Increasing Plant-Level Awareness of the Industrial Network

Leveraging Real-Time Visualization and Monitoring Across Ethernet Endpoints

PANDUIT®

Introduction

As production facilities aim to further automate their processes by using smart manufacturing and Industrial Internet of Things (IIoT) concepts and technology on their plant floors, the number of connected devices that need to be monitored and controlled dramatically increases. This is driving a shift in the way the plant floor works at many facilities. Currently, automation and controls engineers need to integrate older propriety and serial industrial networks, which were tightly tied to automation, with new networked systems based on an IT infrastructure.

With their previous systems, there were only a few nodes to hook up, control, and monitor. This allowed automation and controls engineers and technicians to manage and troubleshoot their networks using programming software tied to the automation system. Now, Industrial Ethernet, which uses standard Ethernet protocols along with rugged connectors and extended temperature switches, is becoming the new standard for automation and process control in industrial environments.

These systems connect computers, networks, data centers, machines, and a variety of other devices. By nature, these systems are built on IT-oriented technologies, yet because of their impact on production output, they can be much more critical than a typical in-office network. While these systems use IT-based technologies, their impact on plant output requires collaboration between IT personnel and automation and control engineers to ensure the Ethernet network provides an effective control system foundation for plant operations.

With so many connected devices to manage in industrial environments, it can be challenging to identify and visualize where each device and system are connected. Therefore, detection, diagnosis, and problem resolution have become increasingly costly and more time-consuming. Many companies are falling into the cycle of letting their infrastructure break and then reactively fixing the issues, in spite of latent risks, rather than taking a proactive approach to monitor and predict maintenance needs for their facility. As a result, in the United States, almost 80% of companies have insufficient or ineffective preventive maintenance programs.[1] This white paper discusses the need for manufacturing facilities to increase real-time visibility of the industrial network to determine and resolve connectivity issues while increasing time and cost savings.

Real-Time Visualization of the Plant-Floor Network

As the number of smart, connected devices implemented on the factory floor increases, so does the likelihood of a failure. This is especially true for companies that have more established manufacturing processes. Many of these plants are being retrofitted with new equipment piecemeal as permitted by time and budget availability. While plant managers and automation and controls engineers understand the importance of maintaining up-to-date documentation of their network, this can be quite difficult. Not all components are added to the factory floor at the same time or by the same technicians. Often, efforts are made to manually track information such as the IP addresses for devices on the plant floor, or to update industrial network drawings. These types of tasks usually require a substantial amount of work, which is quite difficult in an industry that has shrunk by nearly 15% in the past decade and has dealt with many challenges around workforce availability, training, and aging.[2] Thus, there are substantial knowledge gaps within companies regarding how systems are interconnected and which components rely on each other to function.

Additionally, because of the harsh nature of the plant floor, automation networks are highly susceptible to interruptions. However, for the design and deployment of industrial systems, the physical layer of the system usually gets the least attention and less than 10% of the budget; yet, nearly 80% of network issues on the plant floor originate from problems with physical layer connectivity (Figure 1).

This often results in downtime and lost production, especially since closed-loop process control often relies on an Ethernet link. Frequent breakdowns can be costly for manufacturers or potentially dangerous for factory floor workers.
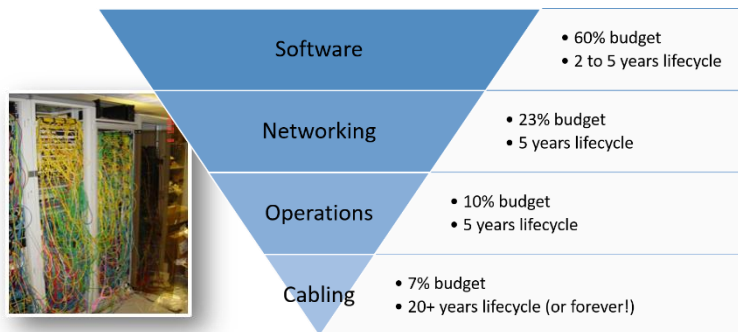

Figure 1. Nearly 80% of all network issues on the plant floor originate from problems with physical layer connectivity, which is typically just 7% of the infrastructure budget.

Executives in the manufacturing industry anticipate that 95% of companies will take advantage of IIoT technology within three years.[3] This will dramatically increase the number of connected industrial devices on the plant floor in the future, making the possibility of disruptions even more likely, and the need to rapidly detect those disruptions even more critical.

Ideally, automation and controls engineers need to assure network uptime with real-time visualization and monitoring of the entire network, in addition to network diagnostic capabilities. With awareness into all levels of devices and connectivity, operational field technicians can efficiently communicate with IT and automation teams about issues, allowing individuals who are not network or machinery experts the ability to respond to issues as if they were. This approach could help manufacturers proactively improve the uptime of their Industrial Ethernet infrastructure. IntraVUE™ industrial network and visualization software by Panduit® offers automation and controls engineers the ability to use this approach to address the challenges unique to these industrial environments.

## Continuously Monitoring the "Edge" of the Network

With the implementation of IIoT through Industrial Ethernet, the number of connections at the very edge of the network has grown drastically and the architecture of networks has become increasingly complex. Many components on the plant floor are now interconnected, including Input/Output (I/O) devices, PLC controllers, human-machine interfaces (HMIs), drives, process instruments, and IP cameras (Figure 2).
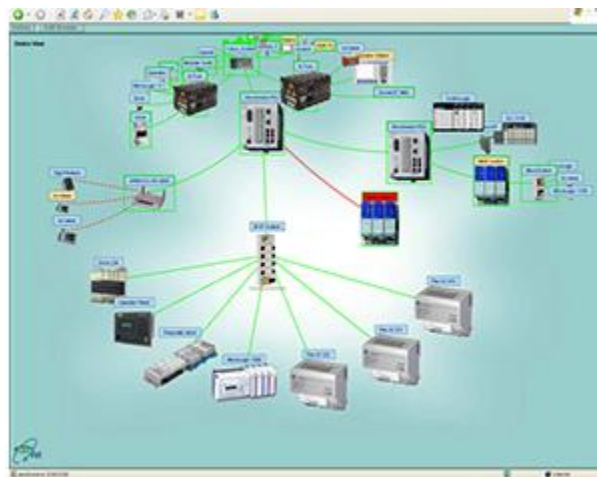
Figure 2. A schematic of a highly connected plant floor.

Instead of only providing computing resources, these connected devices make machines move, sense positions, and provide safety features. These devices also have requirements and applications that are quite different than the typical Ethernet network operating in an enterprise environment. Thus, within plant networks, it is critical for IT teams and automation and controls teams to work closely together to ensure the uptime of not only the network, but all the devices on the network.

Traditionally, typical networking tools are often extended from enterprise environments to perform the important roles of configuring and monitoring the switch networks. But, these tools may be familiar to non-IT personnel, such as the technicians on the plant floor. This can be a major challenge when issues arise on the plant floor because the typical first responders are technicians who understand the devices, but may not have a great deal of network experience. Thus, it is important to have a tool that can provide enough details about an issue so the device can be effectively reset, repaired, or replaced, but not too much information about the network that it appears overwhelming to the technician. IntraVUE™ software addresses this fine balance of information by providing network details through easy-to-view, real-time interactive graphics. As shown in Figure 3, the red line indicates a disconnected device. Additional details about the port on the switch where the device should be connected are available by hovering over the line. As a result, from one web-based application, automation and controls engineers and technicians can visualize all the network's devices through a simple interface all the way to the edge of the network from a single location.
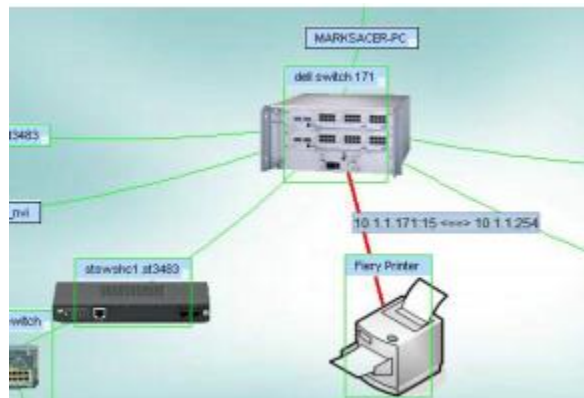
Figure 3. IntraVUE™ software graphically displays where the broken connections occur.

Automated Analytics

Issues with deployed plant equipment are significantly more expensive to resolve than machinery issues discovered during design or development (Figure 4). As the plant floor becomes more connected as a result of IIoT, there are more points where issues can occur. Thus, automation and controls engineers need to provide information to electricians and technicians so they can easily support all the interconnected pieces.
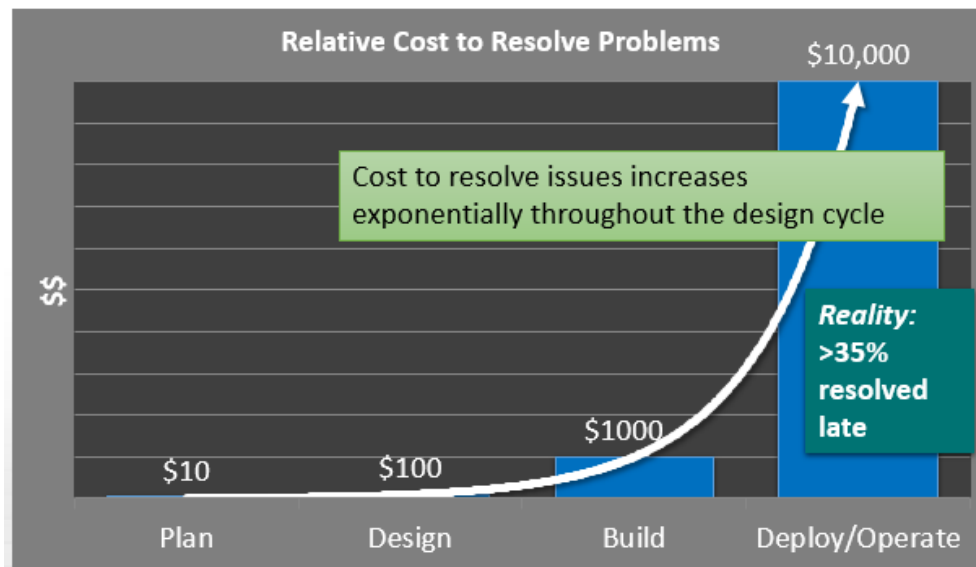
Figure 4. Issues with deployed plant equipment are significantly more expensive to resolve than issues with machinery discovered during design or development.[4]

To simplify this process, automation and controls engineers can use a tool such as IntraVUE™ Reports to automatically generate written reports tailored to the skills and responsibilities of the employee receiving the reports. Deeper levels of visibility can be provided based on the stakeholder group receiving the reports. These reports can identify issues and offer suggested courses of action for many common problems that can occur on Industrial Ethernet networks, including:

- o Device failures
- o Duplicate IP addresses
- o Broadcast or multicast storm
- o Intermittent connection problems
- o Devices that were accidentally moved
- o Foreign computers momentarily linking to the network (security issues)
- o Large file transfers between devices
- o Accidental cable loops
- o Switch resetting
- o Overloaded or misbehaving devices

With these reports, plant engineers can deep dive and probe into data, or they can pull together general information to share with their technicians.

The Advantages to Understanding All of the Plant Floor

As the plant floor becomes increasingly sophisticated and interconnected, the need for plant automation and controls engineers to have visibility into their entire network and simplify support all the way to the edge is rising. Having a tool that can reduce the potential for intermittent communication disruptions, enable continuous real-time monitoring, and provide remote support can offer valuable time and cost savings to manufacturing facilities of all sizes. With tools such as IntraVUE™ software, automation and controls engineers can continuously view, analyze, diagnose, and document the plant floor to avoid issues. Industrial controls professionals can have visibility into the plant's entire Ethernet connectivity landscape where connectivity issues are occurring, and plant technicians can access the root of the problem faster, improving uptime and significantly decreasing network support costs and response times.

Resources

For more information on how Panduit® can help increase the plant-level awareness of your industrial network or request a live demonstration with a Panduit Industrial Automation expert, visit www.panduit.com/intravue or email iai@panduit.com.

About Panduit

Simplifying Robust Industrial Network and IoT Deployment

Panduit is a world-class developer and provider of physical infrastructure solutions that improve reliability, security, and safety of Industrial Automation Infrastructure systems while reducing deployment and operating costs. Working with industry leaders, Panduit helps bridge the gap between IT and Controls Engineers by providing optimized building-block architectures for connecting enterprise, industrial networks, and control systems.

Panduit is simplifying robust industrial network deployments, providing our customers confidence and peace of mind through our enterprise, data center and industrial automation expertise, tools, and comprehensive offering.

www.panduit.com/ia · iai@panduit.com

References

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[1]*Source*: *Wireman,Terry. Total Productive Maintenance. New York, New York: Industrial Press, Inc. 2004.*

[2]*Source*: *United States Department of Labor, Bureau of Statistics.* http://www.bls.gov/iag/tgs/iag31-33.htm

[3]*Source*: *Economist Intelligence Unit.* http://www.industryweek.com/growth-strategies/new-go-market-model-industrial-internet

[4] *Source:Mechatronics Part I: Motion Control's Next Top Model; Aberdeen Group, The Mechatronic System Design Benchmark Report.*