped for the digital age

By using managed switches, machine and plant builders immediately realize concrete benefits for themselves and their customers, the operators. Right from the start, this optimally prepares both parties for the ever-growing demands placed on network communication in an age of rapidly advancing digitalization. At a reasonable extra cost, managed switches create a high-performance and scalable basis for ongoing success in the future.

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Security information

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