

Technical
article

Professional service for wireless, failsafe communication in the truck final assembly

A renowned truck manufacturer has further automated its final assembly and converted the automated guided vehicle system for chassis to wireless, failsafe communication. This was preceded by an evaluation of the situation on site as well as a sound infrastructure and channel planning. After receiving the go ahead by the customer, the network specialists from Siemens Professional Services put the Industrial Wireless LAN (IWLAN) into operation, fine-tuned it and verified its performance. Since then, the transport has been running failsafe as well as more flexible and (cost) efficient.

Lifeline of said truck final assembly is an automated guided vehicle system (AGV) with eight automatically guided vehicles, which transport the truck components on an approximately 400 meter long loop. The communication between the mobile vehicle and stationary controllers was previously handled by a bound cable system, which proved to be inflexible and over time, increasingly high-maintenance. Motivated by successful projects in industrial environments, the manufacturer decided to convert its AGV to wireless communication. To this end, the manufacturer sought support from Siemens Professional Services for Industrial Networks.

Failsafe IWLAN professionally (planned and) implemented

The stipulated failsafe communication demands the highest availability and the shortest, deterministic response times, which decisively shaped the design of the application. It was clear from the beginning that on the automation side, there could only be a solution with the Siemens-proprietary iPCF-MC protocol in conjunction with PROFINET and PROFIsafe communication, which uses the 5 GHz frequency band set for industrial environments. Only with that is a quick and trouble-free hand over (roaming) of the mobile network participants between several IWLAN access points possible.



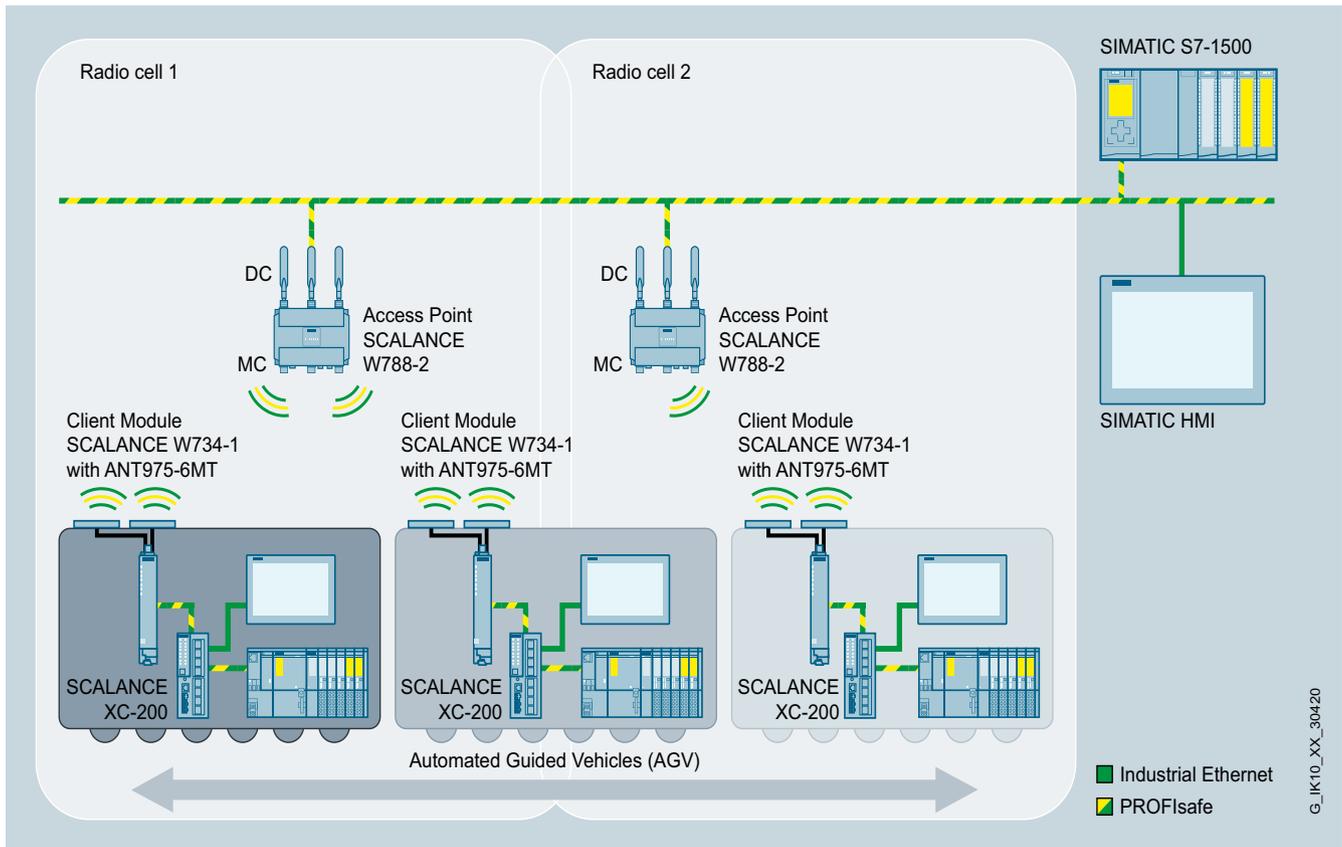
Core components of the IWLAN solution designed and implemented by Siemens Professional Services are SCALANCE W788-2 access points along the route and SCALANCE 734-1 client modules on the vehicles.

Spectral analysis indicates signal strengths and sources of interference

To avoid potential interference from other wireless communication nearby, a spectral analysis in the entire channel spectrum of the 5 GHz band was conducted along the entire route. This ruled out interference with radar applications, which exclusively transmit in the mid 5 GHz band range. Thus, occupied channels could be detected, and enough suitable free channels be identified and assigned. These are deliberately used several times along the route to keep the number of channels low.

For optimum coverage of the entire route, ten SCALANCE W788-2 M12 IWLAN access points with three ANT795-4MC antennas each were ultimately installed. These are connected to the central controller via a SCALANCE X switch and separated in a Virtual LAN (VLAN), which provides additional protection against unauthorized access. On the vehicles, SCALANCE W734-1 RJ45 IWLAN client modules with two ANT795-6MT antennas each are mounted, which are connected to the respective vehicle controller via PROFINET.

With these specifications and by means of a floor plan, the rough planning of the wireless network was created, suitable hardware selected and an approximate cost framework calculated. After the operator's OK, an IWLAN specialist from Siemens Professional Services inspected the structural and especially the wireless conditions on site. As part of this site survey, the installation locations (determined off-line) for the access points were verified with devices from the SCALANCE W portfolio from Siemens, and the infrastructure adapted to the actual structural conditions.



The iPCF-MC IWLAN protocol enables rapid, reliable roaming and deterministic, failsafe communication in applications with clients that move freely in the wireless field.

(iFeature enables) Determinism and rapid roaming

The SCALANCE W access points were selected because they possess two wireless interfaces, which are a prerequisite for using the so-called iFeature iPCF-MC. The abbreviation stands for "industrial point coordination function-management channel", a Siemens-developed IWLAN protocol for deterministic – also failsafe via PROFIsafe – PROFINET communication and rapid roaming by participants/clients that move freely in the wireless field.

The deterministic behavior is controlled by the respective access point, which queries all clients of its wireless cell at cyclic intervals to exchange data all around. The iFeature also enables rapid and reliable switching between two wireless cells – with constant roaming times well below 30 milliseconds. To this end, the clients continuously scan the environment for alternative access points and detect their signal strength. As the signal strength decreases, the switch to another access point is prepared and can be performed very quickly once the switching threshold is reached, i.e., when the signal to the connected access point becomes too weak. This works because one of the two wireless interfaces of each access point is exclusively used as a management channel and sends a beacon frame as a cyclic signal, while only user data is transmitted in the polling interval over the other wireless interface.

In the course of this, the clients may only send for the duration of a given time slice – after they have been requested to do so by the access point. In addition, the roaming process is optimized so that it can be deterministically completed within the configured PROFINET update time. Thus, PROFINET update times as fast as 32 milliseconds can be realized. In the end, 128 milliseconds on PROFINET were sufficient in this project to safely rule out communication errors when using an iPCF cycle time of 64 milliseconds.

IWLAN put into operation, set up and fine-tuned

Following the mounting of the IWLAN components by a system integrator, the installation was mechanically inspected by Siemens specialists, the wireless network set up, the devices put into operation and the system fine-tuned. This generally includes an update to the latest firmware, the allocation of IP addresses and WLAN channels, the adjustment of the transmitting power and the orientation of the antennas. Via the recorder function of the SCALANCE W client modules, the signal characteristics of two vehicles on trial runs were recorded, analyzed and found to be good. As was the second, concluding spectral analysis – so that the IWLAN installation as a whole could be handed over fully operational after just less than two days.

According to the operator, the solution meets all requirements. It can be flexibly expanded when necessary, and easily maintained and serviced.

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 only form one element of such a concept. For more information about industrial security, please visit <http://www.siemens.com/industrialsecurity>

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Professional Services: Comprehensive support in all aspects of industrial communication networks

An Industrial Wireless LAN is more challenging than a conventional WLAN: The industrial operation makes much higher demands than the office world; often these vary from industry to industry and from country to country, and whether it takes place indoors or outdoors. This requires both comprehensive and very specific expertise. When it comes to wired as well as wireless networks, the specialists from the Professional Services for Industrial Networks are always on the ball. The Siemens team was established to support manufacturers and operators of machinery and equipment with network technology from Siemens and other suppliers in every life cycle phase – from design to service.