Process Automation System
Quantities

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Process Automation Characteristics

• A PA system is used to control a process such as chemical, steel, oil-refineries, petrochemical, paper or pulp factories.

• PA data consist of many analog values, such as temperature, pressure, flow, or level.

• Typically more standard controls (i.e. PID: Proportional-Integral-Derivative) are used than other industries (e.g. discrete or motion control).

• Fast control cycle is **NOT** required (1 sec cycle is enough in many cases).

• A PA system operates 24x7x365, and requires procedures to stop safely. Hence, the extra high reliability and availability is required.
PA System Architecture Example

- **HMI**
- **Controller**
- **IO Station**
- **Remote IO Station**
- **Media Converter**

- **Cabinet**

- **Metal cable (TSN)**
- **Optical fiber or Single Pair Ethernet (TSN?)**

Hazardous Area
Maximum Quantities Example

• Up to 32,768 redundant TSN end-stations per system
  • HMI or Controller: up to 2,048 redundant stations (typically 1 vs. 15)
  • IO-Station: up to 30,720 redundant stations
    • Up to 16 IO-Stations per Controller (1,920 controllers)
    • 128 IO items per IO-Station -> about 4M IO items in a system

• Up to 64 TSN domains per system

• Up to 1,024 redundant TSN end-stations per TSN domain
  • 4 HMIs
  • 60 Controllers
  • 960 IO-Stations
Communication Example (in a TSN domain)

• Application Scan Interval
  • HMI: 1,000ms
  • **Controller: Basic 1,000ms, Fast 100ms**

• Controllers to HMI (monitoring)
  • Data size: 1,400 Byte
  • Up to 3,000 subscribed signals per scan interval
  • Scan interval: 1,000ms

• IO Control Data Size (PV or MV)
  • 4 Byte data + 1-4 Byte status per IO item
  • Up to 1,024 Byte per IO-Station (which has up to 128 IO items)
  • Input vs. Output = 2:1 (typically)

• IO-Stations to Controllers (input)
  • Up to 2,000 published signals per scan interval (typical 1,500)
  • Scan interval: **100 - 1,000ms (typical 1,000ms)**

• Controllers to IO-Stations (output)
  • Up to 2,000 published signals per scan interval (typical 750)
  • Scan interval: **100 - 1,000ms (typical 1,000ms)**

• Controllers to Controllers
  • Up to 1,000 published signals per scan interval
  • Scan interval: **50 - 500ms (typical 500ms)**
Short Summary

- PA data size is relatively larger than others.
- PA scan interval is larger than others.
- The number of station in a PA “system” is very large.

![Graph showing data size vs. scan interval]

- Data Size: ~1.5KB, ~0.5KB, ~0.2KB
- Scan Interval: ~us, ~ms, ~sec

- PA: ~1.5KB
- Discrete Control: ~0.5KB
- Motion Control: ~0.2KB
Thank you for your attention!