




Industrial Communication

Redundant, high-performing, secure – Production Network restructured

Constructed with industrial-grade Network Components from the Company's own Product Range

For safeguarding and optimizing of the production, Siemens is relying on industrial-grade network components from its own product range for its production location in Fürth, Germany. The electronics company implements additional redundancy at the distribution and access layers with it. Furthermore, process-oriented, segmented VLANs and layer 3 (routing) procedures make the production network especially high-performing, available, flexible, and secure.

In a new production hall at the Fürth location, the Systems Engineering Business Unit of the Siemens AG has concentrated production facilities from other buildings and factories, and integrated them into the production and businesses processes. The network architecture planned there was realized with industrial-grade network technology from the company's own Scalance product range.

In the new "Hall L", the electronics company has been manufacturing different products in small to medium quantities since March 2014 – down to a batch size of 1. From individual circuit boards to modules to complex controllers for a wide range of industrial applications. The expression "low volume – high mix" aptly describes Fürth's highly flexible and demanding business with roughly 5000 product variants. Correspondingly large is the number and variety of different means of production and workstations that had to be integrated into the IT structures.



In a new production hall at the Fürth location, Siemens Systems Engineering flexibly produces different products in small to medium batch sizes.

Strong Partnerships

The expanded network solution was developed, planned, and implemented in close collaboration with the Global Services Information Technology division from Siemens, the local IT department, and the Siemens partner Atos Germany. Consulting support was provided by the network experts of the Industrial Communication department. Atos, an internationally operating vendor, brought in its IT competence throughout all implementation phases of the project. To begin with, the individual requirements concerning availability and data security were recorded. From that, the experts developed a network design meeting the special demands asked of a secure networking of production and office environments. "To construct the network, we configured and installed the Scalance components, and then commissioned the overall network," tells Dieter Müller, project manager of Managed Services at Atos.

Multilayered Tasks and Requirements

Over 100 clients in the production of the Fürth location were to be networked with the central servers in the Siemens data center (WAN) – including the controllers of four SMT lines (surface-mount technology), THT soldering systems (through-hole technology), surface finishing systems, as well as PCs at various assembly and testing stations.

Some of which run in a three-shift operation around the clock. "Distributed over the network are work orders for machines and systems, work instructions for employees, and also software updates and images for the controllers," states Michael Dorn, project manager from the local IT team.

For tracking and tracing the individual process steps, all processes with interactive data exchange between end devices and servers require increased availability and performance. This sometimes involves approvals from the central office – so that interruptions of the communication would halt the production. All that calls for a highly reliable communication. At the same time, the demands on IT security increase further.

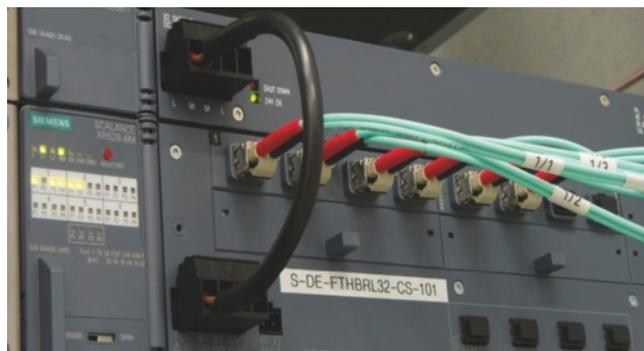
To fulfill all these requirements, the production network in the new factory building was to be decoupled from the rest of the location, and be divided into logical, production-process-oriented segments with a manageable number of participants. The goal is to prevent, as much as possible, failures caused by malfunctions or attacks. As security measures, for instance, higher-level firewalls with layer 3 architecture throughout as well as access restrictions via access control lists (ACLs) are utilized.

"The Scalance product range meets all requirements in an industrial environment and was offering the right components for the implementation of the network solution at the Fürth location," tells Uwe-Armin Ruttkamp, Fürth site management. Preceding the migration project was an analysis of all clients by Atos to ensure that even older controller and operating systems were layer-3-capable and could be routed via IP addresses. In particular, technical restrictions had to be observed with some testing systems. In the end, though, all systems were able to be integrated into the new structures.

Revised Network Structure for an efficient Production

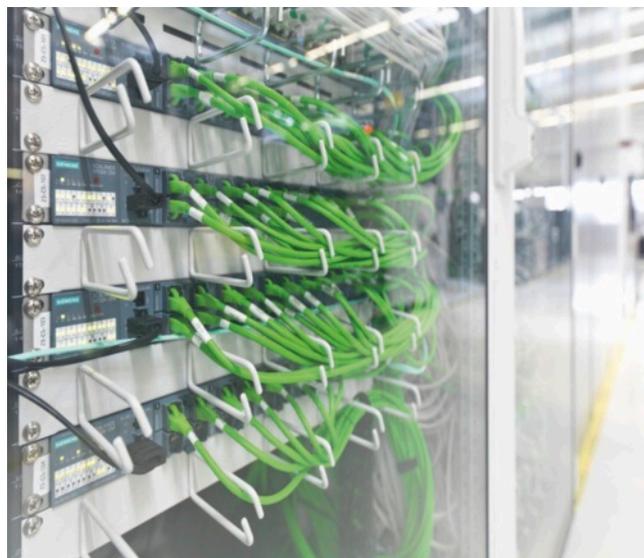
The present communication network at the Fürth location is structured into three layers consisting of core, distribution, and access layers.

In addition to the existing core routers in the campus LAN and the hardware firewalls, two physically separate switches of the type Scalance XR528-6M were installed at the distribution layer.



At the distribution layer (production backbone), two redundant Scalance XR528-6M switches provide for increased reliability.

They are connected with each other by means of redundant 10-Gigabit fiber optic rings, and represent an expandable production backbone. If one of the devices fails, the remaining one takes over the operation. The higher-level hardware firewalls separate and regulate the access between the production and the rest of the network. The communication of the production VLANs is likewise controlled by the firewalls. Also redundantly connected to the two Scalance switches of the distribution layer are a total of nine Scalance XR324-12M switches with multiple ports at the access layer. They are distributed among several wiring closets in the production and combined into multiple redundant rings. Via patch fields, end devices in the production grouped into VLANs are connected to the redundant rings. In the field, an end-to-end Gigabit Ethernet is realized through Cat 6 cabling.



The high-performance Scalance XR324-12M switches – redundantly coupled to the distribution layer – securely connect about 20 VLANs to the data servers.

Segmentation follows the Production

The original, site-wide VLAN with roughly 150 participants was not segmented, thus problems with the layer 2 communication could affect even higher-level layers. The network was not yet set up redundantly – so that failures of individual network components could have resulted in prolonged downtimes.

With the implantation of the Scalance switches, the network for the production area in the new factory hall was separated from the rest of the location, and segmented following the requirements of the production. For instance, there are now about 20 smaller VLANs – each with a maximum of eleven participants.



The Siemens plant in Fürth produces a wide range of products: From individual circuit boards to modules to complex controllers for different industrial applications.

This noticeably increases the bandwidth in the individual segments and with it the transmission speeds. Furthermore, malfunctions or possible attacks could now only affect a small number of devices. The availability of the facility is thus significantly increased. The interaction of hardware firewalls and ACLs provides maximum protection against unauthorized access from the outside as well as between the production VLANs.

“Thanks to the good preparation of the project and the migration in the back office, the actual transition of the individual participants in the production could be performed and tested during chronologically coordinated maintenance slots – so that the operation was hardly impacted,” states Bernhard Steigerwald, head of Global Services Information Technology Factory Automation. Even after the completion of all function tests,

Atos continues to look after the overall solution at the Fürth location through its so-called Full Managed Services. The availability of the network is secured further by a team of specialists, which can be reached 24/7. As a result, Siemens benefits from reliable IT services for an effective industrial network communication, and thus increases its economic efficiency.

Designed for the Production

The robust managed switches of the families Scalance XR-500 and XR-300 in 19-inch rack format are designed for industrial use. The devices can be equipped with different media modules to integrate even “grown” heterogeneous structures. Fast convergence times of the industrial



Michael Dorn, project manager in the local IT team at Siemens Systems Engineering in Fürth: “In intensive collaboration with all parties involved, the specific tasks of our production could and can be implemented efficiently and economically.”

redundancy protocols enable a quick reconfiguration after network changes. The configuration of the switches is automatically stored on removable media – so-called C-Plugs. Following a hardware change – which can be performed during ongoing operations and does not require a specialist – the configuration is immediately available again after inserting the C-Plug. This saves valuable time and keeps the availability of the data network, and with it the production, at the highest level.

Successful Project thanks to successful Collaboration

“The collaboration of all parties involved worked perfectly and was fun,” tells Lorenz Rappl, head of manufacturing in Fürth. “We are truly pleased with the project progression as well as the achieved stability, availability, and performance of the new network infrastructure in daily operations.” The Scalance components employed in the solution are produced by the Siemens plant in Karlsruhe, Germany, and have been functioning trouble-free since the commissioning.

“The focused and constructive collaboration between our IT department, Atos, and the network experts from Industrial Communication has paid off: Thanks to the capable project management, the solution at the Fürth location could be implemented successfully,” states Steigerwald.

It is also planned to add IWLAN access points (Industrial Wireless LAN) from the product family Scalance W to the control cabinet manufacturing of the new factory building in Fürth.

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