Change is Collection of “Processes”
An Overview of Efforts to Bring EtherNet/IP to the Process Industries

19th Annual Meeting of Members and Conference General Session
October 11, 2018
Announcement at SPS IPC Drives 2017: “In 2016, EtherNet/IP maintained its position in the market for industrial Ethernet accounting for 25% of all new Ethernet nodes shipped. Adoption of EtherNet/IP is expected to remain strong as one of the technologies and standards well positioned to benefit from the overall growth in IP-connected devices.”

Susanne Cumberland, analyst

New Connected Industrial Ethernet Nodes 2016

Process Automation & Instrumentation represents around 1% of installed base of industrial Ethernet.
Thought Leadership
Ethernet is an Enabler for the Namur Open Architecture (NOA), Open Process Automation Forum (OPAF), and Industrie 4.0 and IIOT-related initiatives
Advanced Physical Layer for Industrial Ethernet
Single Pair Ethernet PHY for the Automotive & Industrial Sector

Currently at home in the CG Task Force of IEEE 802.3 Working Group

Innovation Driving COTS to New Industrial Sectors
Change is Coming

Advanced Physical Layer for Ethernet to the Field

Cross Industry/Consortia Collaboration
Use Cases for Ethernet in Industrial Applications

Advanced Physical Layer for Ethernet to the Field

Cross Industry/Consortia Collaboration
Ethernet is Coming

- Ethernet-based Communication System for the Process Industry
- Use Cases for Ethernet in Industrial Applications
- Advanced Physical Layer for Ethernet to the Field

Cross Industry/Consortia Collaboration
Change is Coming

Innovation Driving COTS to New Industrial Sectors

Cross Industry/Consortia Collaboration

Optimization of Technology & Standards for Use Cases
Enhancements to The EtherNet/IP Specification for NAMUR’s NE107 Specification for Field Device Diagnostics

Maintenance Required

Function Check

Out of Spec

Failure

Optimization of Technology & Standards for Use Cases

Change is Coming
Change is Coming

Optimization of Technology & Standards for Use Cases

Enhancements to The EtherNet/IP Specification for Integration of FieldComm Group’s Data Specification for HART - today’s largest installed base of field devices
Optimization of Technology & Standards for Use Cases
Cross Industry/Consortia Collaboration
Innovation Driving COTS to New Industrial Sectors
Research & Development
Convergence of OT and IT
Thought Leadership

Ethernet is Coming
Welcome ODVA’s Newest Principal Member
System Suppliers on the Move in ODVA

Honeywell Process Solutions
Brian Reynolds
Senior Director of Engineering Projects and Automation
Honeywell Overview

NYSE: HON | ~1,300 sites | ~131,000 employees | Morris Plains, N.J. headquarters | Fortune 100

Aerospace

$14.8B Sales

Our products are used on virtually every commercial and defense aircraft platform and in more than 100 million vehicles worldwide and include aircraft propulsion, cockpit systems, and satellite communications.

Home and Building Technologies

$9.8B Sales

Our products, software, and technologies are in more than 150 million homes and 10 million buildings worldwide, helping customers control their comfort, security, and energy use.

Performance Materials and Technologies

$10.3B Sales

We develop advanced materials, process technologies, automation solutions, and industrial software that are revolutionizing industries around the world.

Safety and Productivity Solutions

$5.6B Sales

We improve enterprise performance and worker safety and productivity with our scanning and mobile computers, software, warehouse automation solutions, and personal protective equipment.

Aligned to Key Global Macro Trends

Reflects 2017 Full Year Results
Honeywell Process Solutions

Strengths

- 40-plus year leader in automation
- Safety, reliability, security built into technology platforms
- Continuous evolution approach to maintain asset lifecycle
- Revolutionary approach to lower risk project execution
- Outcome-based solutions to optimize assets and productivity
- Smart and connected field instrumentation
- Global expertise and local service

- > 10,000 installations in more than 125 countries around the world
- 13,000 Employees
- 24 Factories Worldwide
- 200+ Local Offices
- > 90 Local Service Centers Worldwide
- > 2,000 Service Technicians
Serving Process Industries

Our solutions are installed at more than 10,000 sites around the world.

- Refining & Petrochemical
- Pharmaceuticals
- Oil & Gas
- Chemicals
- Power Generation
- Minerals, Metals & Mining
- Midstream Gas
- Pulp & Paper
Honeywell Connected Plant

**PROCESS**
- Predictability in End to End process performance with expertise through exclusive licensors partnership
- Production optimization via advanced machine learning analytics
- Open and collaborative platform

**ASSETS**
- Superior equipment performance through connectivity
- Preventive and predictive maintenance
- Open and collaborative platform

**PEOPLE**
- Seamless knowledge transfer and competency management across generations
- Real time collaboration to improve productivity
- Worker safety & compliance at all times

**Range of Client Improvement**
- Increase OEE
- Improve Uptime
- Improve optimization
- Improve safety
- Improve Competency

**Range of Client Improvement**
- Up to 5%
- 5-10%
- Up to 20% incident reduction
- 5-10% on MTBF & MTTR
- 3-7%

**Connected Plant**
- $90-$100M benefits for customers

**Plant Performance**
- $30-$50M benefits for customers

**CYBER SECURE**
Honeywell Products that integrate ODVA Technology

ControlEdge™ UOC
Unit Operations Controller

ControlEdge™ PLC

ControlEdge™ vUOC
Virtual Unit Operations Controller

<table>
<thead>
<tr>
<th>ODVA Technology</th>
<th>Date</th>
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</thead>
<tbody>
<tr>
<td>EtherNet/IP</td>
<td>2014</td>
</tr>
<tr>
<td>DeviceNet</td>
<td>2003</td>
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<tr>
<td>ControlNet</td>
<td>1997</td>
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</tbody>
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Over 20 years of experience with ODVA technology and standards using CIP
Experion System with EtherNet/IP

Honeywell Advanced Applications
Improve operators, operations, and the bottom line

Advanced Applications Network

Experion Station
Remote Operations

Digital Video Manager
Video as Process Sensor

Unif ormance PHD
Enterprise Historian

eServer
Web Server

FDM
Asset Management System

Orion Console
ASM Operator Effectiveness

Redundant Servers
Global Database, History

Direct (Opr.)
Station

Flex/Engg.
Station

Simulation Node
SIM C300

Fault Tolerant Ethernet (FTE)

Supervisory Control Network

Honeywell One Wireless Suite

C300
EtherNet/IP

EIM
EtherNet/IP

Series C
EtherNet/IP

ControlEdge
PLC

ControlEdge
UOC

ControlEdge
vUOC

General Session
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Importance of EtherNet/IP to HPS

• The use of Ethernet based I/O networks for automation applications has been steadily trending up over the past decade.

• Ethernet based I/O networks and smart I/O devices have become a common requirement for most all Greenfield and Large Revamp projects.

• EtherNet/IP is a well defined, mature, and open industrial protocol that provides a comprehensive set of data messages and services. It is equally applicable to both factory and process automation in both continuous and batch operations.

• EtherNet/IP is preferred by a large percentage of our customers. Our support for EtherNet/IP enables the user to utilize their vendor of choice.

• EtherNet/IP supports Honeywell Connected Plant by providing a way to collect more meaningful data from devices improving overall equipment effectiveness (OEE) and safety.
Importance of ODVA to HPS

• Industry 4.0, IIoT, and the concept of Edge Analytics are driving the message that users can improve all aspects of their process, people, and the bottom line, using valuable data resident in devices located close to the process. ODVA helps Honeywell encapsulates these themes under our Connected Plant initiative.

• **Interoperability** allows the user to safely interconnect different (conformant) device types, from a multitude of vendors, on the same EtherNet/IP network. ODVA and EtherNet/IP ensures that all data is accessible and all devices interoperate in a safe and predictable manner.

• ODVA ensures device Interoperability through……
  – Strong specifications and well defined device behaviors
  – Mandatory and comprehensive conformance testing
  – EDS technology

• ODVA and Interoperability enables Honeywell to provide solutions that unlock all of the value provided by EtherNet/IP. ODVA also ensures that EtherNet/IP will grow as the technology grows.
Topics

About DuPont
DuPont and Honeywell
About the Application
Lessons Learned
View to the Future
Founded in 1802 by Éleuthère Irénée duPont
Originally a gunpowder manufacturer
Invented nylon, Dacron®, Orlon®, Teflon®, Freon®, Kapton®, Mylar®, Corian®, Tyvek®, Nomex®, Kevlar® among many others
60,000 employees in 90 countries
DuPont merged with Dow Chemical in 2014
Created three segments, in preparation for split into three separate companies (2019)
  – Agriculture (Corteva)
  – Materials Science (Dow)
  – Specialty Products (DuPont)
About DuPont

Specialty Products Division

Electronics & Imaging
- Circuit & Industrial Technologies
- Photovoltaics and Advanced Materials
- Advanced Printing
- Semiconductor Technologies
- Display Technologies

Safety & Construction
- Kevlar® and Nomex®
- Tyvek® and Typar®
- Corian® Design
- Performance Building Solutions
- Water Solutions
- Sustainable Solutions (for reporting purposes)

Transportation & Advanced Polymers
- Performance Resins
- Performance Solutions
- Nylon Enterprise & Polyester

Nutrition & Biosciences
- Nutrition & Health
  - Probiotics, Cultures & Food Protection
  - Emulsifiers & Sweeteners
  - Protein Solutions
  - Pharma Excipients
  - Systems & Texturants
- Industrial Biosciences
  - Advanced Biofuels
  - Biomaterials
  - Bioactives
  - Microbial Control
  - Clean Technologies
Safety & Construction
At A Glance

Core Market Segments
- 34% Construct
- 20% Water
- 16% Industrial
- 11% Transport
- 8% Healthcare
- 5% Gov
- 5% Energy
- 2% Other

Category Leading Brands
- Kevlar
- Dow
- Styrofoam
- Great Stuff
- Tyvek
- Corian Design
- Nomex
- Dow Filmtec

- ~7,000 Colleagues
- >10,000 Customers Globally
- #1 or #2 Share in In-kind Core Segments
- 19 R&D Centers
- >1,000 Products Launched in 2017
- >18,000 SKU's
- 42 Manufacturing Sites
Spruance Works Facility
- Located just outside Richmond, Virginia
- Opened in 1929 to produce Rayon
- Headquarters for Safety & Construction business
- Largest site in DuPont with approximately 2500 employees
DuPont – Honeywell Alliance

DuPont has developed a list of approved suppliers
- DCS – Honeywell and Siemens
- PLC – Rockwell and Siemens
DuPont holds a seat on several Honeywell committees
- Experion PKS Customer Advisory Board
- User Input Subcommittee
- User Group Steering Committee
- Quality Control System Forum
- Abnormal Situation Management Consortium
About the Application

Started Small!

– Needed to interface to existing Honeywell Experion® PKS distributed control system (DCS)
  • In same building as existing operations
  • Concerns about “protection to operations” and personnel exposure.
  • Needed a way to keep electricians in immediate area of new equipment
  • Consequence of failure of new technologies was low because test facility.

– Success (or not) would dictate feasibility of commercial implementation in the future
Experience with Various Networks

- In general, DuPont has been slow to implement process control via networked devices, preferring old-school method of “home-run” cables back to controllers and I/O located centralized Instrument Control Rooms.
  - Safety and reliability are of highest priority because of engrained history, and hazardous chemicals and processes.
  - Many facilities are over 30 years old, and networking use was not as common.
  - Risk of production loss if new technology fails to perform.
  - Important to keep controller to controlled device connection simple & short.
About the Application

Experience with Various Networks

- Profibus used primarily for single device communication
  - Isolated cases where Profibus was only network option available from the vendors
  - Complex setup and configuration
  - Difficult to add or modify networked components, including temporary communication loss when downloading

- ControlNet used primarily for Rockwell PLC and Drive communications
  - 5000’ between devices
  - Robust and easy to implement within Rockwell PLCs
  - Complex interface into Honeywell control system, requiring PLC code modifications, packing data into custom arrays for data exchange

- DeviceNet used sporadically
  - Robust “sensor” network
  - Complex interface into Honeywell control system, using data exchange blocks and specific network configuration, with communication loss when adding devices
About the Application

Approximately 200’ from DCS to project area.
Multiple active operations.
Varying ceiling / roof heights.
No existing cable tray.
Implemented both EtherNet/IP and Profibus
- Newly released EIM unproven
- Hands-on experience with Profibus

Honeywell interface modules designed to connect close to controller

Redundancy options available but not implemented
New equipment being installed consisted of:

- Vendor skid with Rockwell CompactLogix PLC
- Pumps, blowers, other motors, some constant speed, some variable speed
- Temperature, Pressure, Flow instrumentation

Experion compatible remote solutions limited to Profibus and DeviceNet.

- Turck ExCom IO via Profibus (strong reputation, unused in DuPont)
- Experion Universal Process Cabinet (expensive, fiber optic interconnection)
- DeviceNet for VSD and motor starter interface (vendor reluctance, complex)
- Experion Ethernet Interface Module (EIM) being introduced, but untested.
About the Application

Turck ExCom

- Worked as designed and intended
- Profibus interface a bit of a challenge to implement and modify
  - Once configured, smooth integration into Experion® control modules
  - Changing configuration (adding or changing module types) proved difficult and resulted in temporary communication loss
- EtherNet/IP interface not available from Turck
- EtherNet/IP interface to Honeywell not commercially available
Honeywell Experion® Ethernet Interface Module

- EtherNet/IP based communication
  - Module resides in same cabinet as controller
- Developed backup plan of hardwired connections
  - Honeywell identified a defect and temporarily halted production
- Seamless integration into Experion control modules
  - Rockwell PowerFlex 753 Variable Speed Drive
  - Rockwell PowerFlex 525 Variable Speed Drive
  - Rockwell E300 Electronic Overload Relay
  - Rockwell CompactLogix PLC
About the Application

On Time!
– Use of EIM reduced labor hours 80% for motor, drive, & PLC interfaces

On Budget!
– Use of EIM reduced wiring cost 50% for motor, drive, & PLC interfaces

Eleven Months and Counting!
The key strength of EtherNet/IP is in its ability to pull multiple pieces of data from a given device, avoiding multiple cable pulls and I/O consumption, and giving a more complete picture of the status and operation of the device.
Lessons Learned

Experience with Products from ODVA Members

– Honeywell Experion® Ethernet Interface Module has performed well.
  • Intuitive and straightforward setup and configuration.
  • EtherNet/IP based devices integrated to date have gone smoothly.
  • Anxious for Honeywell to add to supported EtherNet/IP devices.
  • Strongly recommend for future projects.

– Turck ExCom has performed well, but due to complex Profibus setup will not be recommended for future projects.
  • Turck has developed an EtherNet/IP interface, which will be evaluated in 2019.
Experience with Products from ODVA Members

- Endress+Hauser Promass flowmeter
  - Smooth integration into Rockwell PLC – Detailed EDS file!
- Acrison SBC-2000 Feeder
  - Smooth integration into Rockwell PLC – Detailed EDS file!
- Red Lion N-Tron, Rockwell Stratix, Cisco Catalyst, and Phoenix Contact Ethernet switches have all performed well and will continue to be used.
- Rice Lake Weighing Systems EtherNet/IP based scales successfully used in commercial facility for years
View to the Future

- Plans to evaluate EtherNet/IP devices and applicability
  - Honeywell ControlEdge Unit Operations Controller
  - Rockwell Automation ArmorPoint and ArmorBlock IO modules
  - Other EtherNet/IP based devices (IIOT)
  - Device Level Ring topology

- EtherNet/IP devices that do not come with full and complete EDS files will not be evaluated!

- Currently in design phase of $130M capital project
  - Squeezed into existing manufacturing facility
  - Multiple interconnected unit operations islands
  - Remote, distributed IO required to reduce current operations risk
  - Installation and configuration are both time constrained
Capabilities and ease of implementation make it the network of choice for future projects.

Dave Bell, E. I. DuPont de Nemours and Company
THANK YOU