

HMS Industrial Networks

Your Partner for Industrial Communication

Why it's time to move to PROFINET



Whitepaper



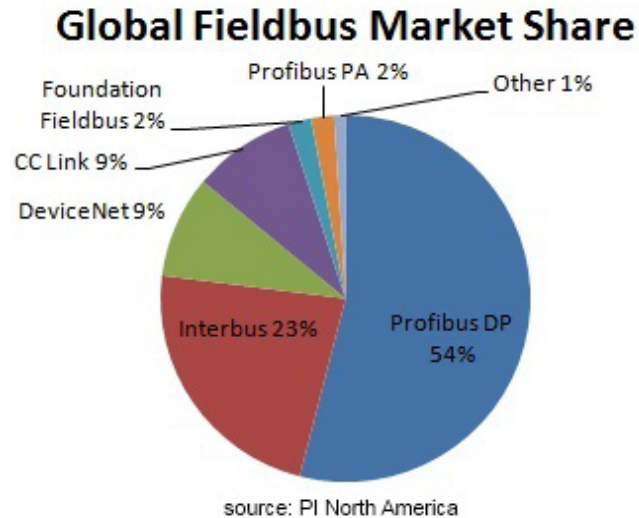
Why it's time to move to PROFINET

Fieldbus network technology has been the de facto standard on the factory floor for the past 20 years. Prior to fieldbus's dominance in the industrial automation market, discrete point to point wiring was used for transferring control data. Fieldbus improved upon this by creating a digital two-way multi-drop communication system. This led to less wiring, faster startups, and reduced downtimes adding up to monetary savings. Out of all of the fieldbus standards in use around the world, the one that has captured the majority of the market share is PROFIBUS.

Being the most widely used fieldbus network in the world, it is no wonder that many device manufacturers seek to integrate PROFIBUS into their products. PROFIBUS has more than 33.3 million installed nodes as of January 2011, establishing itself as a market-leading protocol due to a number of factors:

- Can be used in a large breadth of applications
- Deterministic nature guarantees predictable data response times
- Able to support high-density IO and communicate with programmable automation controllers, drives, HMI, smart motor overloads, etc
- Able to utilize fiber optics for redundancy and distance requirements
- Successful activities and support through PI (PROFIBUS and PROFINET International)

Given all this information, why would a device manufacturer develop PROFINET into their product? After all, both protocols were created by the same organization. They utilize the same application profiles and share the same concepts. As we will soon see, the benefits of PROFINET give PROFIBUS a run for its money.



Comparing PROFIBUS to PROFINET

Although they were both created by the same organization, PROFINET is NOT simply PROFIBUS on an Ethernet cable. They are distinct protocols and should be treated as such. In comparison, PROFIBUS utilizes a Master/Slave architecture of communications whereas PROFINET employs a Producer/Consumer model. The divergence in approaches can also be found in the technical specifications. PROFINET is built on Ethernet, allowing it to take advantage of all that Ethernet has to offer. It supports an extremely high node count, through the use of network switches. It supports faster data rates. It even supports larger data packets, up to 1440 bytes.

At a glance, we have:

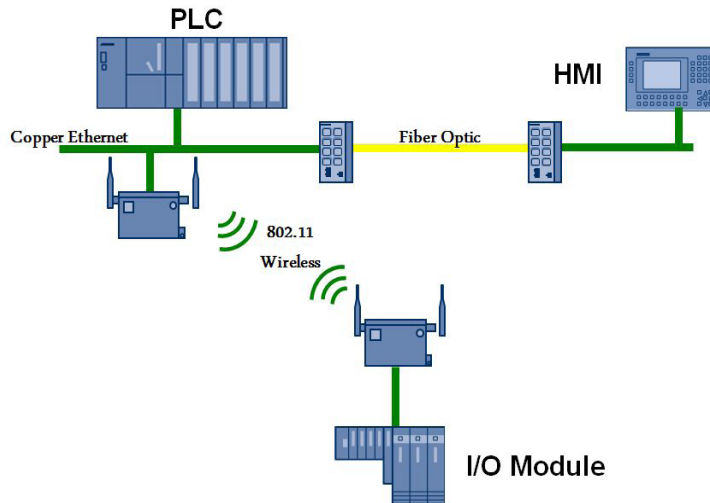
PROFIBUS	PROFINET
Master/Slave	Producer/Consumer
125 nodes per network	Virtually unlimited node count
Max 12Mbps data rate	100Mbps data rate
Max 244 bytes of data per cyclic message	Max 1440 bytes of data per packet
150 meters at 1.5Mbps (copper)	100m at 100Mbps (copper)

PROFINET is Standard Ethernet

A number of the enhanced functionalities inherent within PROFINET come from its basis on Ethernet. Utilizing Ethernet allows you to transmit more than one protocol at a time. With a fieldbus implementation, you are limited to just one protocol. However, with PROFINET this is not the case. All other Ethernet based protocols, such as HTTP, FTP, SNMP and SMTP can be utilized on the same cable. This means that you can transmit real time control data via PROFINET while gathering quality data and diagnostics through SNMP. You can even run completely separate applications such as video feeds or phone systems (VOIP) through the same wiring!

An added benefit for device manufacturers is the ability to create an interactive web page on their product. This allows an end user to remotely connect to the device in order to view status information, diagnostic data, or even manipulate simple variables. Typically, fieldbuses do not have this type of functionality built into their protocols. Furthermore, in order to "tap into" a fieldbus network and communicate with devices, your computer would need a special card or adapter. All you need with PROFINET is an Ethernet port, which comes standard with most laptops/PCs today.

PROFINET also has the flexibility to be used over a variety of media. Since PROFINET is based on standard Ethernet, it can be used on wired copper and fiber optic cable. It can also be used on standard 802.11 wireless connections. This does not require any proprietary wireless adapters, enabling you to mix and match suppliers. In comparison, to utilize wireless communications on a PROFIBUS network, proprietary adapters must be used.



- Allows multiple types of data on the same wire (real time, diagnostics, audio, video, etc)
- Integration of engineering and diagnostics within device via built-in web pages
- Doesn't require a special adapter to configure/diagnose
- Variety of media available such as copper, fiber optic, and wireless

From commissioning to replacement, PROFINET enhances your device

Implementing PROFINET on your device eases commissioning time because of its plug and play nature. With fieldbuses, you are required to know the capabilities and characteristics of the network. This can include network speed, flow control, and other properties. In comparison, PROFINET devices use auto-negotiation in order to probe and automatically determine the speed and duplex mode of the network. At the moment, these parameters are 100Mbps full-duplex.

The standard start-up time for devices is in the range of seconds. However, after initial commissioning, your devices can go instantly from power-up to cyclic data exchange with an IO Controller. By implementing the Fast Start Up technique into your device, it will be ready and available within 500ms. This provides a significant value-add for a number of industries and applications, such as automotive and robotic tool changers.

One reason people rely on PROFIBUS is because of its deterministic nature. Due to a single protocol being run exclusively on a PROFIBUS cable, the respective Master is able to calculate exactly how long a message will take to receive its intended recipient. With this calculation, a certain degree of repeatability is guaranteed since the message delay is predictable. Unfortunately, standard Ethernet does not guarantee the same predictability or repeatability. If a message is not received on time, it is simply resent until the delivery has been confirmed. Such a solution is not suitable for a control environment.

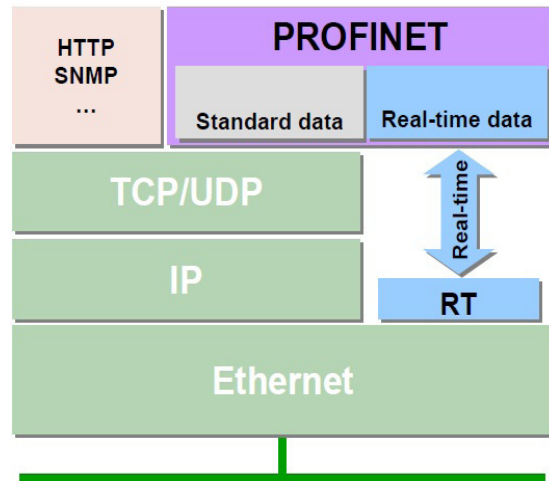
Thankfully, some clever engineering techniques, have enabled PROFINET to achieve the same level of determinism as PROFIBUS. Through the utilization of the same layers as PROFIBUS within the ISO/OSI reference model, PROFINET can skip other unnecessary layers to reduce messaging latency. By reducing latency, faster messaging speeds and greater repeatability (i.e. determinism) can be achieved.

PROFINET also simplifies the device-replacement process, through the use of LLDP (Link Layer Discovery Protocol). This topology discovery technique allows simple replacement of a PROFINET IO Device, without having to reconfigure the device name or IP address. Essentially, every PROFINET device knows who their neighbors are and can assist the IO controller in configuring the newly replaced device. This eliminates the need for a memory card and saves time for the end user by not requiring manual reconfiguration when a device needs to be replaced!

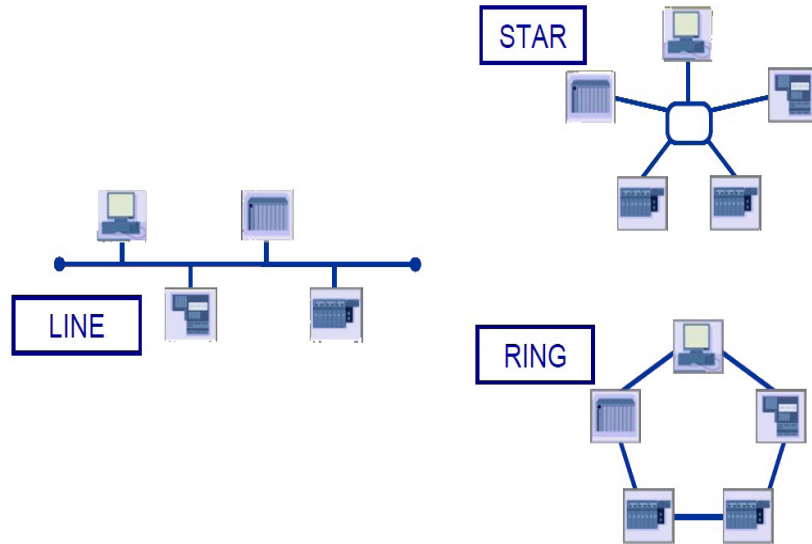
- Plug and Play nature makes commissioning fast and easy
- Fast Start Up enables cyclic communication in under 500ms
- PROFINET is deterministic by passing over unnecessary ISO/OSI layers
- Simple device replacement is possible thanks to topology discovery

PROFINET increases the availability of your device

PROFINET devices can contain one or two Ethernet ports. Devices with dual Ethernet ports have a built-in switch that allows you to daisy-chain other PROFINET devices on the same line. This line topology is similar to the standard bus topology found in PROFIBUS, and can reduce wiring costs compared to a typical star topology. With the combination of the topology discovery feature and other IT features, you can actually “map out” your network and have a visual representation of how your network is wired together. This feature allows much quicker diagnostics and can be used to visualize incidents such as wire breaks and loss of communications. Furthermore, this topology doesn't require the use of additional switches, reducing overall costs.



As seen in the table on page 3 , the maximum distance between two directly copper-connected PROFINET nodes is 100 meters. However, this distance can be greatly increased through the use of networking switches. Switches handle the majority of the network load and traffic, ensuring that network collisions are avoided when possible and transferring data to appropriate recipients. They also allow a number of networking architectures to be created, the most popular being star and ring topologies. Engineering the proper architectures for the respective applications is vital. Star topologies make sense when many devices are spread throughout an area. Ring topologies make the most sense where redundancy is required.



While engineering of these architectures is indeed critical, maintenance is just as important. Being able to predict network problems and detect issues is extremely helpful. PROFINET devices have support for the Simple Network Management Protocol (SNMP). End users can use SNMP data to determine network load, network uptime, and relevant data to get an understanding of overall network health. For example, if you notice a huge spike in network traffic, you can pinpoint where this spike is coming from and diagnose it before it turns into a problem and halts networking communications. Having these tools at your disposal increases your network uptime.

Most of all, PROFINET will enable you to have plant network visibility. This means that any and all aspects of your network can be viewed by all layers of your computer infrastructure. Your production data can be automatically entered into a higher-level ERP or MES system. Statistics can be automatically used to generate real-time reports. Furthermore, remote access can be configured so that you can view device data while being away from the factory floor.

- Line, Star, and Ring topologies are all possible and useful in their own ways
- Managing network performance increases uptime
- Plant network visibility enables connectivity and remote access

Protect your investment with PROFINET

All of these advantages are reasons to consider PROFINET. Currently existing PROFIBUS devices can be easily integrated along with PROFINET devices. The use of proxies and gateways allow the two networks to pair up and tackle any automation application. While PROFIBUS is still dominant in the marketplace, the growth numbers indicate that PROFINET will be on its heels in no time. Implementing PROFINET is a great way to ensure your device's continued success. Thanks to the help and support of PI (PROFIBUS and PROFINET International), PROFINET will continue to meet the needs of the automation marketplace.

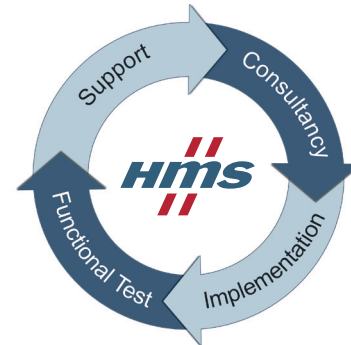


For more information on how to develop your PROFINET solution, please contact your local PROFINET Competence Center.

What's the purpose of PROFINET Competence Centers?

Compared to PROFIBUS, PROFINET is a very innovative and multifaceted technology. Accredited PROFINET competence centers provide valuable assistance for a quick access to PROFINET technology, offering a broad range of trainings and services.

HMS runs an accredited competence center for PROFINET in the USA and PROFIBUS and PROFINET in Germany. The range of training and services HMS offers is targeted towards the needs of device manufacturers and OEMs. It's the company's goal to guide device manufacturers through all phases of the development cycle on a partnership basis. Training includes PROFINET fundamentals and services that cover all aspects of PROFINET connectivity using Anybus technology. They include implementation consultancy, developer training, development support, adaptations of the GSD file and preparatory tests for successful PROFINET certification.



Further Information

Subject	Web Site
Official PROFINET website	www.profinet.com
PROFINET Connectivity Solutions	www.anybus.com/products/profinet.shtml
PROFINET site from PI North America	www.allthingsprofinet.com

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