EtherNet/IP for Automotive Assembly

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General Session and 15th Annual Meeting of Members

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About COMAU

COMAU is one of the leading suppliers of assembly lines for the automotive industry

COMAU offers machining and assembly modules, body welding systems, sub-assembly lines, integrated robotics, and comprehensive services
A network of 23 operative centers in 13 countries
Featured Application

- Framing line for an industrial truck
- 150 feet long, 50 feet wide, 18 feet high
- Consists of 8 stations
- 8 minute cycle time
Evaluated Numerous Networks

- DeviceNet
- ControlNet
- EtherNet/IP
- EtherNet Powerlink
- Profibus
- Profinet
COMAU Migrates to EtherNet/IP

EtherNet/IP is used for 80% of data communication because it:

• Cuts debugging time in half  
• Eases installation by 30 percent  
• Improves support with efficient traffic evaluation and a reduced learning curve  
• Supports use of standard, off-the-shelf products and tools (ex. Wireshark)  
• Is very flexible, as COMAU moves into new territory with adaptive solutions
EtherNet/IP Architecture

EtherNet/IP:

- Enables all network devices to “speak the same language”
- Extends Ethernet TCP/IP to the plant floor while reassuring the industrial robustness
- Provides a pure, standards-based Ethernet solution for interoperability
- Enables connectivity anywhere, anytime
Network Architecture Overview

• In addition to EtherNet/IP, COMAU uses DeviceNet
• These networks share the Common Industrial Protocol (CIP)
• As we all know, CIP encompasses a suite of services, including control, safety, motion, synchronization, configuration and information
Motors and drives use EtherNet/IP, simplifying equipment design, configuration and commissioning.
Bill of Materials

- A-B GuardLogix controllers 1756-L61s /LSP
- Rockwell RSLogix 5000 programming software
- A-B EtherNet/IP communication cards 1756-EN2T
- A-B Panelview Plus Terminals
- Cisco IE 3000 managed switch
- Hirschmann EtherNet/IP managed switches
- Numatics G3 EtherNet/IP manifolds
- A-B 1734 Point I/O
- SICK safety light screens and laser scanners
- Emerson VFD Drives
Design Considerations

• What functionality does the product require today and in future applications?
  ➢ Master(scanners), Slave (node adaptor) – Ex. Robot comm.
  ➢ Peer-to-peer messaging

• What are the physical requirements?
  ➢ IP20, IP65 or IP67

• What hardware should be chosen for this product?
• What firmware version should be used for this application?
• What are the configuration requirements?
• What design and verification tools should be used?
Lesson Learned

Robot Communication

Most of the robots require several tool changes: e.g. material handling, SPR guns, sealer, drill, vacuum

- **Issue**: EtherNet/IP communication time was 12s~30s, which would impact cycle time
- **Solution**: Implemented DeviceNet Quick Connect; proved application with less than 1s connection time (will migrate to EtherNet/IP now that Quick Connect is available)
Lesson Learned

Remote Control

Our customer made a late request for remote control in a router configuration (with multiple VLANs).

• **Issue**: I/O or Producer/Consumer tag traffic will not pass through a router
  - By design, the time-to-live parameter was configured in the firmware for a value of 1
  - This value will be reduced by a router and then discarded

• **Solution**: Overlapping the VLANs and opening the subnet mask on devices to allow multicasting
CIP uses the Producer/Consumer model, as opposed to the source/destination message addressing scheme.

Nodes on the Producer/Consumer network determine if they should consume the data in a message.
Lesson Learned

Hardware Convergence

To use DCS (Dual Check Safety) and a single Ethernet network cable for safety and process, we needed to establish independent instances of Ethernet (for dual-check safety relative to process communication)

- **Issue**: A logical and visible distinction must be made between process and safety-related communications

- **Solution**: We routed safety communication to a separate EN2T card
Benefits of EtherNet/IP

• Higher speeds, more data transfer within a shorter amount of time
• Cost effective solution supported by hundreds of vendors
• IT friendly, compatible with standard Internet protocols
• Remote diagnostics and maintenance from the office network
• Proven, complete solution for manufacturing automation
Specific Results

- Installation, Commissioning and Debugging for 10 stations, 12-15 robots takes couple days rather than 1-1/2 week.
On the Horizon

• Unicast communication for improved performance
  - Available with RSLogix v20

• EtherNet/IP Quick Connect
  - Available, currently in testing at Comau