

October 6, 2011

Overview of Networks  
for  
Process Control Systems



# 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

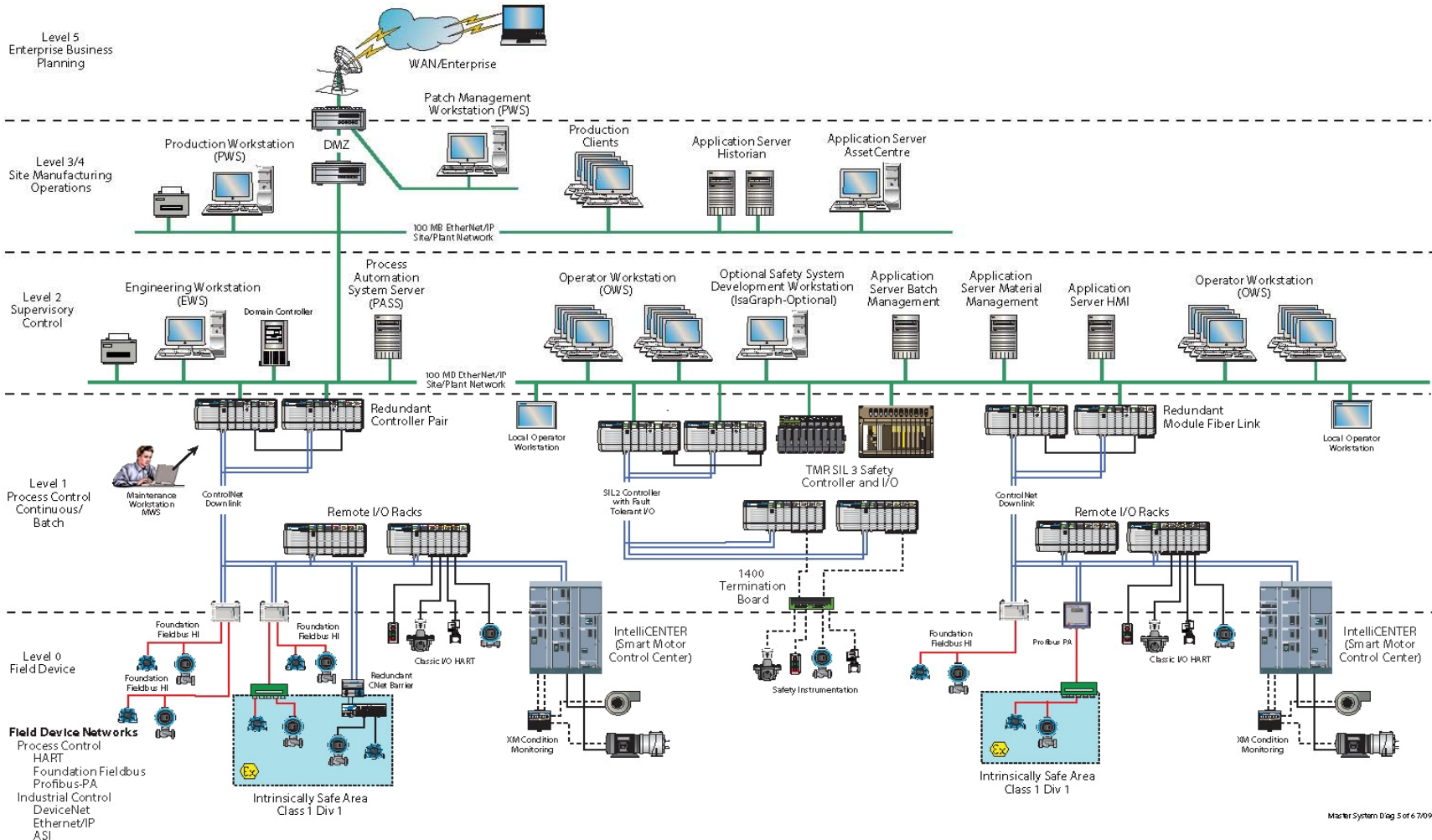
- Know your network(s)
- Use the right tool for the job
- Trends in the industry
- What to ask your vendors
- Know meaningless terms (RS-485, Ethernet, Device Network, etc)
- Know when you have an answer you need

# A Process Control Network

**Rockwell Automation**

**Process Control Multi Server/Multi Client System**

**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 through

# 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

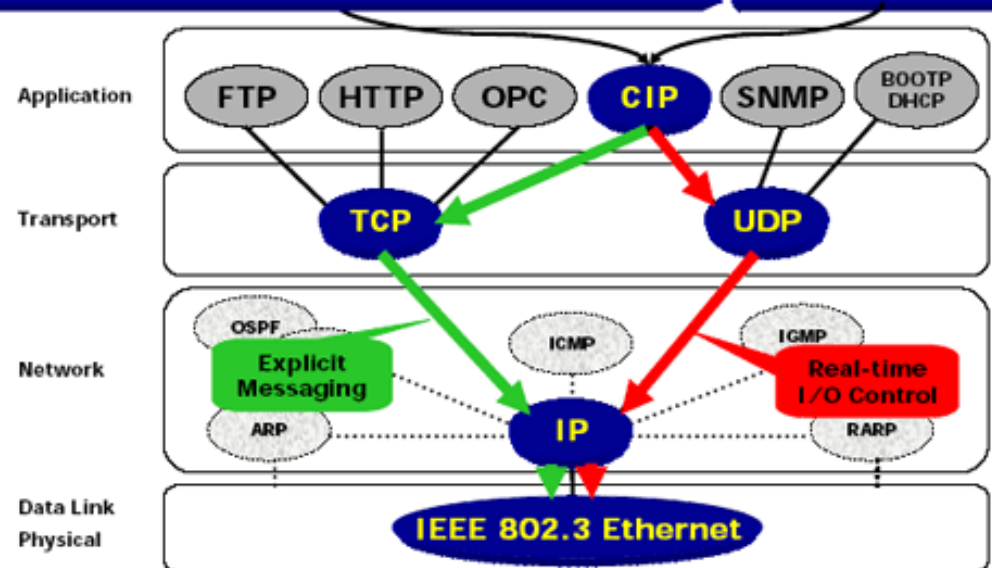
- Primarily Programmable Logic Controller (PLC) to Human Machine Interface (HMI) communications
  1. Ethernet/IP
  2. Modbus TCP
  3. Profinet
  4. CANopen

# Ethernet/IP

- 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

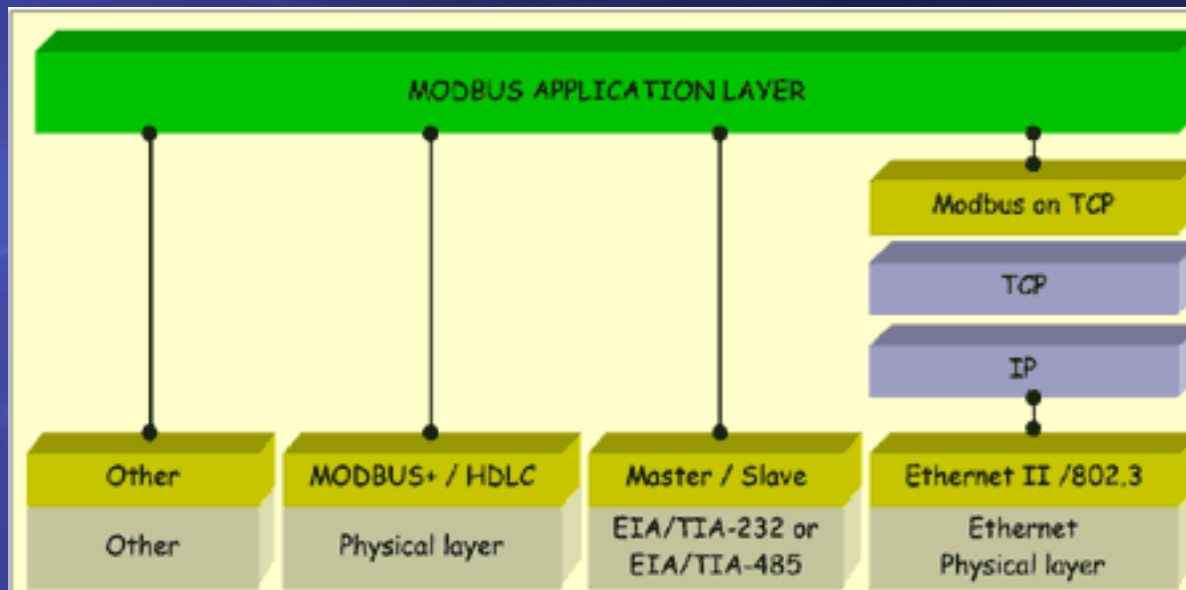
CIP is a proven, real-time application layer protocol added to create an open industrial Ethernet product

EN 50170 Standard  
IEC 61158 Standard  
IEC 61784 Standard



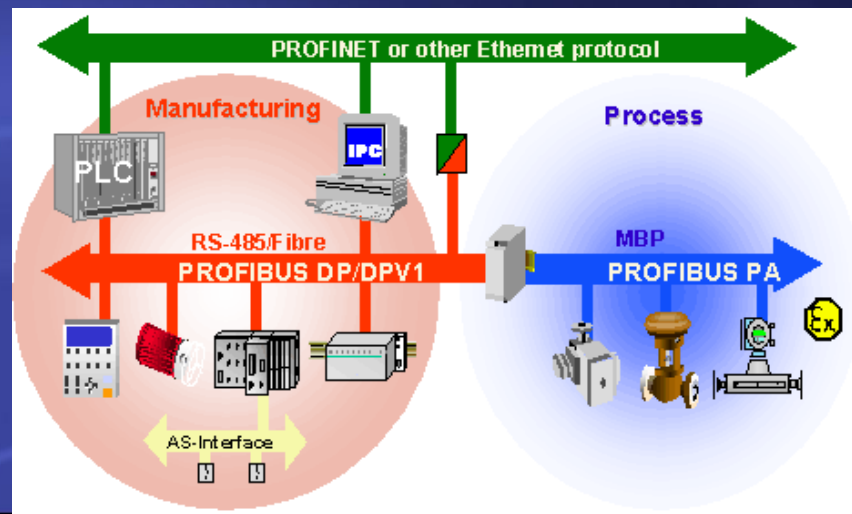
# Modbus TCP

- 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

# PLC to PLC and I/O Networks

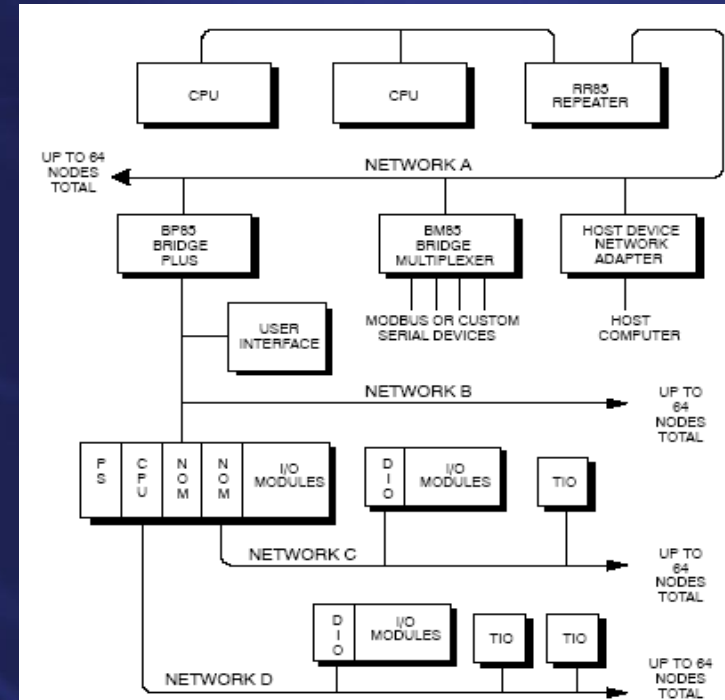
- Generally, these are less open (more proprietary) networks
- Closely tied to manufacturer of control system equipment
- Many times, these networks have very specific cable requirements

# 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.

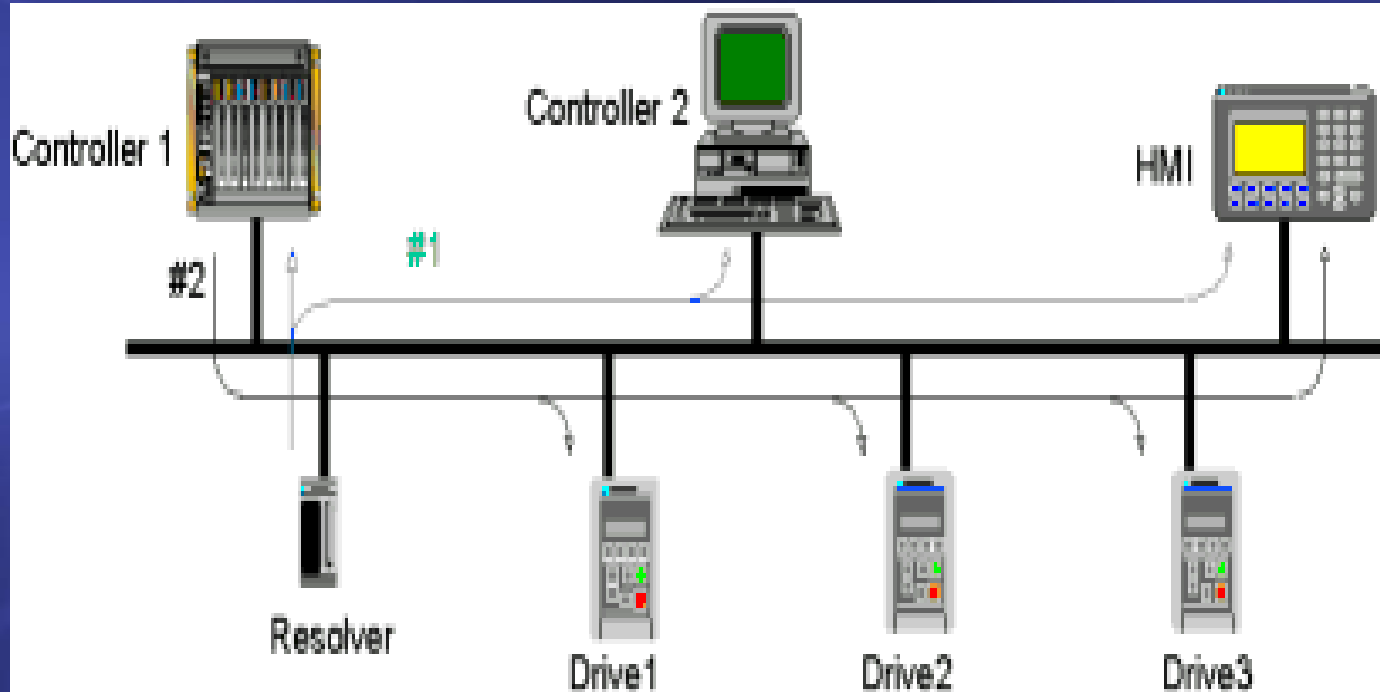


# Controlnet

- 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

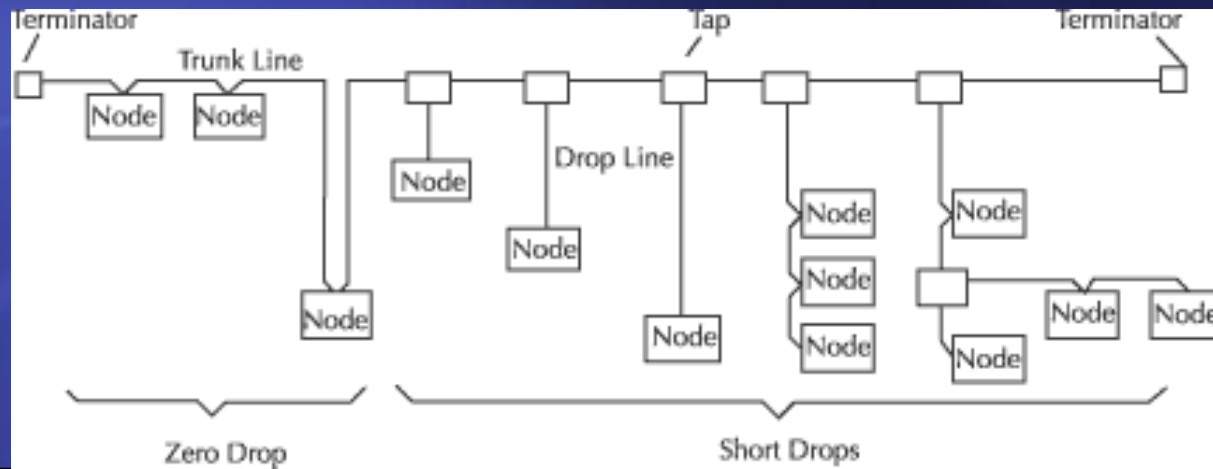
- GE PLC communications network
- Being phased out
- Many installations still in use
- Avoid on new installations

# 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



# 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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