Process Automation System
Quantities

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Atsushi (Alex) Sato, Yokogawa Electric
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
- Cabinet
- Remote IO Station
- Media Converter
- Hazardous Area

- Metal cable (TSN)
- Optical fiber or Single Pair Ethernet (TSN?)
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 stations in a PA “system” is very large.
Thank you for your attention!