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A PTO White Paper

Bringing Ethernet to the Plant Floor



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Seven Critical Things to Know before Bringing Ethernet to the Plant Floor

1. The critical thing about network layout is not to take Office topologies to the plant floor but to implement plant / machine topologies with Ethernet.

Office Ethernet infrastructures are typically based on commercial grade products meant to be located in a temperature controlled environment and Ethernet switches designed around a large star topology. On the other hand, Industrial Ethernet architectures take into account the differences in conditions and additional feature requirements such as high speed redundancy. An Industrial network utilizes different topologies dependent on the plant environment (star, ring, tree, and/or line). Shielded cables, metal connectors, and devices with higher temperature and vibration specifications are also required. Furthermore, the Ethernet switches are designed to be configured and maintained by the same individuals that support the automation system.

2. The critical thing to know about Ethernet is that it's just the wire; you need an industrial protocol to run automation applications.

The IEEE 802.3 Ethernet Standard defines the wiring, the media access rules, and the structure of an Ethernet frame. Although different devices utilizing communications based on this standard can coexist on the same network, the devices must utilize the same protocol or "communication language" in order to communicate with each other. PROFINET is the communication protocol which is designed for use in industrial applications providing the functionality required for Distributed I/O, Machine-to-Machine connectivity, Machine Safety, and Motion Control.

3. The critical thing about throughput is not how fast the network is but how quickly and predictably the data gets to where it's needed.

Throughput is really the crucial factor when determining the speed of the network. Throughput is defined by the amount of data that can be transferred through a network in a given time period. It is only possible to improve performance of a network by shortening turnaround times in the communication stack. PROFINET achieves maximum throughput in a network designed for the plant floor with deterministic and reliable communication. The turnaround times in the PROFINET stack are more than 10 times faster than a standard Ethernet TCP/UDP implementation. PROFINET accomplishes this feat by taking advantage of an Ethernet Real-time channel for time critical applications where speed and determinism is required and while using the Standard TCP/IP channel for configuration, diagnostics, network routing and communication of "bulk data transfer".

4. The critical thing about network configuration is not just how easy it is to setup but how little programming you have to do to make it run.

When establishing the communication relationships between devices, PROFINET utilizes a configuration approach instead of a programming approach. Due to the object-oriented approach which configures interconnections between devices instead of programming and debugging communications, system-integrators and end-users confirm a reduction of 25% in engineering time and commissioning. One key factor for this improvement is the ability of the PROFINET configuration tools to automatically calculate network utilization to specify the system-wide scan rate.

5. The critical thing about Industrial Ethernet is not if it supports the application you need now, but if the same Ethernet will support all your applications in the future.

Manufacturers today are already realizing value by reducing the number of dedicated and proprietary networks and interfaces. However, this implementation often occurs in a phased approach. PROFINET allows customers to implement a totally integrated automation solution at their own pace on one single Ethernet network which supports the different control disciplines such as peer to-peer communications, distributed I/O, machine safety, motion control, and data acquisition. PROFINET is also prepared to handle the requirements of vertical integration. One example is the trend to seamlessly integrate production data to the business systems (like Enterprise Resource Planning systems) allowing production yields, metrics and other productivity measures to be easily gathered with Ethernet connectivity to the plant floor.

6. The critical thing about Industrial Ethernet is not just if it talks Ethernet, but how it integrates with already implemented networks and machines from different vendors.

Since PROFINET works with standard Ethernet switches and utilizes the TCP/IP protocol suite, a system based on PROFINET may be connected to the overall automation network without the requirement of high-end switches or special features such as IGMP snooping and VLAN. PROFINET not only allows network connectivity, but also allows communication between multiple vendors' products and systems. PROFINET's component-based automation concept simplifies interfacing by utilizing the open technology of XML to represent the entire machine as a component – independent of the control system inside. Then the engineering tools connect the components and configure the communications between the machines using a graphical interface.

7. The critical thing about the cost of an Industrial Ethernet network is not the cost of the components, but the cost of engineering, installation, and maintenance.

PROFINET and Industrial Ethernet components take advantage of IT technologies like OPC and SNMP to monitor and display the status of the network. Furthermore, diagnostic capabilities within PROFINET provide the ability to incorporate the status of the network directly into the automation system which could include the PLC, SCADA, and HMI systems. This simplifies configuration and troubleshooting by allowing everything to be done from one central location.

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