

Designing Industrial Network - An Approach



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Abstract

Industrial Networking is under transformation from legacy communication system to a smart and converged networking system, which is more powerful and efficient. When we talk about Industrial Networking, it includes manufacturing plants, power plants, Oil and Gas, transportation and more. The purpose of this white paper is to present the best approach for designing an Industrial Network that is more suitable, scalable and reliable.

Introduction

In today's competitive environment, Industrial Networking is not behind. Manufacturers and industrialists are expanding their budgets to enhance their existing legacy systems to control physical equipment and send instructions over Ethernet as it is a powerful medium. They want to have converged network which not only controls physical equipment, but also performs data transfer and processing. Like commercial network, Industrial Network is becoming more powerful and advanced, making its landscape robust and user-friendly. Expectations from Industrial Networking is increased, to provide high survivability, redundancy, flexibility and security.

What is Industrial networking?

Industrial networking is the Ethernet suitable for industrial environment. Industrial networking includes communicating processing plant (manufacturing floors, remote machines, field devices) with controlling plant, and then integrating this communication with company enterprise networks. There are different types of physical equipment like: PLC / CNC, IPC, Relay Control, meters, sensors, etc.

Industrial Network Design consideration

Below are important points that need to be considered while designing an Industrial Network:

Industrial Environment

- Type of Communications
- Suitable LAN Topology
- Choosing Industrial Grade Devices

Lets' look at each of these components in detail:

• Industrial Environment

When we talk about Industrial Networking, it includes manufacturing plants, power plants, Oil and Gas, transportation etc. These environments are rugged, harsh and has dust, smoke, humidity, temperature, shock and vibrations. Industrial environment is the first consideration when an Industrial Network is designed. There are many manufacturers who produce network devices that can work in wide ranges of temperature; they are manufactured with fan-less design, which means no rotating parts, resulting in less/no maintenance. We also have seen devices in the market with flexible designs, which can fit in rack or Din rail or even be mounted on the wall. These types of devices are very suitable for Industrial Network, as there is no controlled environment with air condition or racks. There are many standard certifications like FCC, CE, NEMA TS2, IEC/IP, UL, DNV, IEC61850, IEEE1613, etc. which are always referred while selecting the Industrial Networking devices. Therefore, it is always advisable to select devices which are certified for your Industrial environment.

• Types of Communication

Unlike a conventional network, which is used for data transfer and processing, Industrial Network is mainly used to control physical equipment. There are different equipment like PLC / CNC, IPC, Relay Control, meters, sensors, etc. While designing the Industrial Network combination of devices, one needs to take care of different types of communication. Let's understand more about them:

• Multi-protocol Communication:

There are many devices in the Industrial environment which work on serial communications. Some devices work on their proprietary protocols like Modbus, DF1, Profibus & Profinet, and others. Converting these protocols and bringing to TCP/IP is one of the biggest challenges. There are manufacturers who produce such converters that can be used in an Industrial Network to take care of these protocol issues.

• Long distance Communication:

Often, communication happens across far distances, especially in power plants, transportations and Oil and Gas. In these scenarios, communicating over cloud or internet is difficult, mostly because of real-time requirement and security. There has to be consideration in design to use media converters for long distance communication or to use stable Wi-Fi solutions. There are industrial grade media converters in the market which can be used to convert Ethernet to fiber (single/multi-mode), or devices which have SFP ports that can take care of fiber connections. Sometimes, we see these connections directly go to field devices, which work on serial communication; in these cases, separate media converter needs to be used which can convert fiber to serial or Ethernet to serial communication. Now a days, we see there are manufacturers who produce devices which can convert communication from Serial/Ethernet or fiber to Wi-Fi as well; these can transfer data at a very high speed. You need to be careful while selecting these media converters to ensure they take care of proprietary protocols and that, they are built as industrial grade with required certificates.

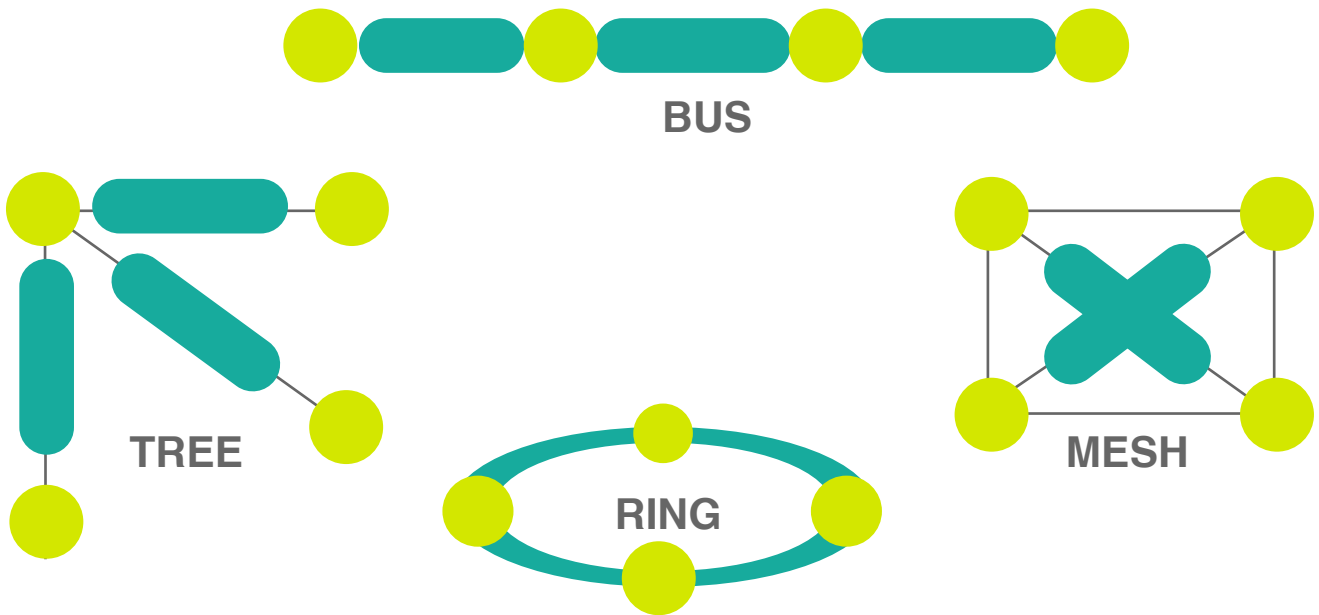
• Redundant Communication:

Industrial environments are less predictable and chances of failures are very high. Failure of communication may cause high damage as most communication is done to control the equipment. There has to be redundancy for both, hardware and software. Some of the industrial grade devices have redundant power supply and need to alarm them via relay or SMTP.

• Suitable LAN Topology

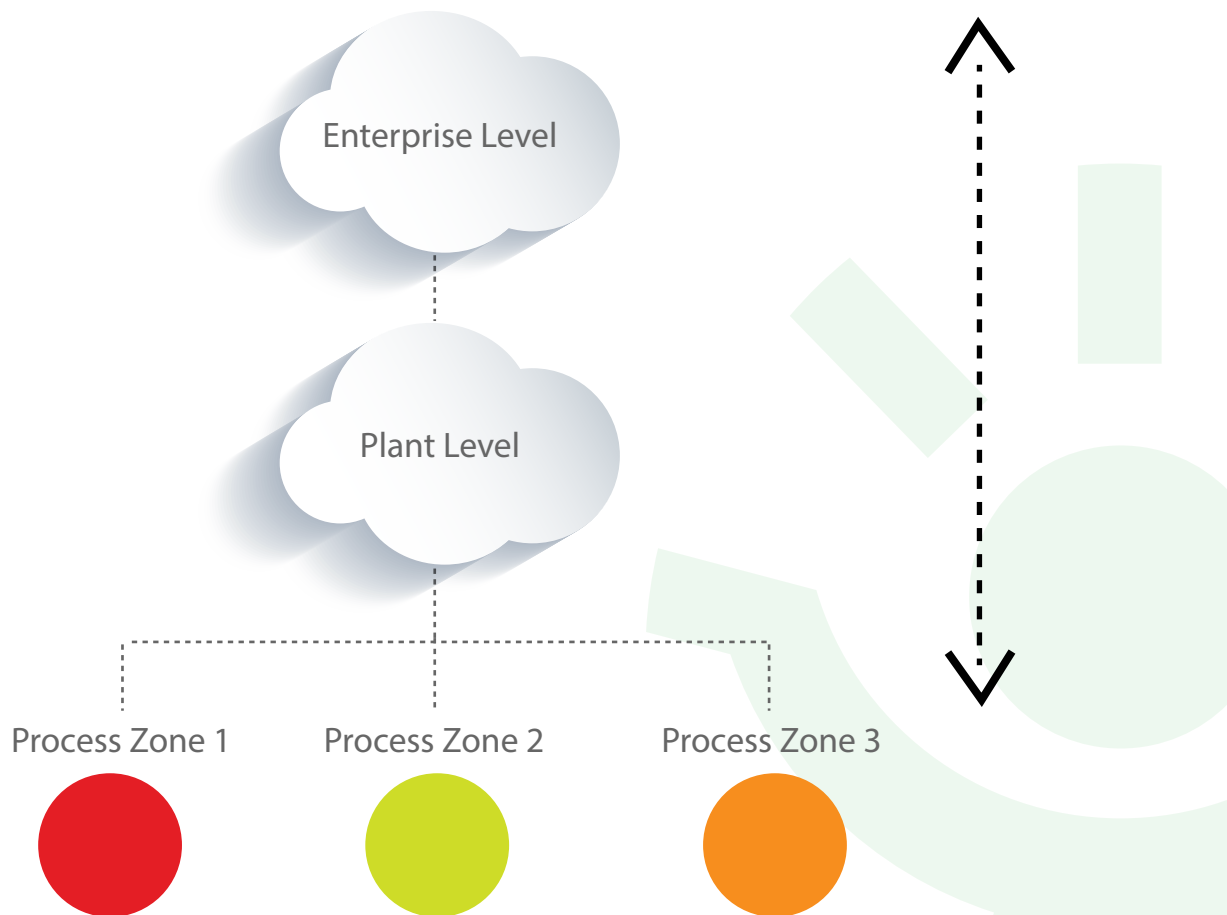
There are many options to design a network like: Bus, Tree, Mesh and Ring.

The below diagram can show you the difference in all these topologies:



Any topology can be chosen based on requirement. Network topology should provide redundancy, faster convergence and flexibility for future expansion, and should have low installation and maintenance cost. Most preferred network topologies are Ring or Mesh

The below illustration shows how traffic flow happens in Industrial Networking.



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About Happiest Minds

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