Disadvantages of Industrial Ethernet Switches



Overview

The goal of this paper is to describe and categorize some variants of industrial ethernet protocols (IE), compare their efciency, and evaluate their respective advantages and disadvantages.

Key Takeaways

Industrial Ethernet switches, while robust and high-performing, face challenges such as environmental vulnerability, bandwidth limitations, protocol overhead, and higher costs compared to standard switches.

Environmental and Physical Limitations

Industrial Ethernet switches are designed for harsh environments, but extreme conditions can still impact performance. Factors such as high temperatures, dust, humidity, vibrations, and electromagnetic interference (EMI) can degrade signal quality and cause packet loss if not properly mitigated with ruggedized hardware, shielding, and specialized cabling. Even with IP-rated enclosures and vibration-resistant designs, installation and maintenance in such environments can be complex and costly.

Bandwidth and Performance Constraints



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Many industrial switches have limited bandwidth, particularly when connecting multiple PLCs or I/O devices. Packet sizes are often restricted (around 500 bytes for some PLCs), which can slow down operations in data-heavy applications. Additionally, TCP/IP protocol overhead consumes processing resources, potentially reducing real-time performance for critical automation tasks.

Network congestion, long cable runs, and inadequate switch capacity can further contribute to latency issues.

Protocol and Compatibility Challenges

Industrial Ethernet relies on specialized protocols like PROFINET, EtherCAT, EtherNet/IP, and Powerlink. While these protocols enable real-time communication, they can introduce complexity in configuration and integration, especially when bridging legacy systems or devices with varying standards. Some switches may lack full support for all protocols, limiting interoperability and requiring additional converters or gateways.

Management and Diagnostic Limitations

Unmanaged switches are simple to deploy but lack remote management, fault diagnosis, and advanced monitoring capabilities. Even managed switches may require specialized knowledge to configure VLANs, QoS policies, or security features. Generic diagnostics are often insufficient, necessitating custom solutions for each device, which increases maintenance time and costs.

Cost Considerations

Industrial switches are generally more expensive than commercial-grade switches due to their ruggedized design, environmental protections, and specialized features. Overpowered solutions may be unnecessary for certain applications, leading to higher upfront costs without proportional benefits.

Summary

While industrial Ethernet switches provide reliable connectivity and real-time communication in demanding environments, their disadvantages include environmental sensitivity, bandwidth and latency limitations, protocol complexity, diagnostic challenges, and higher costs. Careful planning, proper hardware selection, and network design are essential to mitigate these drawbacks and ensure optimal performance in industrial automation systems.

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Article Content

Industrial Ethernet: Challenges and Advantages

The goal of this paper is to describe and categorize some variants of industrial ethernet protocols (IE), compare their efciency, and evaluate their respective advantages and disadvantages.

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Why Your Industrial Network Needs an Industrial

Industrial Ethernet Switches - How to select and what you need to know. How will an industrial ethernet switch improve my network performance?

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Why Use Industrial Ethernet Switches?

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