

LISTEN.
THINK.
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Industrial Automation and emerging Ethernet

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PUBLIC INFORMATION

 *Allen-Bradley • Rockwell Software*

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Automation**

What is Industrial Automation?

- An Industrial Automation Definition:
 - “Application of *technology* to transform *raw materials* into *finished goods*”
 - Moving materials
 - Manipulating materials

- Some technology evolutions
 - Automation degree: Manual (tools) -> Semi-automatic -> Automatic
 - Power source: Human -> animal -> water -> fuel -> electricity
 - Technology: Mechanics -> fluidics -> relays -> electronics



Interconnection of components

- Industrial Automation components
 - Sensors, Actuators, Controllers, Human Interfaces, Information Interfaces

- Generic components are *interconnected* into application systems
 - Power connection
 - Control and information connection
 - Hardwired -> Networks

- Some interconnection goals:
 - Reliable, integrated, simple to apply, economical



Industrial Automation IoT Market

- In their report “Industrial Internet of Things – 2014”, industry market analysis firm IHS Technology forecasts that there will be (2015):
 - 50B node installed base at 13% connected (sensors, actuators, controllers, interface modules, operator interfaces, IT infrastructure, instrumentation, servers, etc.)
 - 6B new node shipments at 31% connected
 - 1.8B new wired nodes with 11.7% CAGR
 - Predominant connectivity via wired networks followed by WLAN then WPAN and WWAN
 - Approaching 50% Ethernet in Process Industry (related IHS report)
 - Other portions of installed base can tolerate less Ethernet overhead
 - Reduced *interconnection* is a significant factor in further penetration



Scope of presentation

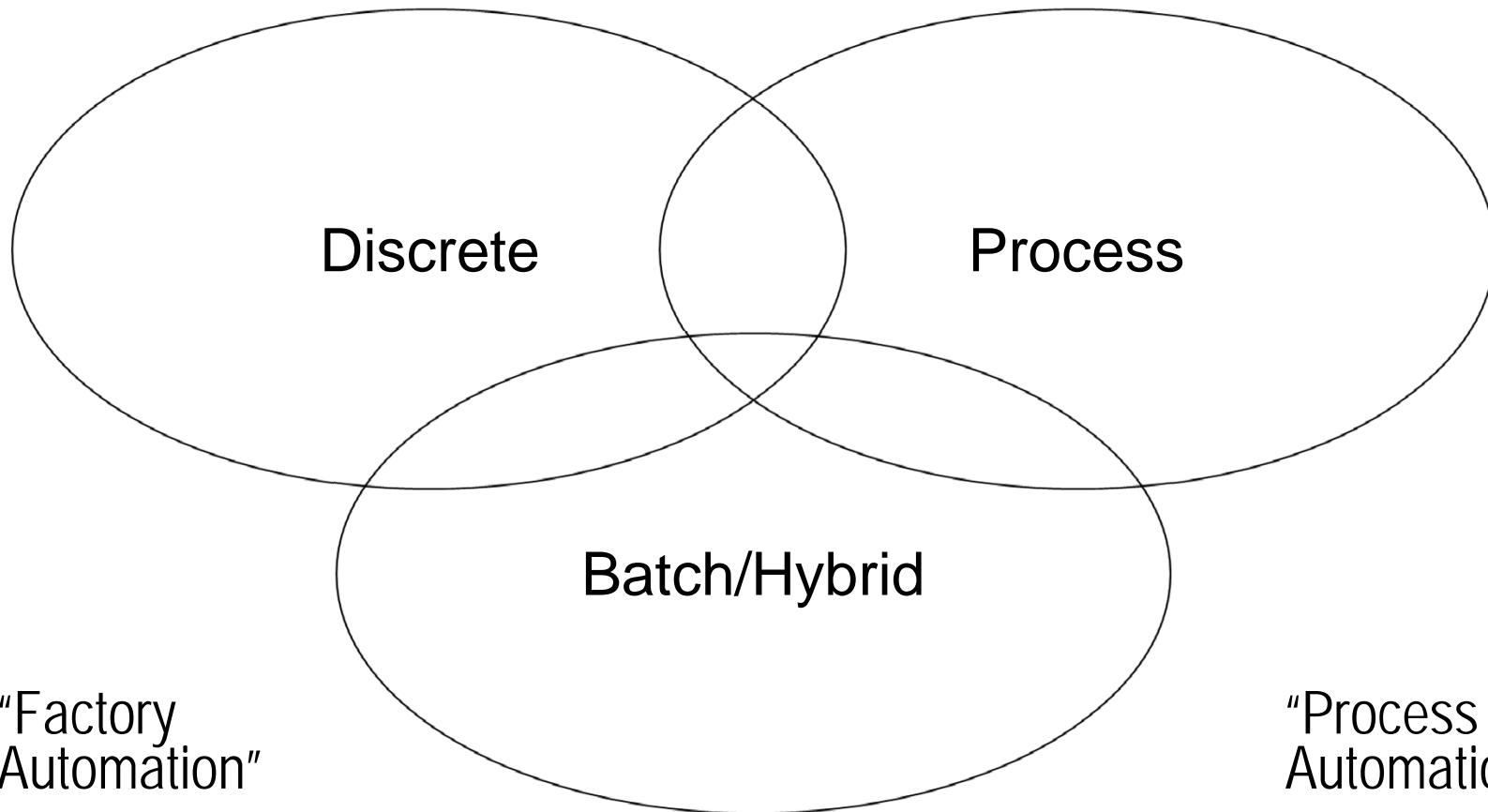
- A wide range of IEEE standards apply to Industrial Automation
 - Power and energy
 - Communication
 - Information

- IEEE Scope for this presentation is 1-Pair Ethernet:
 - IEEE P802.3bp 1000BASE-T1 PHY
 - IEEE P802.3bw 100BASE-T1
 - IEEE P802.3bu 1-Pair Power over Data Lines (PoDL)
 - Related CFIs...



Basic Automation Disciplines/Domains

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"Factory
Automation"

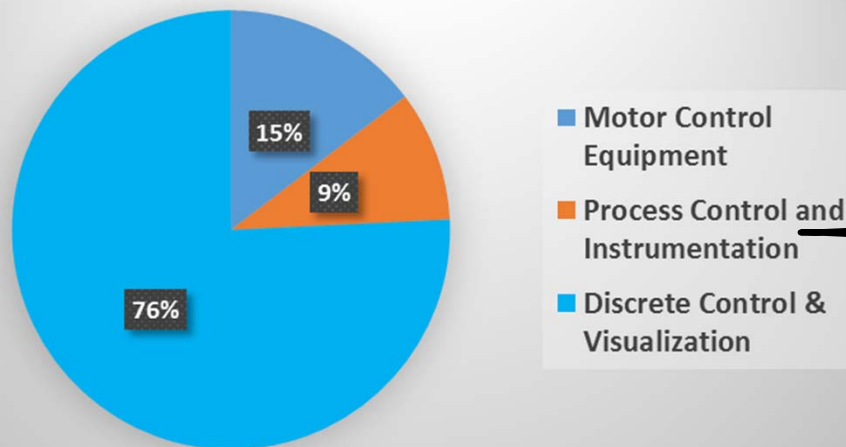
"Process
Automation"



Industrial Automation Characteristics

- A large portion of the *Discrete Control & Visualization* and associated *Motor Control Equipment* is concentrated in machines and is of relatively short distance (40m) and benefits from high performance (100Mb/s -> 1Gb/s)
- Certain important Process Control and Instrumentation applications require very long distances (1000m) and have relatively low performance requirements

New Nodes Connected to a Network, 2015



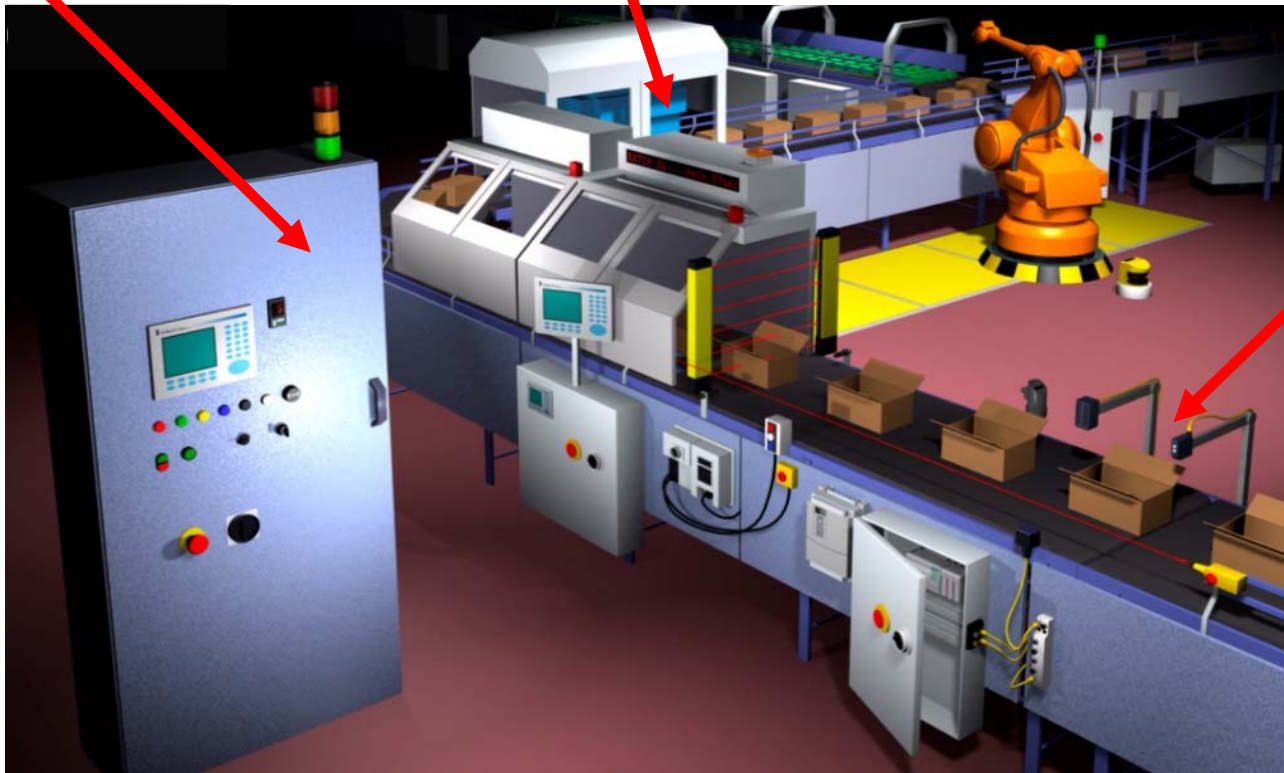
Source: IHS, The World Market for Industrial Ethernet & Fieldbus Technologies – 2013 Edition



Factory Automation Modules

Control
Cabinets

Work cells



Conveyors



In-cabinet cabling relationship to On-machine cabling

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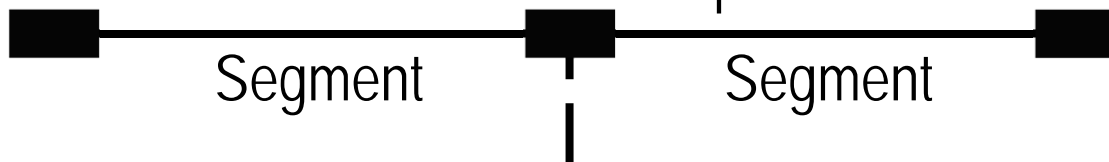
In-cabinet
IP20
RJ45 Ethernet



On-machine
IP67
M12 Ethernet



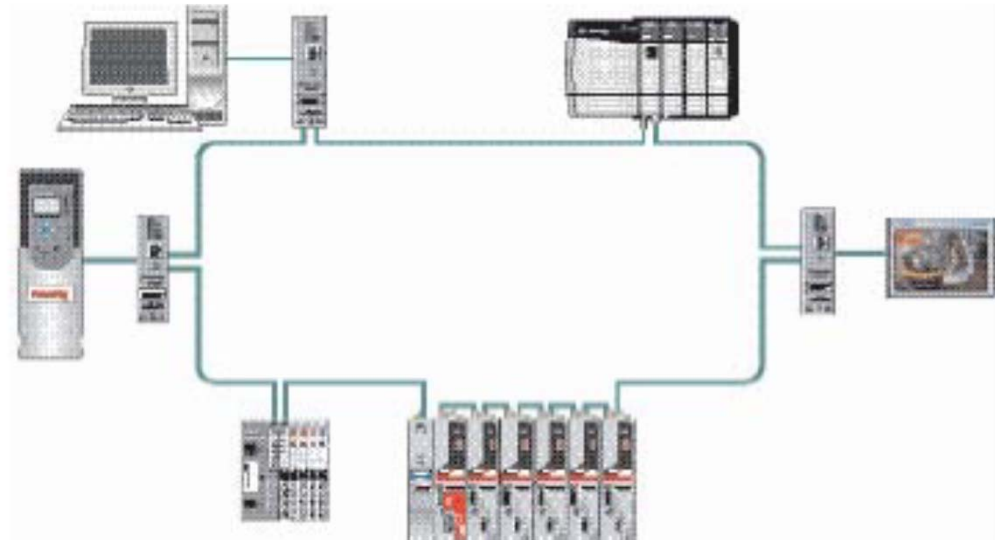
Bulkhead
Adapter



In-cabinet



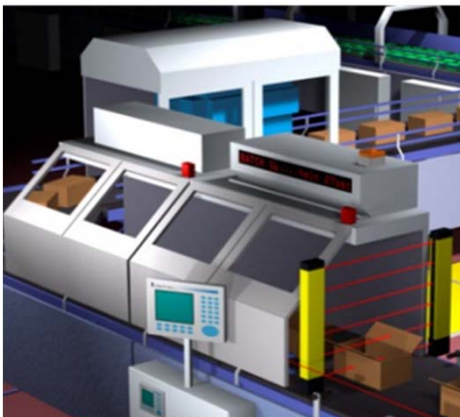
- Dense node packing
- Very short segments
- Linear or Ring configuration of dual-port nodes
 - Cable lengths rarely > 15m



On-machine

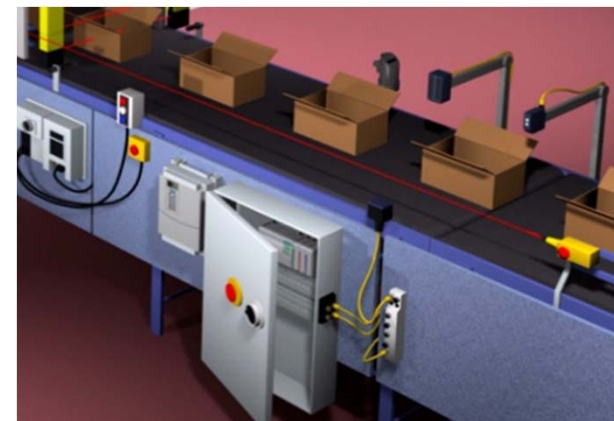
Work Cells

- Nodes spread to best physical position
- Somewhat bigger than the product
 - i.e., an Automobile
- Linear or Ring configuration of dual-port nodes
 - Cable lengths rarely > 40m



Conveyors

- Nodes distributed along length
- Often modular
 - i.e., 3m sections
- Linear or Ring configuration of dual-port nodes



Process Automation “Skids”

- Many Process Automation skids are reasonably small
- On-machine requirements apply



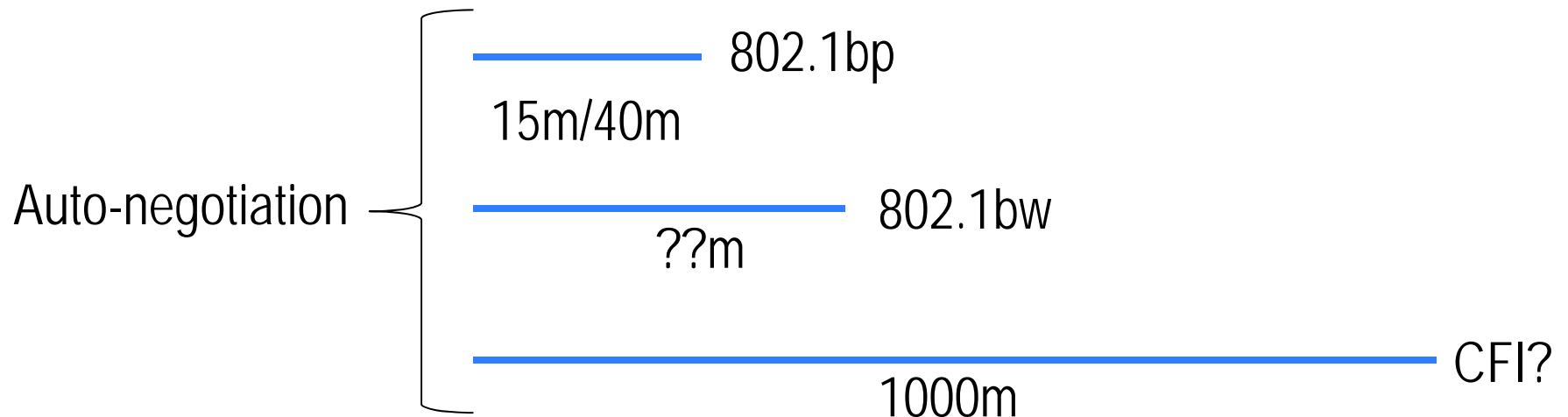
Large Process Automation Applications

- Nodes spread over large site
- Star topologies
- Legacy cable runs
 - 1000m
 - 4-20mA -> Fieldbus -> Ethernet?



Additional application coverage via hybrid systems

- Selectively extend distance with reduced rate for greater application coverage
- Minimize media converters



- Industrial Automation nodes require power
- Various applications will benefit from two strategies
 - 1-pair Ethernet within a “harness” that includes power
 - 24VDC is common
 - 1-pair Ethernet + PoDL



Conclusions

- Major segments within Industrial Automation can benefit from the ongoing 1-pair Ethernet development
 - Factory Automation
 - In-cabinet
 - On-machine
 - Process Automation
 - Skids
- An important portion of Process Automation applications are not met except with much greater length
 - A CFI is likely for an additional 1-pair Ethernet to meet these application needs
- Auto-negotiation extends the benefits of the individual 1-pair standards

