Outline

• What to take away from this presentation
• Why use process control system networks
• Business and internet networks
• High level process control networks
• PLC to PLC and I/O networks
• Device networks
What to Take Away

• Know your network(s)
• Use the right tool for the job
• Trends in the industry
• What to ask your vendors
• Know meaningless terms (RS-485, Ethernet, Device Network, etc)
• Know when you have an answer you need
A Process Control Network

Process Control Multi Server/Multi Client System

Level 5: Enterprise Business Planning
Level 3/4: Site, Manufacturing Operations
Level 2: Supervisory Control
Level 1: Process Control Continuous/Batch
Level 0: Field Device

Field Device Networks:
- Process Control
- Foundation Fieldbus
- Profinet
- Profinet/IP
- DeviceNet
- Profinet/IP
- ASI

Safety Instrument

Process Control:
- Intrinsically Safe Areas
  - Class Div 1

Rockwell Automation

PlantPAx Process Automation System
Why Use Networks

• Fast access to data or information
• Access to more information
  – Process information
  – Component information
  – Energy use information
• Reduced maintenance cost
• Reduced installation cost on capital projects
  – Distributed processing and I/O
  – MCC connections with a single cable
  – Device networks reduce field wiring
Business and Internet Networks

• Standard network used in homes and offices, commonly referred to as Ethernet
• Based on IEEE 802 standards including RJ45 connectors and TCP/IP protocol
• Not directly suitable for process control because transmissions are non-deterministic
• Deterministic is the measure of the chance a message gets though
High Level Process Control Networks

• Based on standard Ethernet with process control modifications
• Used for HMI communication to PLCs or PLC to PLC communication
• Use for high speed and high volume data communications
• Can be used for large multinode applications
• Because these are “determinable”, they are suitable for process control
Types of High Level Process Control Networks

• Primarily Programmable Logic Controller (PLC) to Human Machine Interface (HMI) communications
  1. Ethernet/IP
  2. Modbus TCP
  3. Profinet
  4. CANopen
• Developed in the late 1990s by Rockwell Automation
• Managed by ODVA
• Works more “naturally” with Allen Bradley PLCs
• In ODVA, over 300 members contribute to and manufacture compatible equipment
Modbus TCP

- Developed in 1999 by Schneider Electric
- Managed by Modbus Organization
- Original Modbus protocol with a TCP Wrapper
- Works more “naturally” with Modicon PLCs
Profinet

- Developed in 1999 by Siemens
- Managed by PI (PROFINET International)
- Protocol was largely inspired by the IEC 61499 standard (a European Standard)
- Works more “Naturally” with Siemens PLCs
CANopen

- Developed within the Can-in Automation CiA international users' and manufacturers' group
- Standardized as CENELEC EN 50325-4 since December 2002
- Protocol is a European Standard
- If a single manufacturer developed this standard, it is unclear who that was
• Generally, these are less open (more proprietary) networks
• Closely tied to manufacturer of control system equipment
• Many times, these networks have very specific cable requirements
Types of PLC to PLC and I/O Networks

- Modbus
- Controlnet
- Profibus
- DH+ and RIO
- Genius I/O
Modbus

- Originally developed by Modicon
- Most supported network of this type
- Master/slave fieldbus based on RS-485 with token passing
- Shielded twisted pair cable with 9-pin D-Sub connector.
**ControlNet**

- Provider/consumer fieldbus communication network
- Flexible with line, bus, tree or star topologies
- RG-6 coax cables with BNC connectors
- Originally, a replacement for the Allen Bradley RIO System
- Very good at high speed deterministic communication
ControlNet

- Primarily for remote I/O
- Can be used for communication to VFDs and OIUs
Profibus

• Generally used on Siemens PLC systems
• Multi-master/slave communication system
• Can be used with multiple cable and wiring schemes
• Cable’s distinctive purple color beckons the nickname, “Barney Hose”
Allen Bradley DH+ and RIO

• Proprietary communications and remote I/O networks
• Many installations still in use
• Avoid these on new installations
Genius I/O

- GE PLC communications network
- Being phased out
- Many installations still in use
- Avoid on new installations
Types of Device Networks

• Communication from PLCs to individual devices
  1. Devicenet
  2. Fieldbus
  3. Interbus
  4. Others in use but three listed above are most common
Devicenet

• Based on the automotive standard CAN
• Commonly used in MCCs for communications to motor starters
• Well supported by the major MCC manufacturers
• Work well with VFDs
Fieldbus

- Considered an instrument network used for flowmeters, pressure transmitter, etc.
- Has a long difficult history
- May have finally arrived as a viable network
- Protocol is used for real-time distributed control and now standardized as IEC 61158
- Multiple varieties floating around
Interbus

- Developed in 1987 by Phoenix Contact
- Master slave, fixed telegram length, deterministic ring
- Every remote bus device is a repeater
- Maximum of 4,096 I/O points
Cross Over Networks

- Attempt is made to categorize each type of network
- Although intellectually satisfying, it is not true in the real world
- Many of the networks can and do cross the lines
- Many of the networks are used for various applications
  - Example: Profibus can be used as a Device Network and an I/O Network
Summary

• Know your network type(s)
• Trends in the industry
• Drill down with potential vendors
• Make sure vendors equipment is compatible or that it can be made to be
Questions?

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