



Whitepaper

Implementing PROFINET for Industrial Digitalization

PROFINET as an Effective Industrial Network

Industrial automation and process-related systems are typically complex in structure, consisting of different sub-systems with numerous devices and differing topologies, manufacturers and technologies. PROFINET, a portmanteau for Process Field Net, is an industry standard for data communication over Industrial Ethernet. Decentralized peripherals combined with seamless horizontal and vertical integration for data and information results in flexibility and efficiency for large-scale plants spread over wide areas.

The need for real-time transmission is another important feature of industrial networks. PROFINET frames have a specialized EtherType that directs the Ethernet packet directly to the OSI application layer, bypassing TCP/IP layers and avoiding latency. Also, they are automatically set with higher priority than normal TCP/IP frames, so with infrastructure that supports VLAN prioritization tagging, they can achieve real-time communication. These features make PROFINET especially suited as a solution platform for automation.

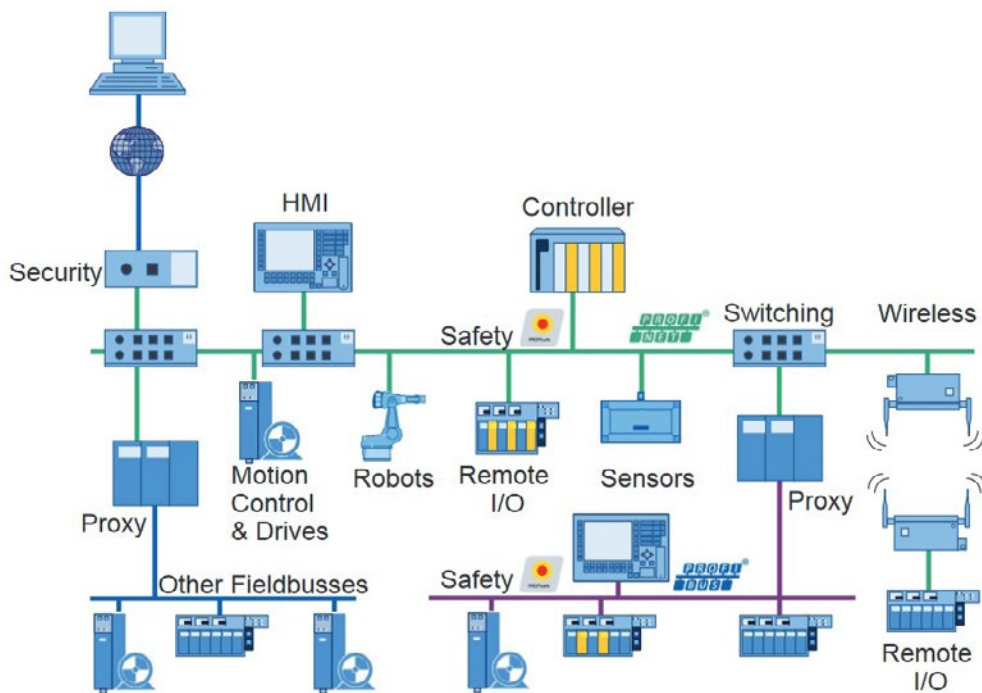


Figure 1. Examples of PROFINET applications and topology

Image courtesy of PROFIBUS & PROFINET International (PI)

PROFINET Conformance Classes

The range of functions for PROFINET devices are divided into conformance classes ("CC" for short), building upon one another. CC-A is the most basic, while CC-B, CC-C, and CC-D have increasingly more stringent requirements. The class recommended for any specific situation, however, will depend on factors such as application type, network topology, and budget.

CC-A functions provide real time communication, including cyclic I/O and topology information, as well as support for standard TCP/IP. Example applications may be in building automation, or to connect various automation islands (complete machines or individual plant units) using the company network.

CC-B includes functions for additional network diagnostics and for topology detection, using the Simple Network Management Protocol (SNMP), or queries to the Physical Device Object (PDEV) using acyclic PROFINET services.

CC-B PROFINET is often applied in process and factory automation, as it covers the typical requirements therein. As a result, tasks of modern automation islands can be implemented efficiently. The PROFINET network is also integrated perfectly into higher-level network management systems via the SNMP mechanisms, paving the way to Industrial 4.0.

CC-C is isochronous operations having a jitter of less than 1 microsecond. Application examples are much less common and directed at extra-demanding and complex motion control. CC-D, the latest addition to PROFINET conformance classes, is used mainly for Time Sensitive Networking (TSN).

PROFINET Certification for Network Switches

Infrastructure components for a CC-A PROFINET can be more simple, such as unmanaged switches, and does not require certification. But they must support the VLAN tag with prioritization to enable real-time communication.

Starting with CC-B, infrastructure components are actively integrated in the automation system as a PROFINET device in order to make use of comprehensive network diagnostics from the controller via PROFINET mechanisms. This means that all switches must be PROFINET certified and have its own GSDML file, ensuring topology detection as well as device diagnosis. With certified devices, latency and downtime can be regulated and minimized, while the extensive, world-wide consistent testing process ensures optimal quality and interoperability.

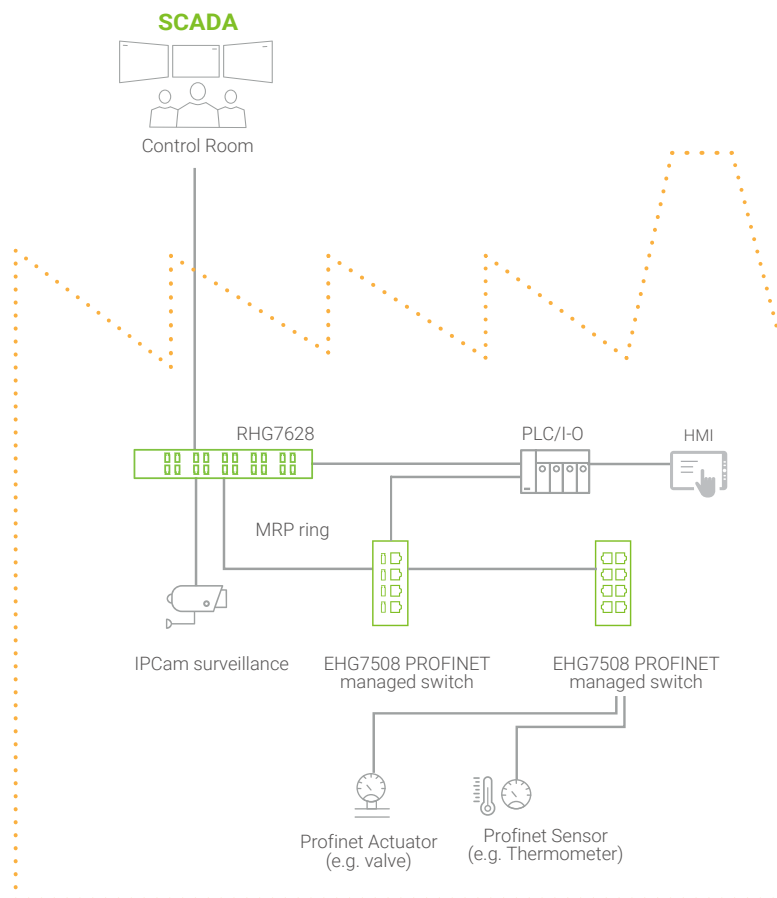


Figure 2. PROFINET system with ATOP switches

ATOP PROFINET Switches

As a PROFINET member, ATOP offers PROFINET CC-B-certified switches suited for various purposes. The EH7504/08 (Full-Gigabit) and EH75XX (Fast-Ethernet with Gigabit uplinks) managed switch series come with a wide selection range of 4-20 RJ45, SFP or combo ports for optimal flexibility as required by industrial automation applications. The RJ45 ports may also provide power over Ethernet (PoE), offering even simpler and more cost-effective deployment.

CC-B certified ATOP switches can be easily managed through the Siemens TIA portal. This allows the use of a common mechanism to manage all devices, and even enable/disable ATOP switch ports in the PROFINET domain.

Redundancy and precision time protocol support, albeit not mandatory functions for CC-B certification, are additional bonuses that prove extremely useful when availability or time synchronization is vital. And for users in the traffic and railway sectors, as well as the cybersecurity-conscious, many models have qualifications to keep your mind at rest.

Meanwhile, nearly the full range of ATOP managed and unmanaged switches are CC-A PROFINET compatible, supporting VLAN tagging for strict QoS and enabling PROFINET packet prioritization. Some applications further require switches to block LLDP (Link Layer Discovery Protocol) packets in order to reduce traffic and optimize real-time functionality. Normally ATOP switches forward LLDP packets as it is useful in providing topology information, but blocking is also available on request.

EHG7504/08 Series Industrial Grade Managed Gigabit Ethernet PoE Switch

Designed to provide a highly reliable, fault-tolerant, extremely fast network connection in a harsh environment, the EHG7504/08 Series are especially suited for smart factories.

- Within **compact DIN-Rail housing** design, the EHG7504/08 switches offer up to **8 Gigabit ports** in RJ45, SFP or PoE combinations.
- Through **RSTP, ERPS Rings and MRP** (both client and master) redundancy, they are ideal for creating a reliable network with constant connectivity.
- Certified for **PROFINET CC-B v2.33**, these series are automation-ready and provide an effective backbone for automation operations.
- Additional features include IEEE 1588v2 **Precision Time Protocol** support as a hardware-based transparent clock; **CE/FCC/UL, NEMA TS-2 and EN50155/EN50121-4** certifications for traffic control, railway and trackside applications; and **IEC62443**-compliant security.



Reliable Solutions Have Reliable Components Throughout

Digitalization is a collaboration that involves multiple parties—nowadays, a full system is rarely developed by a single supplier that ensures inherent compatibility between components. Meanwhile, as automation and networking technology evolves faster than ever, constant upgrading has become the norm for industries.

Future-proof solutions save costs and time by preparing for yet-emerging technologies well in advance to maximize interoperability, while also allowing legacy technologies to remain in use until its proper lifetime is up. This is true for standards like PROFINET, but also for devices like switches, and especially for the hardware and software contained within. And that is why ATOP accepts no compromises in quality and spares no expenses for certification.

Reach out to us for in-depth consultation and find solutions tailored just for your needs.

OFFICAL WEBSITE



LITERATURE LIBRARY



ATOP Technologies | by BlackBear TechHive

2F, No. 146, Sec. 1, Dongxing Rd., Zhubei City, Hsinchu County, Taiwan

☎ +886-3-550-8137

📠 +886-3-550-8131

✉ info@atop.com.tw