

# IWLAN with PROFINET in a High-Bay Warehouse with Order Picking: Radio Field Planning and Cost Analysis

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## Summary

Wireless communication offers many advantages over wired solutions. Certain aspects need to be considered during implementation, however. Among these is planning the ideal infrastructure: Can dead spots really be reliably eliminated? Is it possible to plan and create a radio field optimally without great expense?

This specialist article answers these questions using a typical application in a high-bay warehouse with storage and retrieval machines. Detailed contents:

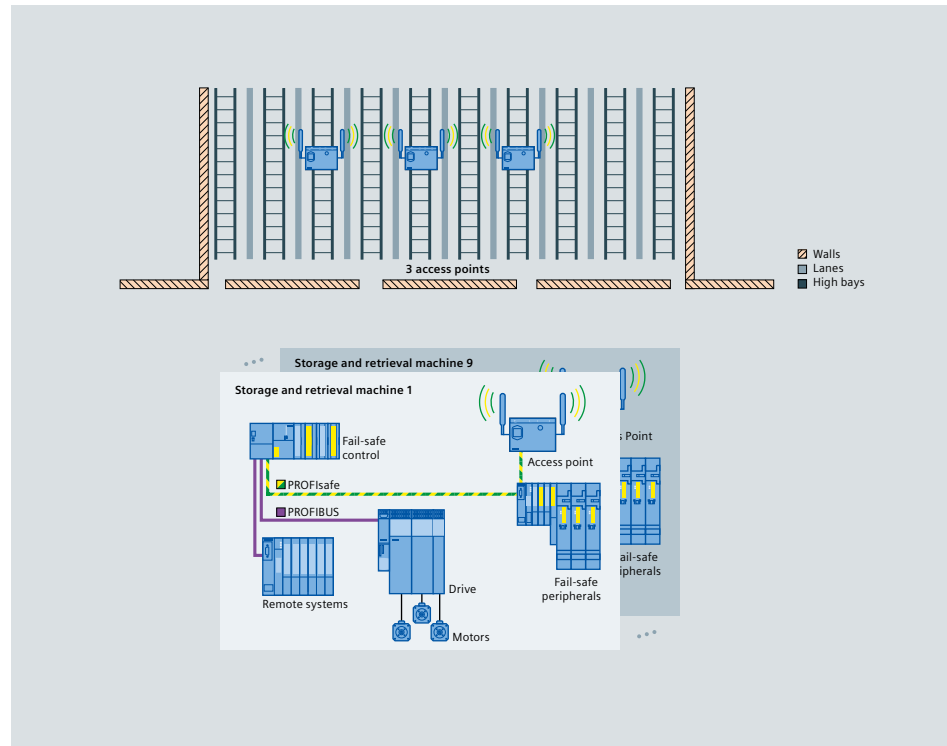
- Project definition and automation architecture
- Configuration of wireless networks with SINEMA E
- Cost analysis
- Conclusion

## IWLAN with PROFINET in a high-bay warehouse with order picking

### Project definition and automation architecture

In the following example, we look at a typical application area for wireless communication in an industrial environment. The task was to convert an existing logistics center with wired communication to Industrial Wireless LAN (IWLAN) with PROFINET. The new solution needed to offer higher performance and improved diagnostics options, as well as enabling the flexible and future-proof integration of both safety systems and stationary and mobile clients. Our example looks at a high-bay warehouse with nine storage and retrieval machines (SRMs) and 16 rail-guided shuttle cars in the order-picking area. Figure 1 shows a typical configuration including the integration of the safety system with Safety Integrated.

**Figure 1:** Typical automation architecture for a storage and retrieval machine with IWLAN and PROFINET



## The benefits at a glance

### The IWLAN solution with PROFINET offers a wide range of advantages for a high-bay warehouse:

- ✓ Higher performance thanks to a higher data transfer rate

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- ✓ Greater flexibility and system availability

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- ✓ Clear cost savings, both in installation and in operation

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- ✓ Increased safety in operation

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- ✓ Safety applications possible via a single medium with PROFINET, including wireless

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- ✓ Integration with Ethernet: easy connection to the control and company management levels

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- ✓ Future-safe solution

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- ✓ Speedy installation and commissioning thanks to reliable hardware components for wireless communication

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- ✓ Good support thanks to widely used technology

And, with the elimination of moving cables, the danger of cable breaks is also a thing of the past. In this way, the risk of an unexpected breakdown is minimized and availability considerably increased. The comprehensive diagnostics possibilities that PROFINET offers also contribute to this. These ensure that weak points in the system can often be detected before any damage is incurred. PROFINET's high-performance diagnostics allow fast troubleshooting and problem solving, and guarantee high system availability.

Furthermore, the integration of existing systems is easy: fieldbuses such as PROFIBUS can be easily connected to PROFINET. In this way, IWLAN with PROFINET creates a continuous network for both wired and wireless communication. This significantly accelerates the commissioning process. A seamless connection is also possible at the manufacturing execution system (MES) level, something that is particularly important in the field of logistics for supply chain management.

Further added value comes with fail-safe and standard communication running parallel over the same system – for instance, over the PROFIsafe profile with PROFINET.

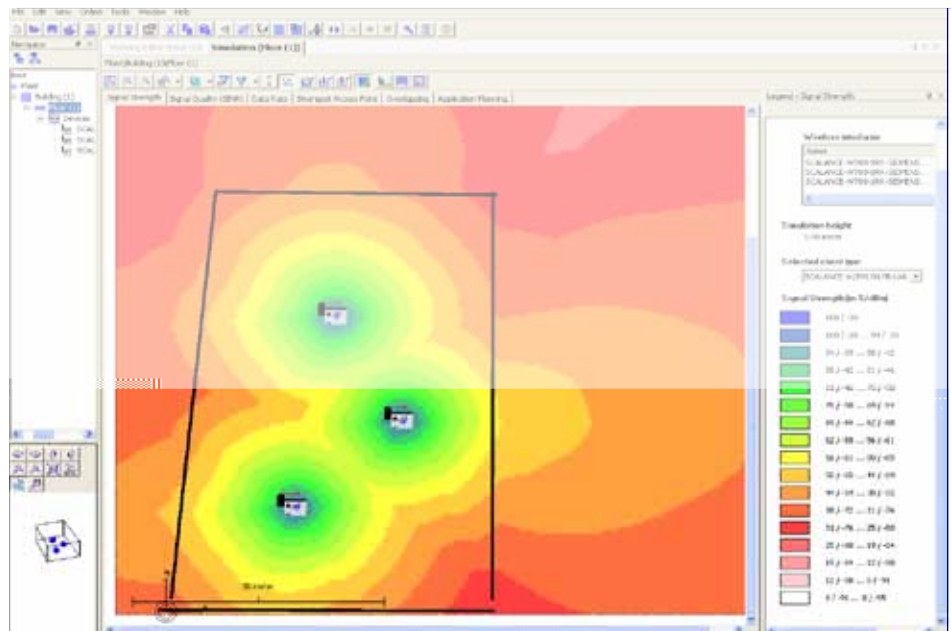
Last but not least, the IWLAN solution with PROFINET features a significantly higher data transfer rate than conventional wireless transmission media such as contact conductors or proprietary radio. This is reflected in a correspondingly higher system performance. It is particularly important for tasks in systems with multiple clients and a high data volume, as is typically the case in logistics. Here, it is not only the data from the mobile systems that are transmitted to the central controller. Where required, storage and retrieval processes within the plant must also be continually monitored on video. To do this, cameras are positioned on the SRM, and their information must also be transmitted. It would not be possible to transmit the resulting high data volumes using a solution with data light barriers or contact conductors. With IWLAN with PROFINET, however, it is possible to operate several applications in parallel. Altogether, wireless communication using IWLAN with PROFINET contributes to a considerable improvement in performance. In a typical application, with modernization of the sorting process accompanied by modernization of the automation technology, it was possible to increase the productivity of a logistics warehouse by more than 30 percent and to reduce the error rate in the system to an absolute minimum. In the end, the warehouse operator was able to significantly increase the logistics capacity without having to construct a new building or expand the existing one.

#### **Configuration of wireless networks with SINEMA E**

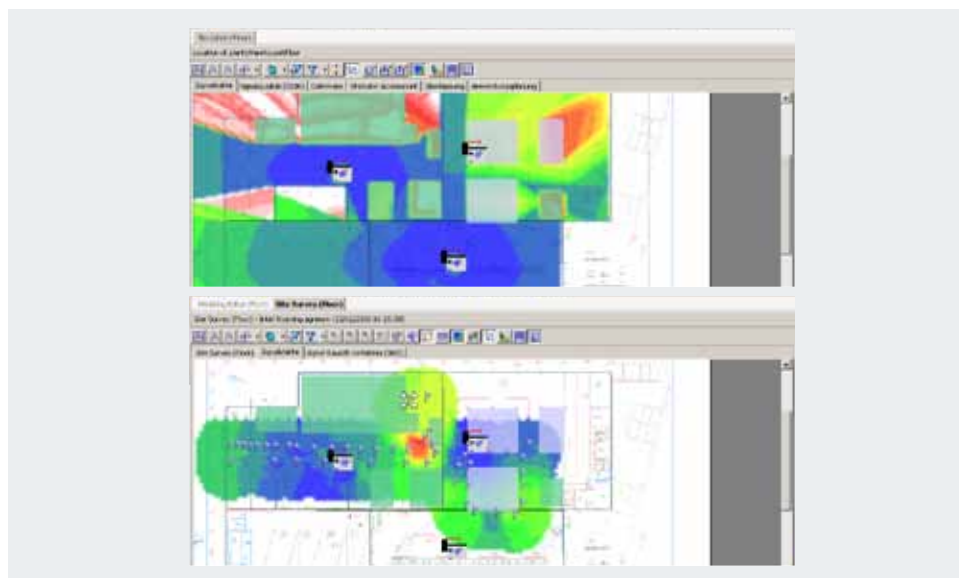
A technical issue that is specific to wireless communication is the reliable connection of the mobile systems to the radio network. In particular, different radio fields must not interfere with each other. The corresponding radio field planning must ensure that the mobile systems always have sufficient signal strength for communication, so that a maximum transmission rate is possible. In addition, the radio field planning must ensure that no interference occurs between the different radio fields. The capital investment requirements are also optimized at this stage, as it is possible to calculate the exact number of routers required and the best positioning for the access points.

Thanks to easy-to-use and powerful tools such as SINEMA E from Siemens, radio network planning can be carried out without any specialist knowledge. SINEMA E allows the systematic and structured planning, configuration, and commissioning of radio networks. To do this, the tool uses existing plans (from manufacturing, production, or application), to which, by selecting them from a catalog with a click of the mouse, all the elements can be added that influence the radio field – for example, access points and clients, or typical obstacles such as walls and machine environments. With SINEMA E, the user can either measure the on-site radio field online or carry out an offline measurement in which the signal strengths are simulated.

**Figure 2:** With SINEMA E the range and signal strength of the IWLAN access points used can be simulated. Interested users can request the SINEMA E demo CD from the regional Siemens partner.



The simulation function shows the range of the radio signals, damping, and even interference from access points (Figure 2). It is thus possible to tell at a glance whether, for instance, an unauthorized person outside the application could receive signals or where signals interfere with each other across shelf boundaries due to channel overlap. Fine-tuning the radio coverage in the application by changing the spatial arrangement, radio parameters, antenna type, and directivity optimizes the radio field. The planning results can be documented and filed at every stage with the help of the integrated report function. This report can then be used by the planner as a basis for costing, by the installation contractor for the device installation, and by the supplier at the end of commissioning for approval in case of warranty and servicing. How precise the results of the simulation turn out to be is illustrated in Figure 3.



**Figure 3:** Radio field simulation with SINEMA E. The results of the simulation with SINEMA E are visualized and compared with the on-site measurements. The comparison shows only small, positive discrepancies.

SINEMA E is also a tool for configuring access points and clients. Here, the most important parameters can be set offline and saved in the relevant project. A number of devices can be summarized in these profiles, so that, for instance, safety installations can be carried out quickly and consistently. The elimination of unnecessary components, together with the flexible planning and configuration of the wireless network over the system's entire lifecycle, ensures reliable network quality and helps prevent unnecessary costs. Users can request a free SINEMA E demo CD from their local Siemens contact.

### Cost analysis

We have based the cost analysis in Table 1 on nine SRMs with data light barriers, fitted out alternatively with an IWLAN solution based on PROFINET and integrated safety systems with PROFIsafe. The wireless solution is already significantly more cost-effective even in terms of its initial investment costs, meaning a positive return on investment is achieved immediately. Added to this are the savings on servicing and maintenance in subsequent years. The figures given are typical for an SRM. The exact savings possible with other specific applications may differ from the sample solution and must therefore be calculated individually.

**Table 1:**

Comparison of total cost of ownership for an application with nine storage and retrieval machines: a conventional solution with light curtains vs. a wireless solution based on IWLAN with PROFINET

Investment costs for a conventional wired solution	
Material and installation costs approx.	139.644 €
Annual servicing costs approx.	8.100 €
Total costs approx.	147.744 €
Investment costs for an IWLAN solution with PROFINET	
Material and installation costs approx.	154.575 €
Annual servicing costs approx.	n/a
Total costs approx.	154.575 €
Savings potential	
In first year approx.	- 6.831 €
In subsequent years approx.	8.100 €
Savings after 3 years approx.	17.469 €

## Conclusion

The actual savings potential with a wireless communication solution is comprised of savings on the investment itself and operational advantages in running the system. With regard to the investment costs, in many cases savings can already be achieved with the initial investment. Particularly when the entire lifecycle is considered, further clear cost advantages are achieved by eliminating maintenance costs for the wireless communication solution.

On an operational level, the advantages lie in particular in the system's greater availability. This means that the capacity of the installed technology is used better, as breakdowns due to cable breakage no longer occur. As a result, the radio solution works more reliably. However, the operational improvements can be precisely quantified only for individual cases.

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