CT298

Industrial Ethernet Infrastructure & Field Instrument Integration into PlantPAx
Speaker Bio

- Jon Eide, Technical Support Team Manager, Systems
- Based out of Indianapolis, IN
- Purdue University, BS in ECET
- At Endress+Hauser for almost 8 years
  - 3 years in Houston
- Rockwell Automation training for Logix5000 platform
- Profibus and Foundation Fieldbus certified engineer
- Solutions group focused on Tank Gauging, Inventory Control, Overfill Protection, Metering Systems, and Asset Management Projects
How this relates per Industries

- Focus on so called “Hybrid Industries”
  - Hybrid industries are industries where the process automation and the factory automation comes together. (E.G. Brewery with a production of beer (slow process) and a filling line (fast process with robots))
Typical Digital and Analog Protocols

- Merging use of Protocols from Process and Factory Automation

  Factory Automation
  
  Ethernet-based protocols e.g. EtherNet/IP, MODBUS TCP, PROFINET IO

  Process Automation
  
  Analog 4…20mA
  HART
  PROFIBUS DP/PA
  Foundation Fieldbus

- Digital Protocols have:
  1. Cycle Data – measured process values
  2. Acycle Data – secondary functions; diagnostics, configuration, etc
Customer evaluation techniques available today

- Knowledge
- Interpretation
- Verification
- Calibration/Proving

- Standard Diagnostics
- Advanced Diagnostics
- In-situ Verification
- Calibrating/Proving

Industrial Ethernet Infrastructure & Field Instrument Integration
Standard Diagnostics – Sample Error Recognition

- **System/Sensor or transmitter errors:**
  - Software errors
  - Incompatibility components
  - Output range error
  - Sensor shut-down
  - Simulation left on
  - Hardware failure

- **Process conditions or errors:**
  - Empty pipe
  - Multi-phase conditions
  - Velocity limits exceeded
  - Drive power limits
  - Flow limit exceeded
  - Zero point failure
Diagnostics Information of Devices

- Normal
- Maintenance required
- Failure
- Function check
- Out of specification

E.g. DCS station, Maintenance station, Laptop, Mobile Device

Field Devices

harmonized events for diagnosis
Diagnostics Information of Devices

- Header and instrument health status showing NE107 status information
- All errors are numbered and show information about cause and remedy
  - **Cause:** What causes the error
  - **Remedy:** How to solve the error
Fieldbus communication options

- Fieldbus communication options which already available for the Process Instrumentation
  - PROFIBUS DP/PA
  - FOUNDATION Fieldbus
  - MODBUS RS-485
  - EtherNet/IP
EtherNet/IP Facts

- EtherNet/IP was developed by Rockwell Automation in 1990.
- The ODVA (Open DeviceNet Vendor Association) administers the protocol and assures the interoperability among different manufacturers.

- Endress+Hauser has been a major member of the ODVA since 2012.

- The term “EtherNet/IP“ can be misunderstood with the combination of Ethernet and Internet Protocol!

- We talk in this case about an industrial “user layer” protocol. This is used between the controller and field components.

- "IP" in EtherNet/IP, is no short-term for "Internet Protocol"; it stands for "Industrial Protocol"
CIP is the Object oriented (Electronic Data Sheets), user protocol for automation. Extends the data transport services, with communication services, suitable to the automation industry. Allows access to the device profile, independently of the used communication medium and network management.

Uses the protocol TCP, UDP and IP for the data exchange.

TCP is used as connection orientated protocol for explicit messages (Point to Point).

UDP for the time critical, cyclic input/output signal exchange with implicit messages.

They are managed over before defined virtual connections.
**EtherNet/IP**

- The Input / Output data exchange:
  - **Implicit Messages** (time critical) over **UDP** transmitted

- Device Configuration and Diagnostic-Messages:
  - **Explicit Messages** (Client-Server-Telegram) over **TCP** transmitted

- Device description (Driver) is supplied as a **Electronic Data Sheet** (EDS)

- **Principle: Producer / Consumer Model**
**EtherNet/IP - webserver, email, …**

SCADA & Engineering

- UDP only for cyclic I/O control
- Webserver (HTTP) via TCP

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Endress+Hauser
Basic Industrial Ethernet

**Topology**

- Daisy Chain
- Line
- Star
- Star + Line
- Ring only with Managed Switches which support Rapid Spanning Tree

D = Device
S = Switch
Why EtherNet/IP for Process Automation?

- The primary advantage is:
  - Simplicity and speed of integration (reductions in commissioning, engineering, training, installation phases means an overall reduction in costs) for complex devices
  - The fact that customers can connect field measurement devices directly to an Ethernet network, now means that there are fewer networks and hardware (i.e. fewer Remote I/O’s, Links, Segment Couplers etc.) to engineer, configure, commission and maintain
Flow & Analytical Instrumentation goes EtherNet/IP

Industrial Ethernet Infrastructure & Field Instrument Integration
Integration of Measurement into RSLogix 5000

- Seamless integration via a Level 3 Add-on profiles provides reductions in commissioning, engineering, training and installation phases, which leads to an overall reduction in costs
- Coriolis and Magnetic flowmeter and Analytical transmitter models with Ethernet/IP as an option
The data structure is automatically created.
Change IO to customized values
Promass 83 with EtherNet/IP in FTView

- An example of the information that can be viewed in FTView

Real-time display of all process variables

Alarms, Trends, Reset Totalizers

Faceplate identical to HART or PROFIBUS PA
**EtherNet/IP connectivity - Technical details**

- Meets all requirements of the EtherNet/IP protocol defined by ODVA
- Dual RJ-45 sockets with integrated switch functionality supports line and ring topologies
- On board EDS file helps to easily identify and commission the device in a network
- Desired level 3 profile for complete configuration
- Maximum of 10 configurable process variables and 6 configurable control variables
- Dip-switches to configure the last octet of the I.P. Address
**EtherNet/IP™ with Coriolis - Network Configuration**

- Default Shipment Configuration
  - Primary Variables:
    - Mass flow rate
    - Volumetric flow rate
    - Corrected volume flow rate
    - Density
    - Reference Density
    - Temperature
    - Totalizer 1 (Mass)
    - Totalizer 2 (Volume)
  - Control reset of the device totalizer(s)
  - Diagnostics access
    - Details notice and fault conditions
    - Diagnostics information configurable to SE or ME based faceplate
Integrated Web server for easy configuration

- The integrated Web server provides an overview of all the measured values and the actual/previous system conditions
- Network address configuration and one-click access to the on board EDS file for the system integration of the device into the network
- Complete, simple and easy device configuration on one page
- The Ethernet module’s firmware can be easily updated
- User rights can be configured and individually password protected
- User-defined labels for the measured variables can be created
Industrial Ethernet Infrastructure & Field Instrument Integration

**Data Map Configurability: Flexible Scan Registers**

### Promass 83 - Ethernet - Loop A1 - Data Map

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Description</th>
<th>Register</th>
<th>Value</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mass Flow</td>
<td>2007</td>
<td>97956.7734</td>
<td>Input Float</td>
<td>Mass Flow</td>
</tr>
<tr>
<td>2</td>
<td>Volume Flow</td>
<td>2008</td>
<td>25.6627</td>
<td>Input Float</td>
<td>Volume Flow</td>
</tr>
<tr>
<td>4</td>
<td>Density</td>
<td>2013</td>
<td>0.9990</td>
<td>Input Float</td>
<td>Density</td>
</tr>
<tr>
<td>6</td>
<td>Temperature</td>
<td>2017</td>
<td>53.4043</td>
<td>Input Float</td>
<td>Temperature</td>
</tr>
<tr>
<td>7</td>
<td>Totalizer 1</td>
<td>2810</td>
<td>1510.3702</td>
<td>Input Float</td>
<td>Totalizer 1</td>
</tr>
<tr>
<td>8</td>
<td>Totalizer 2</td>
<td>2810</td>
<td>1510.3702</td>
<td>Input Float</td>
<td>Totalizer 2</td>
</tr>
<tr>
<td>9</td>
<td>Tube. Damping</td>
<td>9505</td>
<td>210.8556</td>
<td>Input Float</td>
<td>Tube Damping</td>
</tr>
<tr>
<td>10</td>
<td>System Condition</td>
<td>6859</td>
<td>1</td>
<td>Input Integer</td>
<td>Actual System Condition</td>
</tr>
<tr>
<td>11</td>
<td>Reset Tot 1</td>
<td>2808</td>
<td>0</td>
<td>Output Integer</td>
<td>Reset Tot 1</td>
</tr>
<tr>
<td>12</td>
<td>Reset Tot 2</td>
<td>2808</td>
<td>0</td>
<td>Output Integer</td>
<td>Reset Tot 2</td>
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<tr>
<td>13</td>
<td>Reset Tot 3</td>
<td>3008</td>
<td>0</td>
<td>Output Integer</td>
<td>Reset Tot 3</td>
</tr>
<tr>
<td>14</td>
<td>Empty Pipe</td>
<td>5106</td>
<td>0</td>
<td>Output Integer</td>
<td>Empty Pipe Detection</td>
</tr>
</tbody>
</table>

Non-numeric values are marked as "Edit".
PlantPAx Meets the Needs of Process
Thank you very much for your attention!

If you want more….
Basics of Industrial Ethernet
When: August 11\textsuperscript{th}-12\textsuperscript{th}
Where: Endress+Hauser Main Campus, Greenwood, IN

Any Questions?