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Reference

Hofbräu München creates the conditions for digitalized beer production with a new network

The letter pair HB with the crown is known worldwide. The same goes for the Munich Hofbräuhaus am Platzl. The owner of the brand is the brewery "Staatliches Hofbräuhaus in München", which, as a government-owned enterprise of the Free State of Bavaria, sold almost 370 000 hectolitres of barley juice in 2019 and turned over around 52 million euros with its 14 types of beer.

Challenge: network infrastructure no longer met the requirements of digitalization

The decentralized infrastructure installed back then has grown over time and consisted of a mixture of Ethernet components and classic PROFIBUS fieldbus systems. "This production network was now very much outdated and no longer met today's real-time requirements of Industry 4.0 and digitalization," says Silvio Di Tano, Head of Electrical Engineering at Hofbräu München.

Hofbräu München depends on fast and smooth system processes. In this respect, a real-time network is a crucial success factor.

Moreover, these were isolated solutions – for example in the bottling, the brewhouse, or fermentation, yeast and storage cellars – which had fulfilled their tasks well for a long time, but did not allow data exchange beyond their own network boundaries. Today, on the other hand, a centralized bundling of data streams is necessary in order to carry out data analyses throughout the company, to recognize correlations, and to quickly draw conclusions from them.

The existing infrastructure for IT (Information Technology) – for example in the administrative area – is not suitable for production either. This is because the requirements for an OT network (Operational Technology) are fundamentally different from an IT network. While the IT network is primarily concerned with data transmission performance via a common infrastructure and cybersecurity, the OT network focuses primarily on the secure operation of the systems with reliable data transmission of time-critical applications – even in harsh environments with heat, steam, and high pressures.

The focus here is therefore primarily on permanent availability and real-time capability when it comes to the transmission of sensor signals and measured values. Nevertheless, companies today have to connect both of these different worlds, as end-to-end communication with higher-level networks via standardized interfaces is indispensable for digitalized, efficient processes.

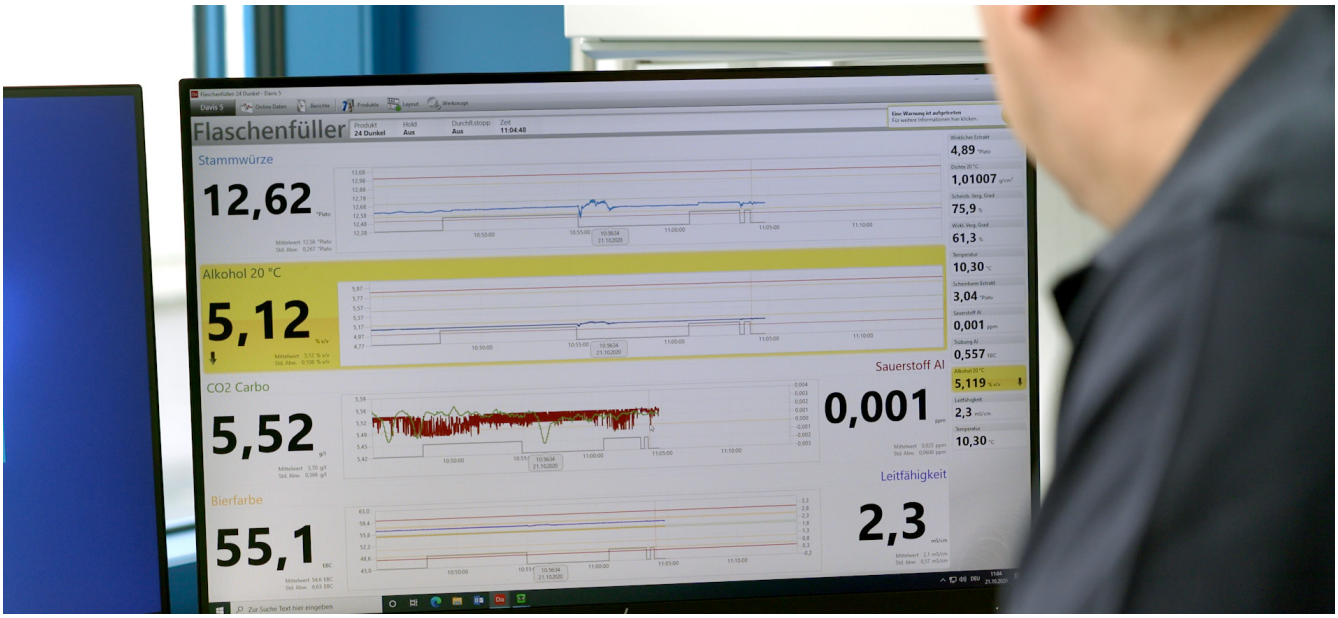
"With the complete modernization, we wanted to integrate our automation technology into the OT world and decided on Siemens for the implementation since this partner has excellent knowledge of both topics and offered the best solutions," Di Tano recalls. It was a matter of bringing the systems in the brewery up to date, connecting them with each other, and increasing data transparency of the processes in order to use a modern ERP (Enterprise Resource Planning) system from then on.

Hofbräu München also wanted to be prepared for the introduction of the Weihenstephan standard "WS Brew", which was released in August 2019. For the brewing industry, this standard defines both a universally applicable communication interface for connecting machines and higher-level data acquisition systems or Manufacturing Execution Systems (MES), and the data which must be provided for acquisition. Siemens has supported the development of this international standard from the very beginning and, with its network technology, ensures that all steps can be documented at any time, from malt intake to bottling of the beer.

"As a master brewer, I have to be able to constantly observe the entire production process from front to back and make it traceable," adds Rolf Dummert. In the past, this was possible thanks to a lot of experience and a sheet of paper, but today this is no longer possible. The much more frequent changes in the brewing processes for the different types of beer – from Hofbräu Original to Dunkel and Weisse to Maibock, Sommerzwickl, Oktoberfestbier or Non-alcoholic and Pure – make automated reporting necessary in order to ensure high quality on an ongoing basis.

Highlights of the solution

At Hofbräu München, end-to-end networking and communication via Industrial Ethernet and PROFINET has replaced traditional fieldbus systems such as PROFIBUS. This enables comprehensive data analyses in the different areas and safe commissioning, diagnosis, and maintenance of the systems and equipment via the network. Its modernization took place during ongoing brewery operations and, as a Siemens solution from a single source, included not only the installation of hardware and software, but also consulting, planning, network design, and step-by-step commissioning according to the specific ideas of the state-owned brewery.



Real-time data analysis ensures consistently high product quality.

"For us, it's about being able to look at the processes in the brewery retrospectively and in a traceable manner at any time in real time," says the technical operations manager. For example, how many and what kind of auxiliary materials are needed, how much energy is consumed, what temperatures have been reached, or what alcohol concentration has been produced as a result? These parameters have a direct impact on the quality of the beer and must be changed quickly if necessary. In addition to the brew master, the quality control laboratory also needs this information, as does the bottling or maintenance department.

"My goal of digitalization at Hofbräu is that in the future I can focus on developing and refining new, great beers all day long – and will no longer have to deal with recurring problems such as production outages or quality defects that used to occur day in day out," sums up Rolf Dummert an important reason for the change in infrastructure. Powerful industrial communication networks, such as those now installed at Hofbräu München, are the prerequisite for this.

From consulting to implementation – all from a single source

When the decision for the network project was made about two years ago, the first step was to task the experts from Siemens with an Industrial Networks Health Check as part of their Professional Services offering. During this inspection of the entire brewery, a thorough review and documentation of the existing network took place. The identification of performance weaknesses and the specification of requirements were also part of this evaluation, which was carried out together with the customer.

This was followed by the network design, the installation of the cables and components, and their step-by-step commissioning. The final stage was the integration of various security components and the completion of the central network management system six months ago. Then, in autumn of the year, there was an update of the network in the beer production area to prepare it, together with the automation segments, for the planned upgrade of the control system.

"We developed the individual steps together, tested and optimized them again and again, and implemented the whole thing during ongoing operations," says Silvio Di Tano, who describes the cooperation with Siemens as a "cooperation on equal terms". They did not just provide an off-the-shelf solution, but an individual infrastructure according to our own ideas. This also includes the implementation of the necessary security requirements. "To minimize the risk of cyberattacks, we built the network according to a cell protection concept in which the individual cells are secured via firewalls," reports the head of electrical engineering.

Another important aspect is the robustness and high availability of the Siemens hardware, which is permanently exposed to temperatures of around 50 degrees Celsius in some areas of the brewery. The ease of maintenance of the plug & play components, which can be easily replaced in the case of a failure, was also a reason for choosing this supplier.

"The network has now reached a stage where we can flexibly connect all existing and, in the future, all new equipment and machinery, and have achieved full data consistency," emphasizes Rolf Dummert. The isolated solutions are now a thing of the past. "And the fact that the entire infrastructure now comes from a single source has also simplified the work for our internal maintenance staff," says the technical operations manager citing another advantage.

Well-equipped for the future with a secure industrial network

By switching from the previous PROFIBUS standard to PROFINET, which is supported by the high-performance SCALANCE components from Siemens, Hofbräu München has made its production network fit for the future. Redundant ring structures, high data transmission rates, and cell protection with segmentation as well as access via firewalls are the basis for fast, fail-safe, and highly available communication in the future digital enterprise.

On the one hand, access to the data is possible from the company's own production and corporate management levels. On the other hand, suppliers can now also access their systems remotely according to a graduated security concept – either on-site or from outside in order to save time, travel, and costs. The Industrial Wireless LAN (IWLAN) installed by Siemens enables wireless access to all information by tablet or notebook throughout the site – for maintenance technicians, for example. "We can connect to any networked device while on the move and analyze, parameterize, or commission it," states Silvio Di Tano.

A tangible benefit is also the significant reduction in the time it takes to change over a bottling line after a change of beer type: "By interconnecting the measuring devices at the filler, we have become more flexible and can set new limit values relatively easy from a central location – with the assemblies that are then switched taking over automatically." Even though Hofbräu München – with its new network – has only just laid the foundation for new applications and is at the beginning of a lengthy development towards Industry 4.0, it is clear that some concrete advantages are already becoming apparent today.

"We have already been able to improve a number of our brewing processes and procedures by making it easier to extract data from the production and analyze it in real time, thus improving the quality of our products," says Rolf Dummert citing another example. The installation of two displays with a dashboard in the quality assurance laboratory also contributes to this. In addition to the usual control of random samples, it can now also track all parameters in a running brewing or filling process in real time and act more quickly if certain limit values are exceeded. In the future, it will also be possible to carry out quality control online for Hofbräu licensees who brew Bavarian beer all over the world under the brewery's name in accordance with the German Purity Law.

Another immediate tangible benefit from the state-of-the-art network is what those responsible at the state-owned brewery expect in the area of energy saving. In the medium term, the brewery wants to operate in a completely climate-neutral manner, and to this end, it also wants to set up an energy data management system (EMS). For this reason, sensors and measuring devices have already been installed in all relevant areas, the values of which are now also transmitted via the network and collected centrally. "Now it's a matter of automatically evaluating these huge amounts of data and using them for the continuous improvement of energy use with simultaneous further process optimization," says the technical operations manager looking to the future.

The use of artificial intelligence (AI) will then also play a stronger role because – according to Dummert – a large part of the data needed for this is already available. However, a continuous evaluation in the areas of heat, compressed air, or water consumption, for example, would be helpful for optimization. And this can no longer be done manually. Cloud-based AI solutions such as the MindSphere platform from Siemens are the key here.

After all, solutions from a single source, as realized in Munich-Riem, include not only reliable hardware and software products, but also consulting services based on comprehensive industry know-how in the food & beverage sector and in OT network and automation technology.

Technical details: three kilometers of cable and secure remote access

Around 3 000 meters of new cables were laid for the brewery's Industrial Ethernet network and 85 different SCALANCE network components were installed which are closely matched to the SITOP power supply units and SIMATIC controllers from the Siemens automation portfolio already in use at Hofbräu München. A building-wide, redundant backbone ring consisting of four SCALANCE XR524-8C switches now forms the backbone of the production network. To protect against unauthorized access to individual cells, six high-performance SCALANCE SC642-2C Industrial Security Appliances are used which act as firewalls monitoring all network traffic and take over routing. They also enable the transition to the office IT via corresponding protocols.

SCALANCE XR524-8C switch as the backbone of the production network

The previous line structure of the network was converted into several subordinate ring segments with participants which logically and spatially belong together. They are redundantly connected to the backbone via layer 2 switches from the SCALANCE XR-300 and SCALANCE XC-200 series – depending on the scope and required functionality. Proven redundancy mechanisms reliably maintain communication in the event of a network device failure. Seven SCALANCE W1788-1 WLAN Access Points transmit according to the current IEEE 802.11ac Wave 2 standard with a gross data rate of up to 1 733 Mbps – even in harsh environments such as found in a brewery.

With a higher-level SINEMA Remote Connect server, the management platform for remote networks from Siemens, an additional central security instance for remote device access was installed. This grants access to dedicated areas of the automation network exclusively to authorized users via VPN tunnel and SINEMA RC client. Authorization takes place via certificates or user accounts.

Furthermore, Hofbräu München can use physical pressure switches to switch remote access by suppliers on and off as required – and thus has full control at all times over when access to the respective system is permitted. Especially in light of the access restrictions in connection with the COVID-19 pandemic, convenient and secure remote access to the systems by the manufacturers' specialists is indispensable. Siemens also utilizes this option for network maintenance, and the service staff of Hofbräu München, too, can remotely access any part of the brewery if necessary.

With the SINEC NMS network management system, the entire industrial network can be monitored, managed, and configured centrally and around the clock – including the security-relevant areas. Thanks to its scalability, it can grow in a flexible manner at any time, even if the network becomes larger and more complex. Its design took into account the Siemens defence-in-depth concept from the outset which is based on the IEC 62443 standard and consists of the three pillars of plant safety, system integrity, and network security. "For us, this network is all about high flexibility to be ready for the future, but at the same time we want the highest possible level of security," underlines Silvio Di Tano.

The SINEC NMS network management system with its scalability can grow with the network, even if it becomes larger and more complex.

The benefits at a glance

With the modernization of the network during ongoing operations, the foundation was laid for the digitalization of production and new applications – such as predictive maintenance or the use of artificial intelligence. The first concrete benefits have been achieved through quality improvements in the brewing process thanks to data analyses, the reduction of energy consumption, and the optimization of plant maintenance. For the future, further uses of data applications are planned in all areas of the brewery which can be realized flexibly and quickly with the help of the OT network in the production. These will further increase efficiency, save costs, and contribute to an increase in production volume.

Munich Hofbräuhaus am Platzl

Founded in 1589, the traditional brewery is present on the market as "Hofbräu München" and exports more than half of its output (54%) to approx. 40 countries around the globe. In addition to producing and distributing beers, the company is also involved in granting brewing licences, franchising catering concepts, and international merchandising.

"In some Hofbräuhaus locations in the US, Russia, China, Brazil, and Dubai, there are dedicated pub breweries which produce our various beers to be sold there," reports Rolf Dummert, a trained master brewer and now technical operations manager at Hofbräu München.

Furthermore, licences have been granted to breweries in China, Hungary, and the USA, which produce beer for their respective markets according to Bavarian quality standards. There are currently 135 employees plus three trainees at the parent company, which since 1988 is located in Munich-Riem.

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 additional information on industrial security measures that may be implemented, please visit
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