FDI + PA-DIM® + Digital Instrumentation

FDT HART COMMUNICATION PROTOCOL ethernet-apl™ advanced physical layer

FieldComm Group™ Connecting the World of Process Automation

PLANNING FOR PLANT DIGITALIZATION

Paul Sereiko • Director – Marketing and Product Strategy • FCG

Agenda

- FieldComm Group Overview and Update
  - Transfer of FDT Group assets to FieldComm Group
  - PACTware
- The changing architecture of Process Automation systems (aka Digital Transformation)
- Three Key Technologies
  - Ethernet-APL
  - PA-DIM
  - FDI
- Getting more from HART – HART 7.9 improvements
- Get trained on FCG technologies
- NAMUR Open Architecture

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FIELDCOMM GROUP OVERVIEW AND UPDATE

FDT and FieldComm Group
PACTware

FIELDCOMM GROUP™
Connecting the World of Process Automation

FDT®

PRESS RELEASE: FieldComm Group Acquires FDT Technology, Bolsters Integration Capabilities

Industry leaders unite to drive intelligent device management innovation and standardization in industrial automation

FRANKFURT, Germany, 10 June 2024 – FieldComm Group, a leading figure in global industrial automation standards, today announces that is has completed the acquisition of FDT Group's assets including the FDT/DTM technology standards. This significant transaction underscores FieldComm Group's dedication to addressing industrial device management challenges across the entire industrial automation market, ultimately enhancing operational efficiency for vendors and end users.

With a comprehensive suite of technologies including Information Models, the Field Device Integration (FDI) standard, and well-established communication protocols like HART, HART-IP, WirelessHART, and Foundation Fieldbus, FieldComm Group's market offerings serve the entire process automation sector. The addition of FDT/DTM technology, a widely deployed device integration standard across process and factory automation markets, adds new technologies to the portfolio, completely addressing the industrial automation hierarchy.

"As digitalization transforms the automation industry by breaking down barriers between operation technology and information technology, the integration of factory and process automation devices becomes both more important and more difficult. Our aim as a standards organization is to add intelligence to the device integration process, with an ultimate goal of making it simpler," stated Ted Masters, President and CEO of FieldComm Group. "Ends users and suppliers will benefit greatly from this acquisition by having a single standards development organization responsible for the full spectrum of device integration from the simplest sensor to the most complex field instrument."

Millions of already installed devices in the field use both FDI and FDT technology for intelligent device management. Leveraging combined resources and expertise, FieldComm Group is now better-positioned to address the industry's evolving needs, improve interoperability, and streamline integration and lifecycle management procedures for the future.

On June 10th, FieldComm Group acquired the assets and staff of the FDT Group in an asset transfer agreement.

In addition to ownership and management of FDI technology, FieldComm now also owns and manages FDT technology.

FieldComm Group technologists and member volunteers have begun development of a unified solution for integration of factory and process automation devices.

Press Release

Press Conference Video

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GOAL: One Entity Focused on Unifying Device Integration

Initial Discussions 2023 → Study Teams → Term Sheet 04-2024 → FDT Member Approval 05-2024 → Completion 06-2024

- Vision…
  - **Harmonize** device integration and management for industrial automation market
  - **Protect** the installed base of deployed instruments and systems
  - Manage and **maintain** existing device integration standards/technologies
  - **Evolve** standards to reach market needs as new technologies emerge including OPC UA FX
  - Ensure **IT/OT** data interoperability, services and mobility
  - Enable a **modernized** environment for intelligent device management

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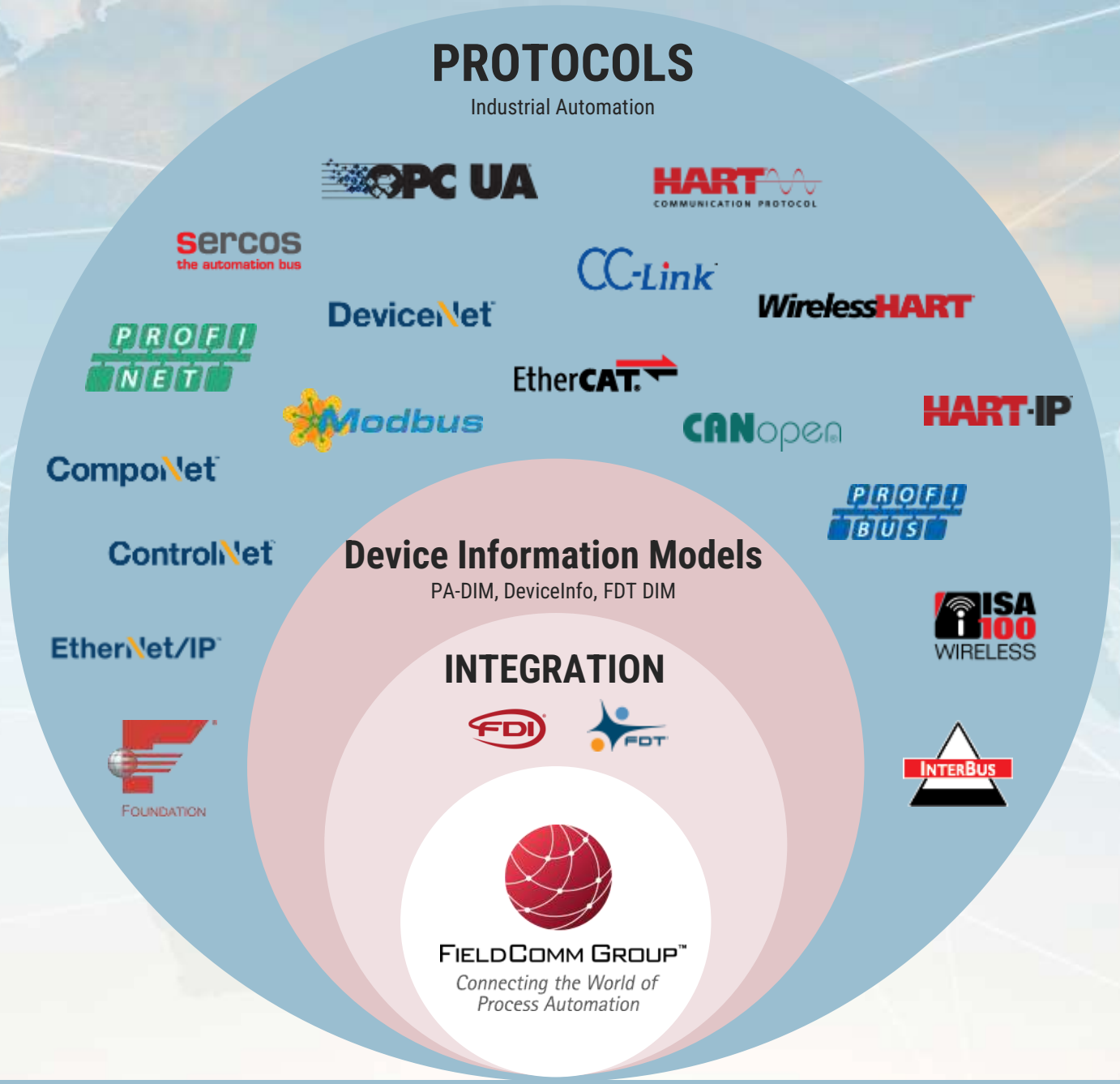
Vision

Create, manage, support, and enhance a united device integration technology for the industrial automation market.



VISION: Unified Device Management Platform

Key Benefits

- Alignment of FDI and FDT technologies within a single organization enables support and development of a migration path and tools from the existing investment in FDI Device Packages and FDT DTM's to a single unified device integration solution.
  - Ensure support of current installed base of devices, hosts, and communication networks
  - Ensure that installed base of devices, hosts, and communication networks can better integrate to hosts for future harmonized technology
  - One device = one device package for all lifecycles of the plant
- This removes barriers that previously existed with two independent organizations and enables development of a unified solution and ultimately reduce supplier investment in multiple technologies.
- The objective is to have an open forum for all SDO's to jointly cooperate on a single device integration solution for all protocols used throughout the industrial automation industry.

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FieldComm Group Distributes PACTware with FDI Device Packages

What is PACTware?

- Widely used configuration software tool for field instruments in the process industry
  - Supports many common communication protocols and device types independent of vendor

One Tool for

- Host to Device Interoperability
- Lifecycle management - configure, operate, and diagnose all devices in a plant/facility

What's new with PACTware 6.1?

- Natively accepts FDI Device Packages with iDTM
- FDT 3-enabled and supports all generation DTMs

FieldComm Group Supports User Community as a new Member of PACTware

- Ensuring a unified environment for device integration - FDT/DTM and FDI Device Packages
- Offering a free of charge PACTware download
  - Communication driver for common HART modems and a generic HART device DTM
  - FDI iDTM (Interpreter DTM) to integrate FDI Device Packages
    - ✓Includes: FDI Device Package Library
  - Download from www.fieldcommgroup.org/pactware

PACTware

Press Release

PACTware download

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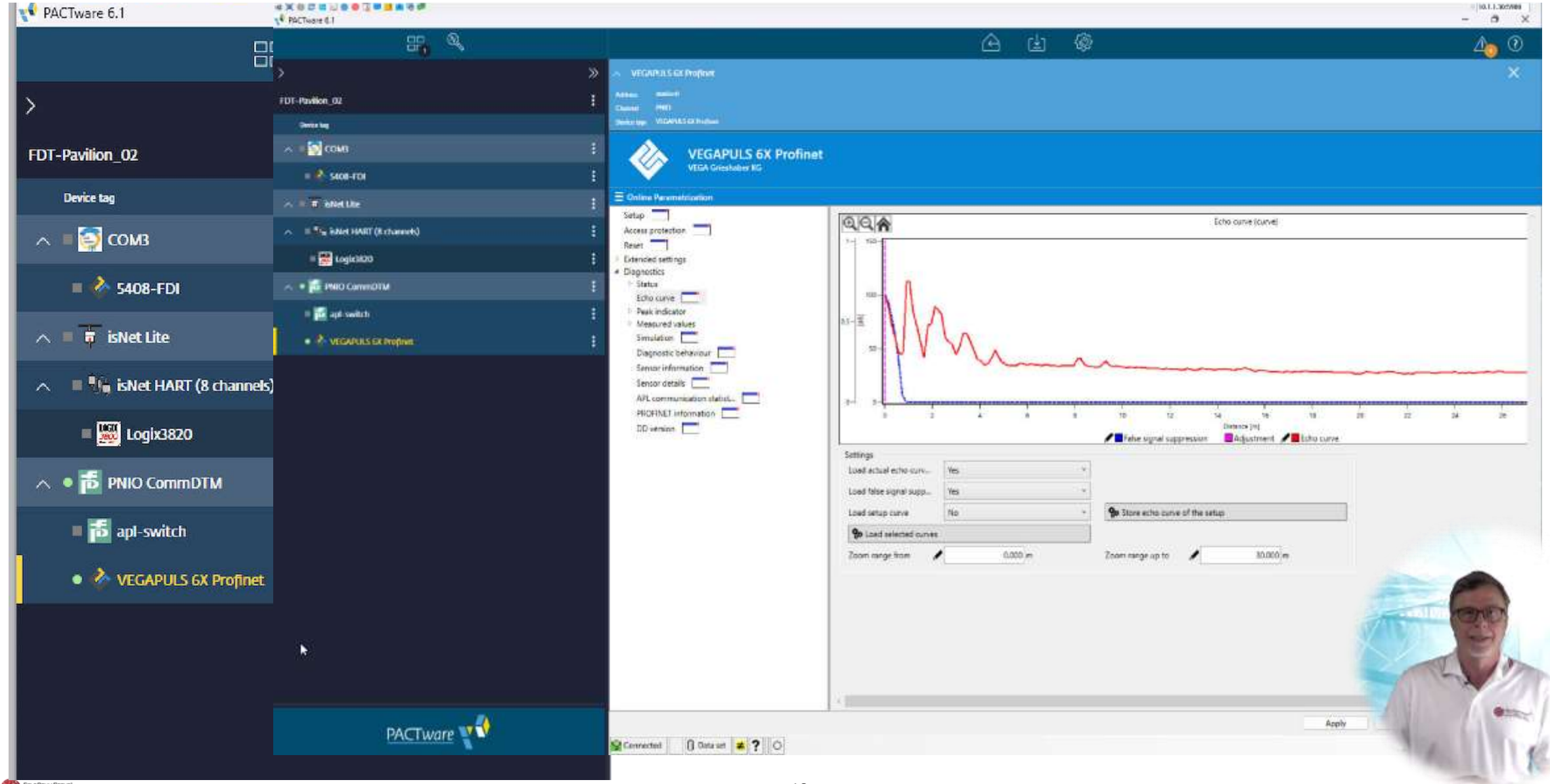
PACTware @ ACHEMA



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DIGITAL TRANSFORMATION

The changing architecture of Process Automation systems

Overall Theme for the Day

KEY COMPONENTS OF DIGITAL ARCHITECTURE

Unified Device Integration

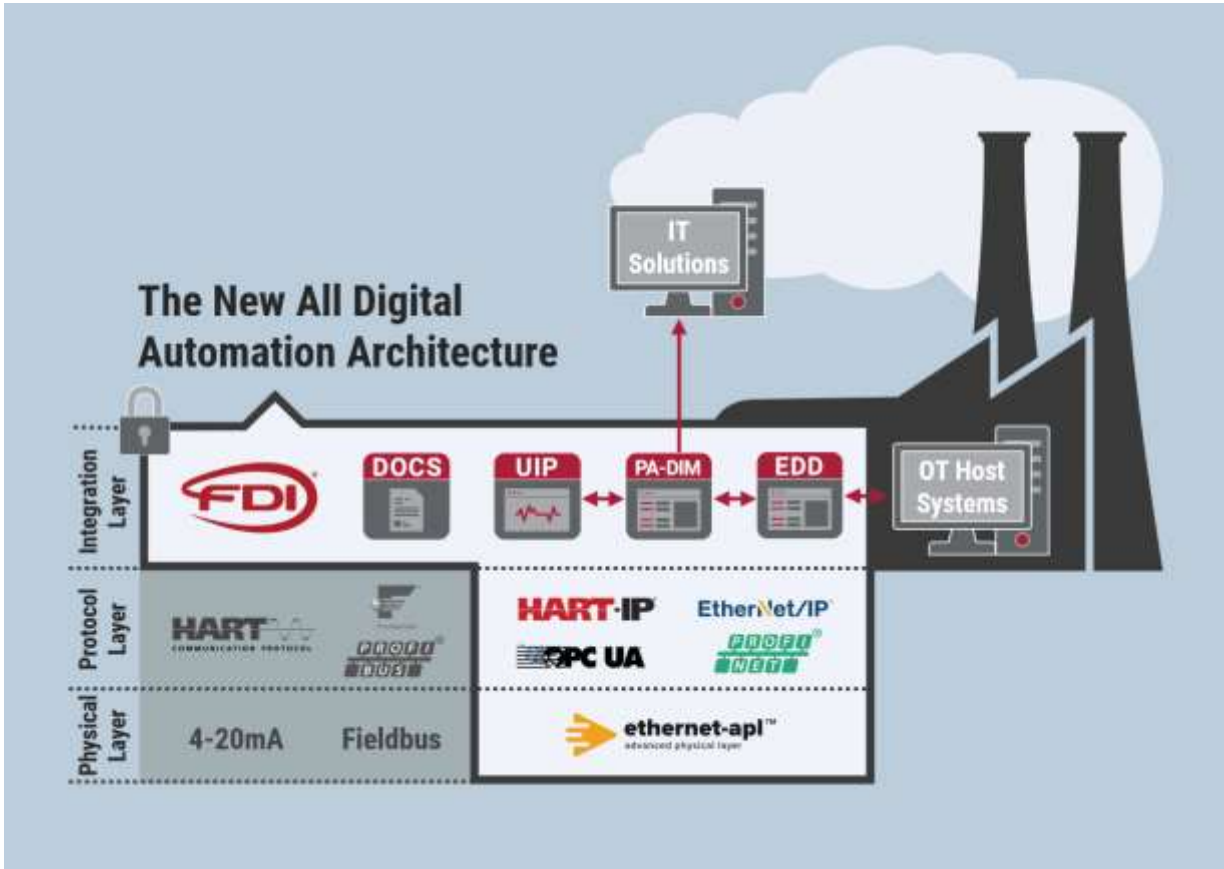
FDI®

Automated Protocol Independent Information

PA-DIM®

ethernet-apl™
advanced physical layer

High-Speed Plant Floor to Enterprise Connectivity



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The Plant of Today

IT Networks
- Analytics
- Big Data
- Central Management
- etc.

Public Clouds

aws Azure Google Cloud

Private Clouds

Business Systems

AMQP OPC UA MQTT JSON

Plant Networks

HMI/Maintenance

Various proprietary

4-20mA

HART COMMUNICATION PROTOCOL

WirelessHART

© FCG

The Plant of Tomorrow

Needs

Solutions

IT Networks
- Analytics
- Big Data
- Central Management
- etc.

Public Clouds aws Azure Google Cloud

Private Clouds

Business Systems

AMQP OPC UA MQTT JSON

Simple, text-based device information

FDI makes devices more accessible

Plant Networks

HMI/Maintenance

Enterprise-wide common information model

PA-DIM

Device-specific Information Model

FDI DEVICE PACKAGE EDD UIP DOCS

FDI Host

Device-specific IM

PA-DIM

Easy device install, commission, and deployment

PA-DIM

NOA-IM

Industry-wide Information Model

PA-DIM conversion for existing devices

FDI Gateway

DeviceInfo

PA-DIM

Reliable Cybersecurity

Common security

HART COMMUNICATION PROTOCOL 4-20mA

WirelessHART

HART on all physical layers

ethernet-apl™ Power Switch

Field Switch

PA-DIM

HART-IP

OPC UA

Higher Speed Communications

ethernet-apl™ advanced physical layer

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THREE KEY TECHNOLOGIES

The changing architecture of Process Automation systems

Three Key Technologies

1

Ethernet-APL

ethernet-apl™ advanced physical layer

Needs

Solutions

IT Networks
- Analytics
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- etc.

Public Clouds aws Azure Google Cloud

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HART

Reliable Cybersecurity

Common security

HART COMMUNICATION PROTOCOL 4-20mA

WirelessHART

HART on all physical layers

ethernet-apl Power Switch

Field Switch

PA-DIM

HART-IP

OPC UA

Higher Speed Communications

ethernet-apl™ advanced physical layer

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Why Ethernet-APL?

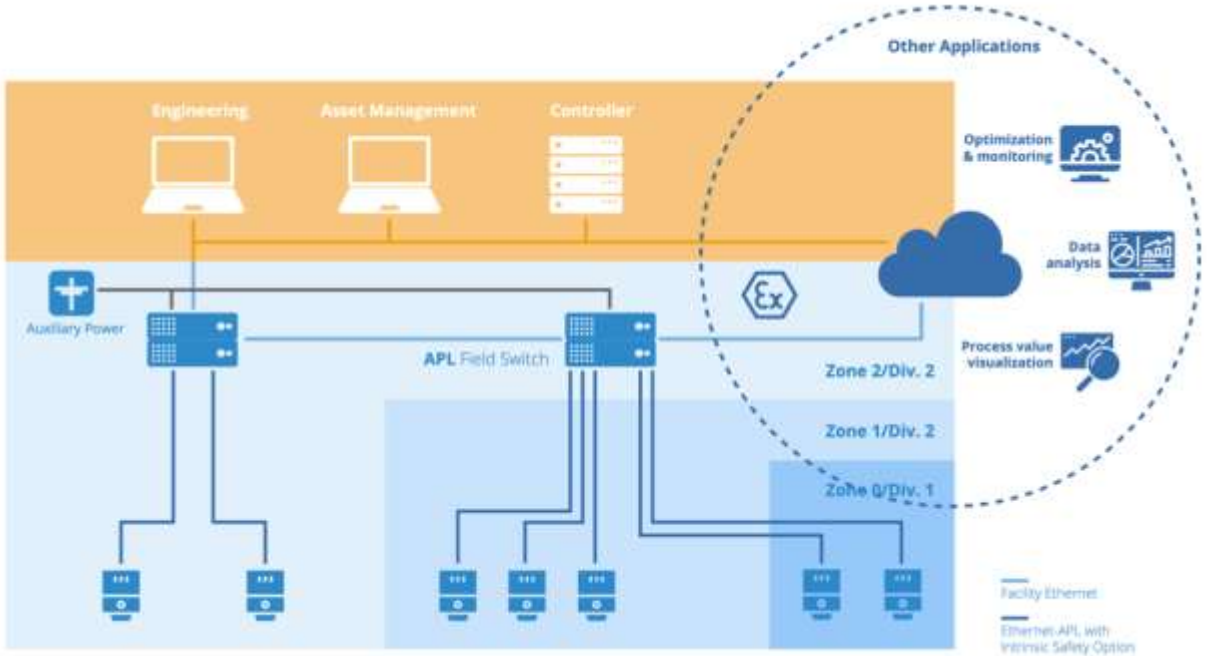
- Ethernet-APL is a high-speed physical layer.
- It is intended to replace 4-20mA and Fieldbus physical layers.
- It is used in conjunction with IP-enabled automation protocols which can co-exist on the same Ethernet-APL network.
  - HART-IP
  - EtherNet/IP
  - Profinet

User Needs

- Simplified infrastructure installation
- Less protocol translation
- 2-wires with both power and data
- Deployable in hazardous areas

Ethernet -APL Delivers

- FISCO installation model
- 1000m trunk between switches
- 200m device to switch
- 10Mb/s speed
- Zone 0 / Div 1 installation



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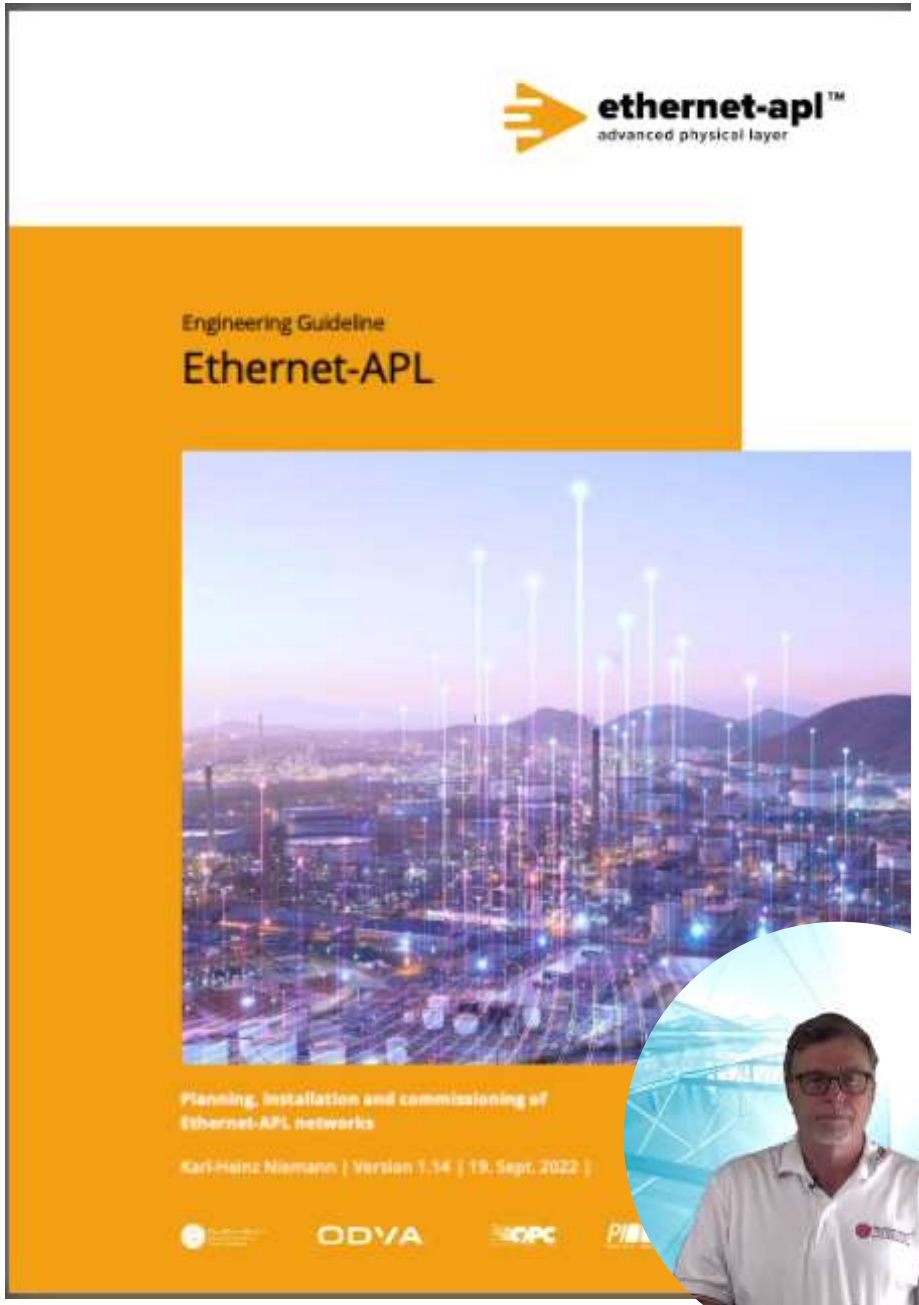
Ethernet-APL Engineering Guide



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Path of Migration - Today

Legend

- 4-20mA
- WirelessHART
- ethernet-apl™ advanced physical layer

Asset Management

Engineering

Controller

Area Control Network

Generic I/O

HART-IP

RS485
Modbus

WirelessHART

Multiplexer

HART

Multiplexer

Multiplexer

Zone 2 / Div. 2

Zone 1 / Div. 2

Zone 0 / Div. 1

Hazardous Zones

Basic measurement devices

Complex measurement devices

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Path of Migration – Stage 1 - NOW

Asset Management
Engineering
Controller
Area Control Network
Generic I/O
HART-IP
Delete
Add an Ethernet-APL switch to Zone 2/D2.
Add instruments from currently announced protocols
RS485 Modbus
WirelessHART
Multiplexer
HART
APL Field Switch
PROFINET
EtherNet/IP
Modbus TCP
Multiplexer
Multiplexer
Basic measurement devices
Complex measurement devices
Zone 2 / Div. 2
Zone 1 / Div. 1
Zone 0 / Div. 1
Hazardous Zones

Legend

4-20mA
WirelessHART
ethernet-apl™ advanced physical layer

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Path of Migration – Stage 2 – FUTURE 1

Legend

- 4-20mA
- WirelessHART
- ethernet-apl™ advanced physical layer

Asset Management

Engineering

Controller

Area Control Network

Generic I/O

APL Field Switch

As new instruments and devices enter the market, they can be added. Consider HART-IP.

Zone 2 / Div. 2

Zone 1 / Div. 1

Zone 0 / Div. 1

Hazardous Zones

Multiplexer

HART

HART-IP

Multiplexer

Multiplexer

WirelessHART gateway

PROFINET

EtherNet/IP

Modbus TCP

Basic measurement devices

WirelessHART

HART-IP

Complex measurement devices

© FCG

Path of Migration – Stage 3 - FUTURE 2

Legend

4-20mA

WirelessHART

ethernet-apl™ advanced physical layer

Asset Management

Engineering

Controller

Area Control Network

Generic I/O

APL Field Switch

APL Power Switch

As comfort grows add devices into hazardous areas and add new device types

Zone 2 / Div. 2

Zone 1 / Div. 1

Zone 0 / Div. 1

Hazardous Zones

Multiplexer

HART

HART-IP

PROFINET

EtherNet/IP

Modbus TCP

WirelessHART gateway

WirelessHART

Basic measurement devices

Multiplexer

HART-IP

APL Field Switch

Analyzer

PROFINET

Multiplexer

WirelessHART

IP Camera

OPC UA

Complex measurement devices

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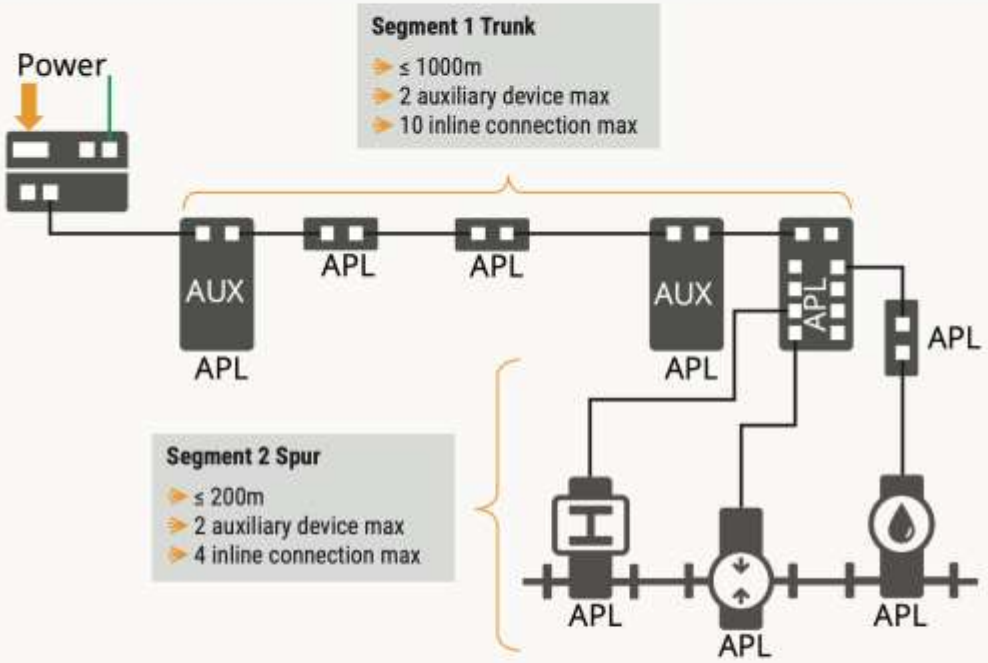
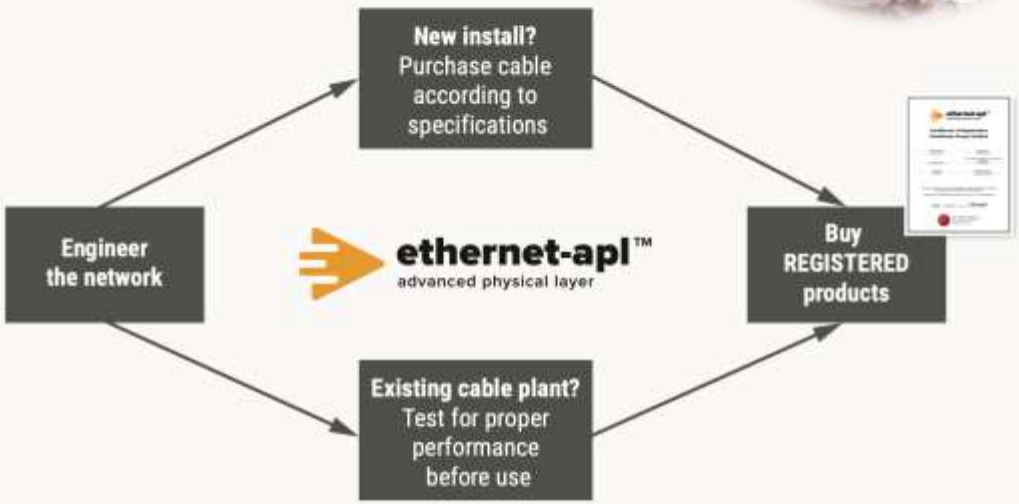
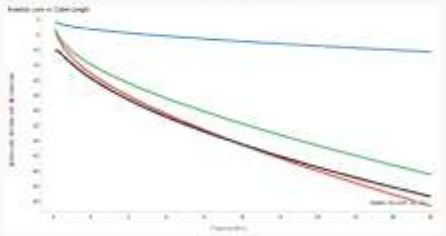
Cabling Considerations



Do it Right!

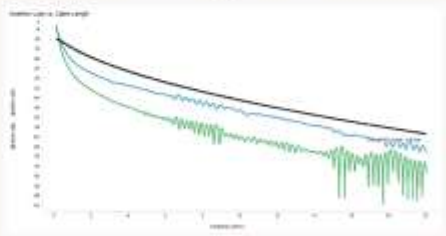


APL Category 4 Cable



APL Category 4 Cable Test Results

Fieldbus Type A Cable



Commonly Available Fieldbus Type A Test Results

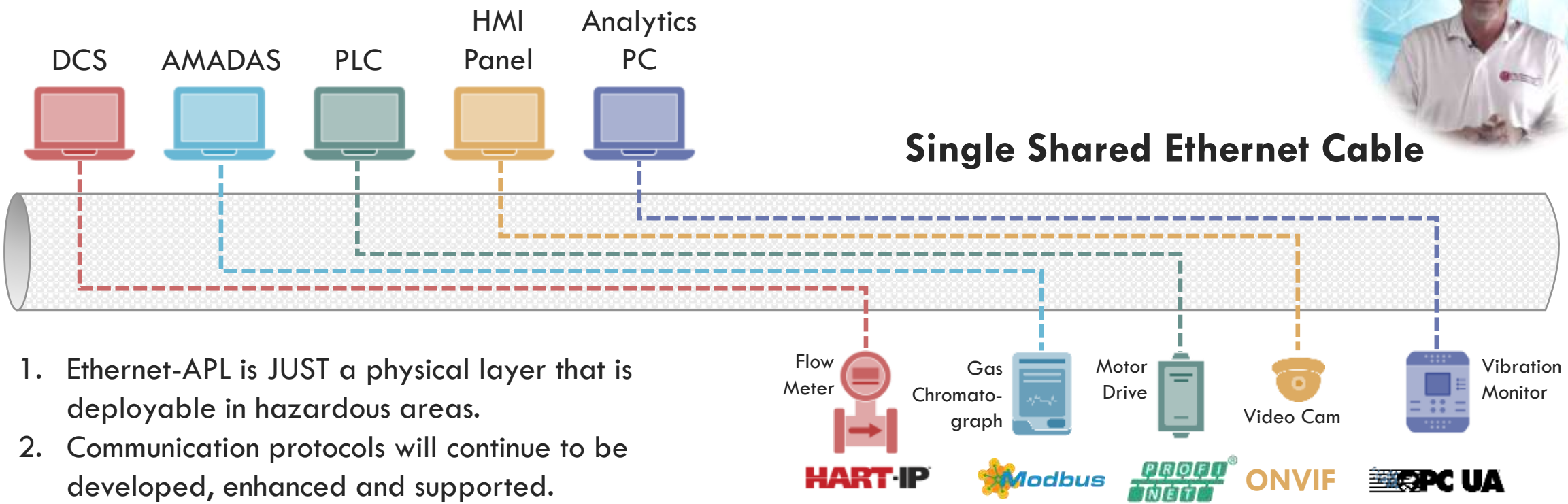
4-20mA Twisted Pair

- **Not Specified for Ethernet-APL**
- Previously installed cables degrade over time
- Cable characteristics determine practical length
- Cables must meet IS requirements
- Engineering guide provides all details

Reference: Texas Instruments Application Report

Key Takeaways:

linkedin.com
Jonas Berge on LinkedIn: 5 Reasons Ethernet & APL change field device integration | 12 comments
5 Reasons Ethernet and APL will change field device integration | 12 comments on



1. Ethernet-APL is JUST a physical layer that is deployable in hazardous areas.
2. Communication protocols will continue to be developed, enhanced and supported.

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ethernet-apl™
advanced physical layer

FOUNDATION®

ETHERNET-APL AND FOUNDATION FIELDBUS

EXECUTIVE SUMMARY 1

FieldComm Group member companies continue to support H1 installed base.

Limited registration of products supporting new FF features, eg. Standard Connection Points, in instruments and host systems (controllers and asset managers)

Significant development by member companies on Ethernet-APL products. Switches, controllers, instruments.

Drivers for Ethernet-APL development:

- Expectation that single infrastructure will lower deployment and commissioning costs
- Expectation that higher speed communications will enable product differentiation
- Expectation that users will increasingly adopt plant-wide digitalization efforts that will be more easily achieved with Ethernet-APL products

FF end users can implement digitalization projects in two ways

- Software only using FF devices that support PA-DIM
- Hardware modernization

This presentation is focused on hardware modernization

EXECUTIVE SUMMARY 2

Many suppliers are aggressive pursuing Ethernet-APL based solutions for new generation systems.

FF and APL use the same cabling (Type A), so it's possible to physically change the signal on the wire from FF H1 to Ethernet-APL

But ….

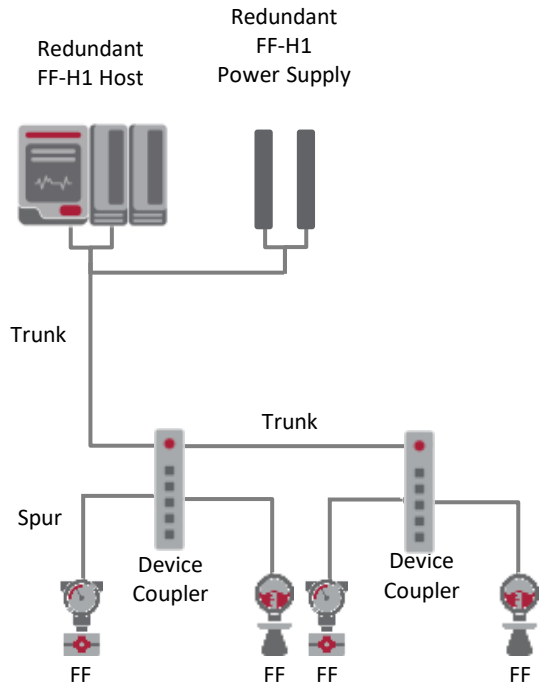
- Ethernet-APL is ONLY an IP physical layer, meaning there must also be an IP enabled automation protocol to manage instruments and control strategy.
- FieldComm Group has created a technical report describing how a **hardware** infrastructure product could be created to support both H1 and APL devices.
- Software implementation is left to the discretion of suppliers.

End Users Must Work with DCS and AMS Suppliers to create products for their needs

FF to Ethernet-APL Migration Concept

ARCHITECTURAL SIMILARITIES OF FF-H1 AND APL

FF-H1



FF Device Coupler

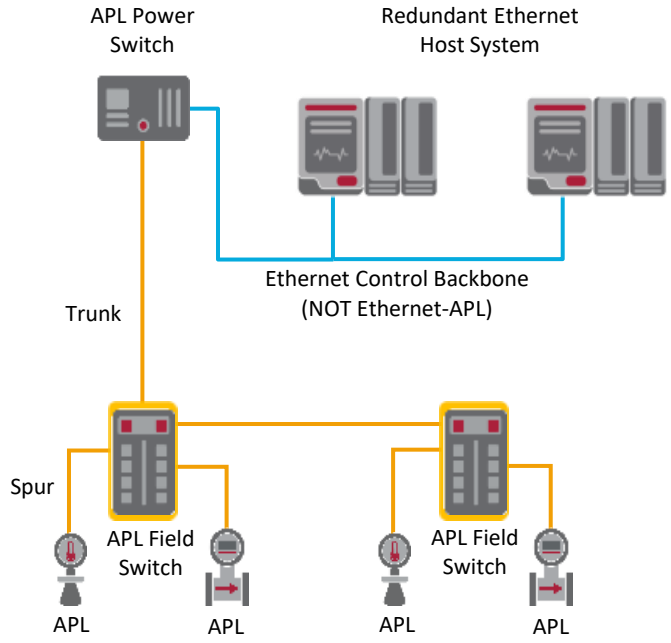
W: 148
H: 77
D: 42

FOUNDATION Fieldbus H1 and Ethernet-APL use Trunk & Spur Topologies

Both use “Type A” cable

Hardware footprint is familiar but different

Ethernet-APL

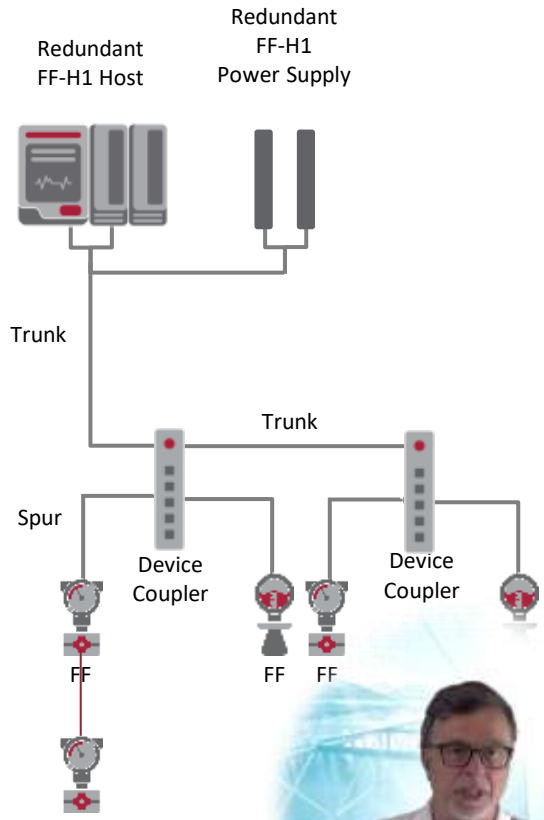


APL Field Switch

W: 119
H: 158
D: 136

ARCHITECTURAL DIFFERENCES OF FF-H1 AND APL

FF-H1



FOUNDATION Fieldbus H1

Multidrop Connection

Infrastructure uses Device Couplers
- Passive component
- Smaller footprint in JB

Controller I/O per segment

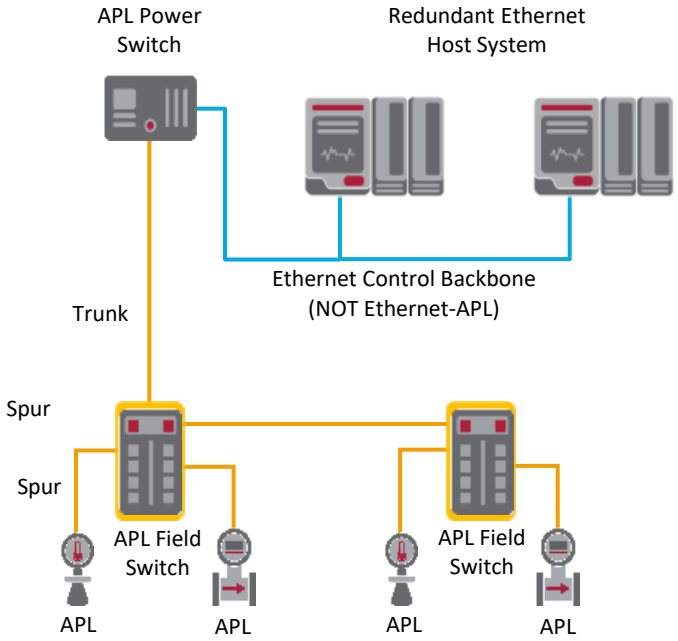
Ethernet-APL Network

Point-to-Point Connection

Infrastructure uses APL Switches
- Active, powered component
- Larger physical component in JB

Controller I/O on Ethernet Control Backbone

Ethernet-APL



Marshaling cabinet space evaluation needed

APL SWITCH WITH H1 SUPPORT

To the control network, all devices on switch will appear as devices that support the automation protocol mapped via the proxy.

New Ethernet APL Switch with H1 Support

H1 + Ethernet-APL

Switch

Proxy: Converts H1 to an automation protocol suitable for IP networking (e.g. Profinet, OPC UA FX, Proprietary)

APL Power Switch

Redundant Ethernet Host System

Ethernet Control Backbone (NOT Ethernet-APL)

Trunk

FF+APL Switch

FF+APL Switch

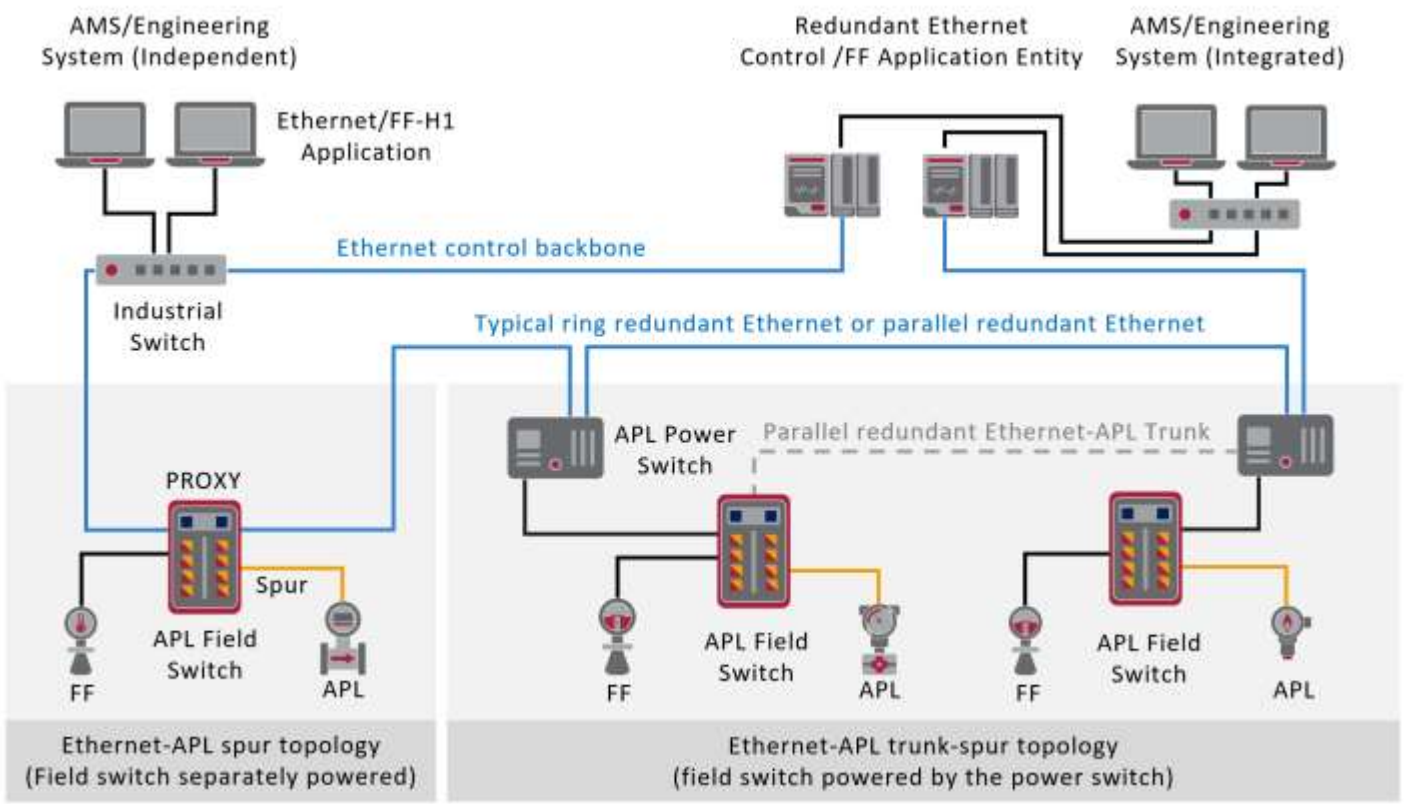
H1

H1

H1

APL

Ports can be configured for H1 or APL autodetect or via switch software



MIGRATION STRATEGY

- Discuss your needs with your host supplier
- Obtain compatible APL Field Switches to replace FF Device Couplers
- Use existing FF-H1 Field Devices on PROXY of APL Field Switch
- Swap to Ethernet-APL Field Devices as FF-H1 Devices need replacement

KEEP IN MIND…

Migration is possible by reusing most of the software assets and new communication service mappings are implemented.

Keep it Simple with principles from Standard Connection Points.

Host suppliers must implement the required software interfaces as a pre-requisite. Hosts and Ethernet-APL Field Switches must be compatible!

Changing an FF-H1 field device to an Ethernet-APL field device always necessitates software re-engineering.

Three Key Technologies

2

PA-DIM
Process Automation
Device Information Model

PA-DIM®

Needs

Solutions

IT Networks
- Analytics
- Big Data
- Central Management
- etc.

Public Clouds

Private Clouds

Business Systems

AMQP MQTT JSON

FDI makes devices more accessible

Simple, text-based device information

Plant Networks

HMI/Maintenance

Enterprise-wide common information model

FDI DEVICE PACKAGE

FDI Host

Easy device install, commission, and deployment

PA-DIM conversion for existing devices

Gateway

DeviceInfo

PA-DIM

Device-specific Information Model

Device-specific IM

PA-DIM

NOA-IM

Industry-wide Information Model

PA-DIM

PA-DIM

Reliable Cybersecurity

HART COMMUNICATION PROTOCOL

4-20mA

WirelessHART

HART on all physical layers

Power Switch

Field Switch

PA-DIM

HART-IP

OPC UA

Higher Speed Communications

Common security

ethernet-apl™
advanced physical layer

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Why PA-DIM®?

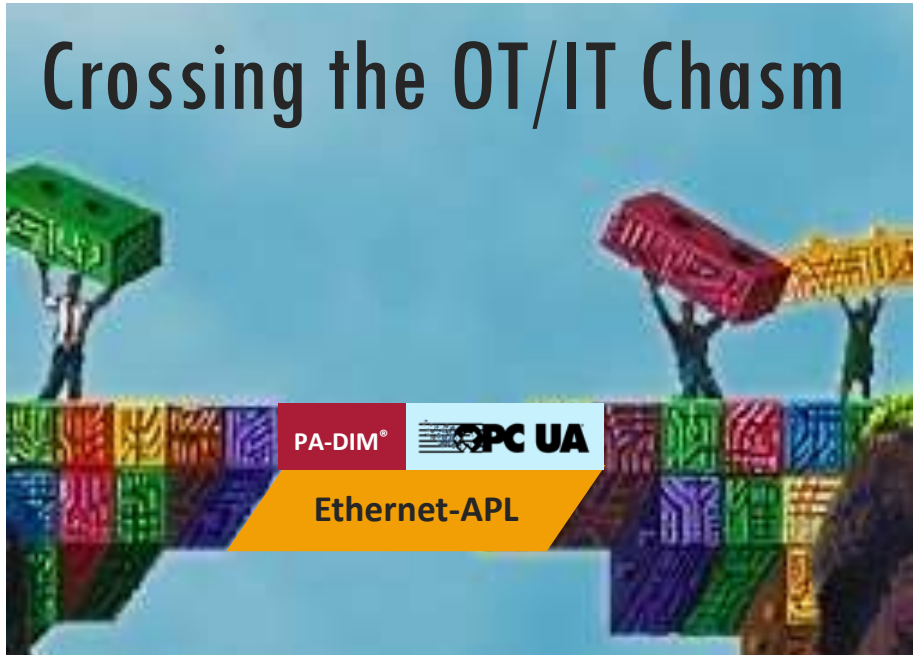
- PA-DIM is an IIoT integration technology
- It maps DD parameters to a protocol independent information model with semantic identifiers
- It enables consumption of field device information by dashboards and IT systems that support OPC-UA

User Needs

- **Data is lost in translation across systems:**
  - Electronically – Information does not move through the layers
  - Semantically – Information moves but meaning is uninterpretable

PA-DIM Delivers

- PA-DIM is an information model for describing device data regardless of protocol, type of device or manufacturer.
- Data is no longer lost!
- PA-DIM conversion for existing devices offered



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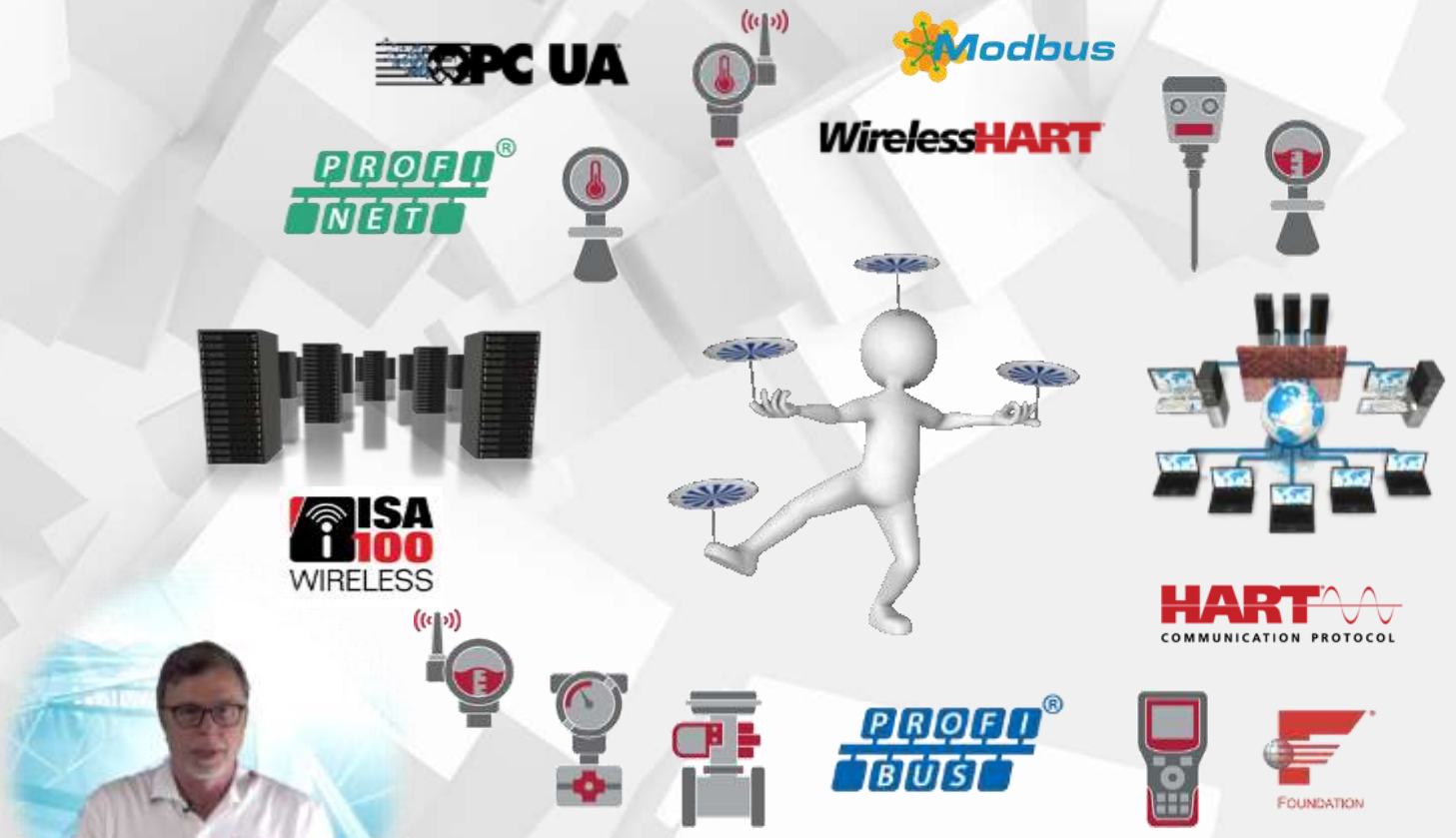
Challenge: Data is not quickly accessible or understandable

Data is distributed across many devices and facilities

Many systems, protocols, versions of tools, and people are in the data chain

Each Tool, Device, and Protocol has a unique access and presentation of data



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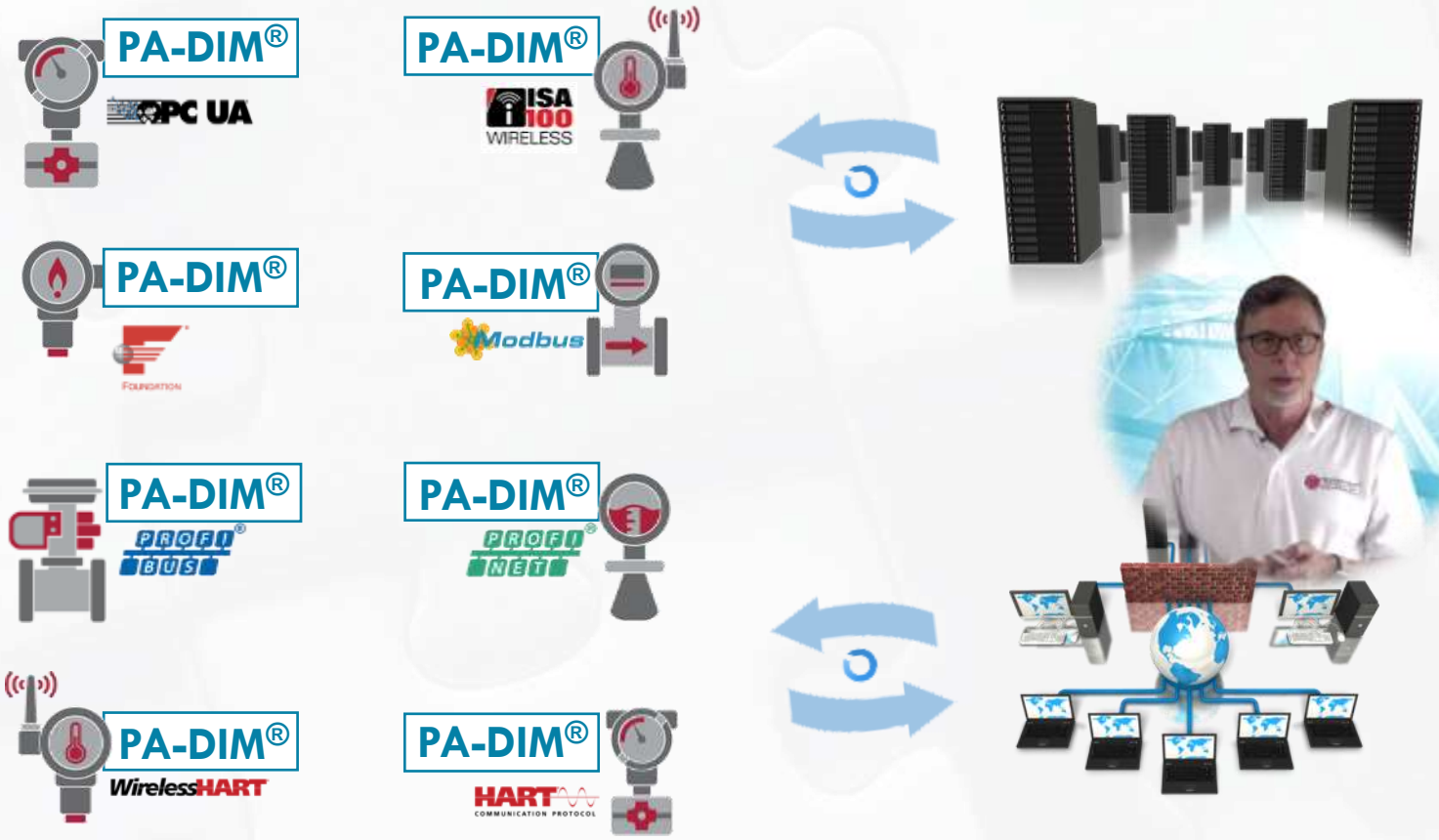
Solution: PA-DIM®

Protocol Independent Device Information Model for OPC UA Enabled Systems

- A single information model across all protocols, systems, and facilities
- Find data easily: from all devices and facilities
- Discover efficiencies offered by PA-DIM®



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SEMANTIC ID'S 1: WHAT ARE YOU? – CONTEXT REQUIRED!

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SEMANTIC ID'S 2:

WHAT ARE YOU?

WHAT ARE YOU MEASURING?

IRDI:	0112/2///61987#ABA767#001
Preferred name:	Differential pressure flow transmitter

What else could you measure?

0112/2///61987#ABB290
mass flow rate

9 kg/s

- 0112/2///61987#ABA927 temperature
- 0112/2///61987#ABN616 pressure

IRDI:	0112/2///61987#ABA763#003
Preferred name:	Coriolis mass flow transmitter

What else could you measure?

0112/2///61987#ABB290
mass flow rate

9 kg/s

- 0112/2///61987#ABA927 temperature
- 0112/2///61987#ABB291 actual volume flow rate
- 0112/2///61987#ABB292 normalized volume flow rate

PA-DIM AT ACHEMA 2024

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NOA USE CASE: AUTOMATED AS BUILT

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Dashboards - Unique Identification

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Three Key Technologies

3

FDI
Field Device Integration

Needs

Solutions

IT Networks
- Analytics
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- etc.

Public Clouds aws Azure Google Cloud

Private Clouds

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Higher Speed Communications

Common security

ethernet-apl™ advanced physical layer

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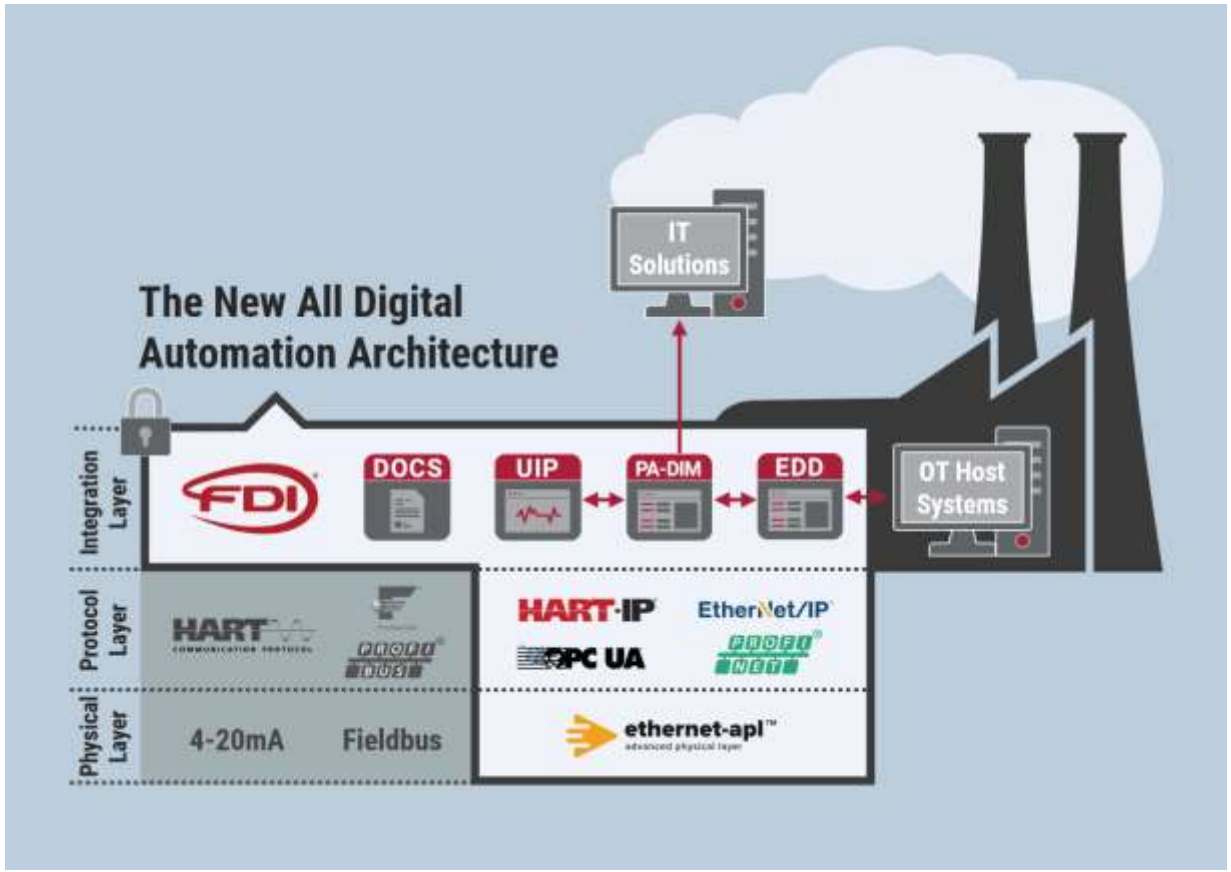
FDI Key Components



- FDI Device Packages
  - All files needed to configure, maintain, and operate device
    - EDD (DD)
    - Optional UIP → HTML5
    - PA-DIM mapping for IT solution
    - Certificate, manuals, user guides, etc.
    - Signed and secure
- FDI Host System
  - Supports features of FDI Device Packages
- State of the Market
  - Nearly 300 registered device packages
  - Most major host systems now support FDI in their latest releases.

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Why FDI?

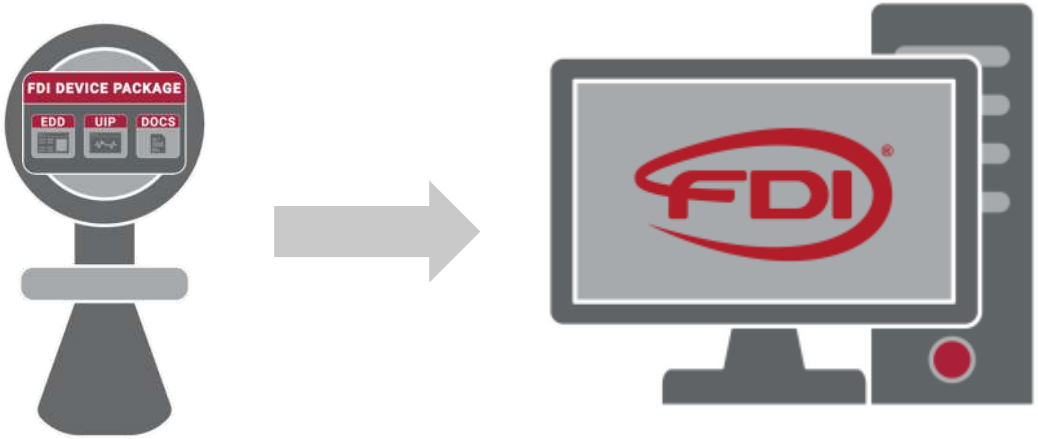
- FDI is a device integration technology
- An FDI enabled Host consumes FDI device packages
- An FDI device package is a bundle of files including an advanced DD (e.g. *.FMA)
- Nearly 300 registered FDI device packages are now available
- Most host systems now support FDI. Emerson AMS Device Manager v14.5 is the first registered FDI host

User Needs

- Enhanced file security
- Standardized bulk setup during start up
- Modern User Interface
- Device health notification
- OT/IT compatibility

Delivered with FDI

- Secure Device Package
- Offline Configuration
- Advanced OS Independent UI
- Advanced Device Health
- IIoT Readiness (PA-DIM)



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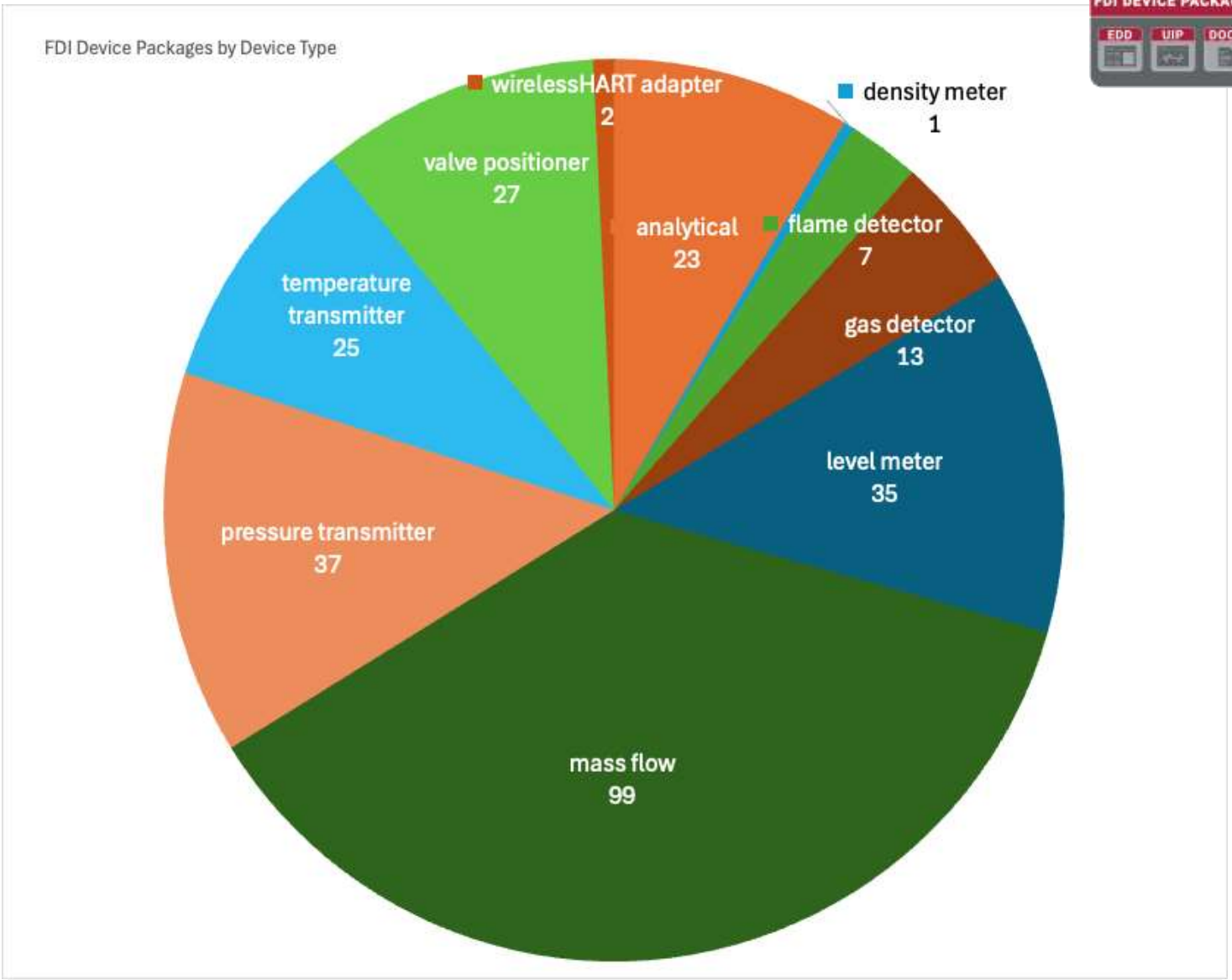
FDI Device Packages by Measurement Type



Registered products with FDI Device Packages

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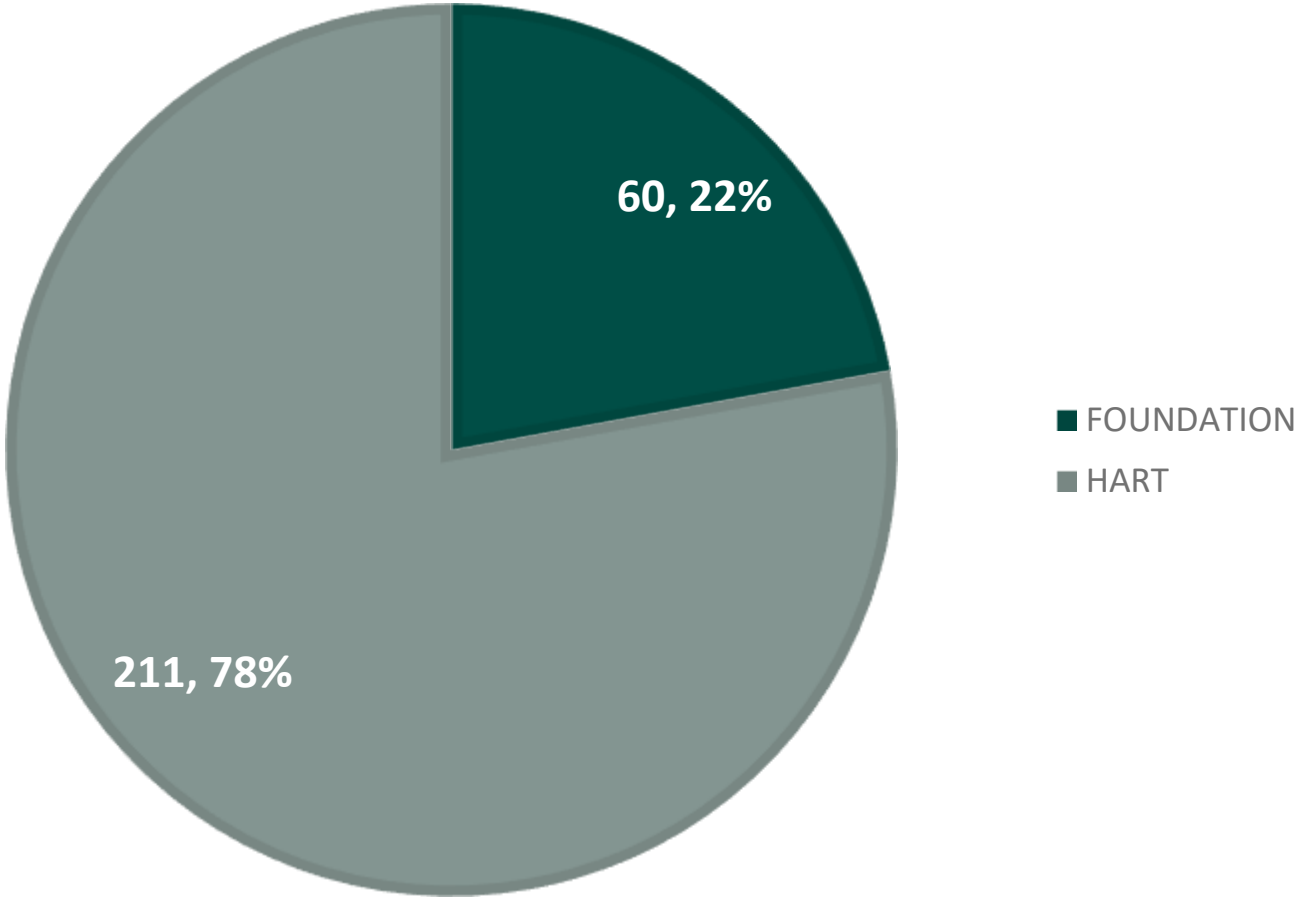
FDI Device Packages by Protocol

FDI DEVICE PACKAGES BY PROTOCOL



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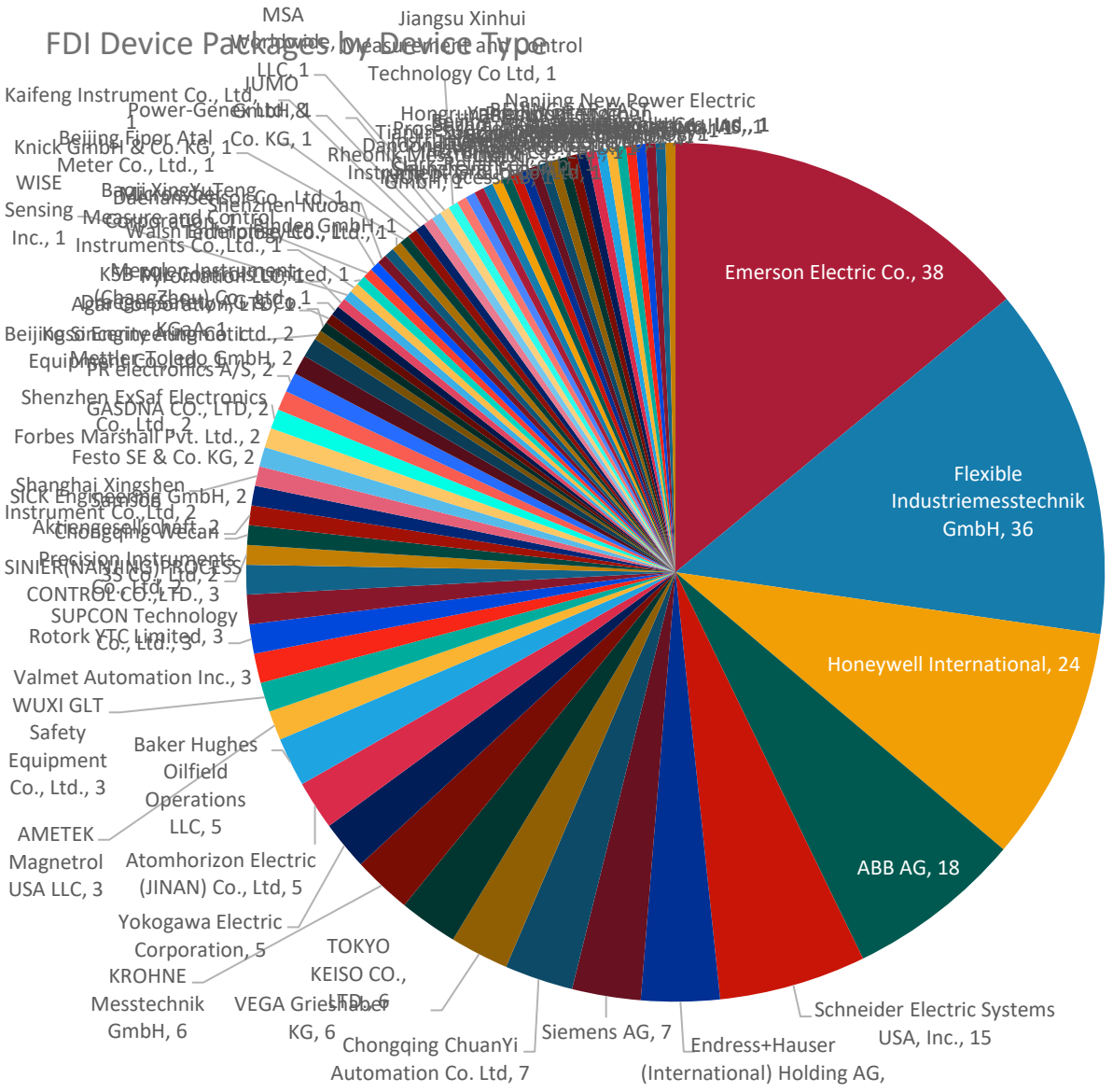
Registered FDI Device Packages by Supplier



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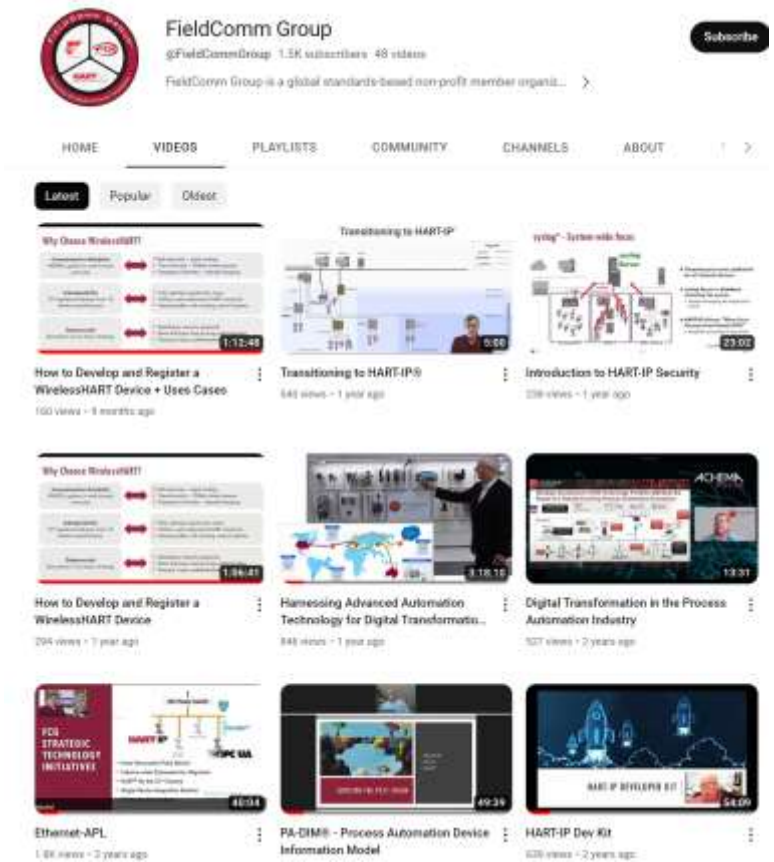
Learn FCG Technologies!

- [YouTube](#)
  Informative videos
  on all FCG technologies



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- [Regional User Seminars](#)
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  the globe

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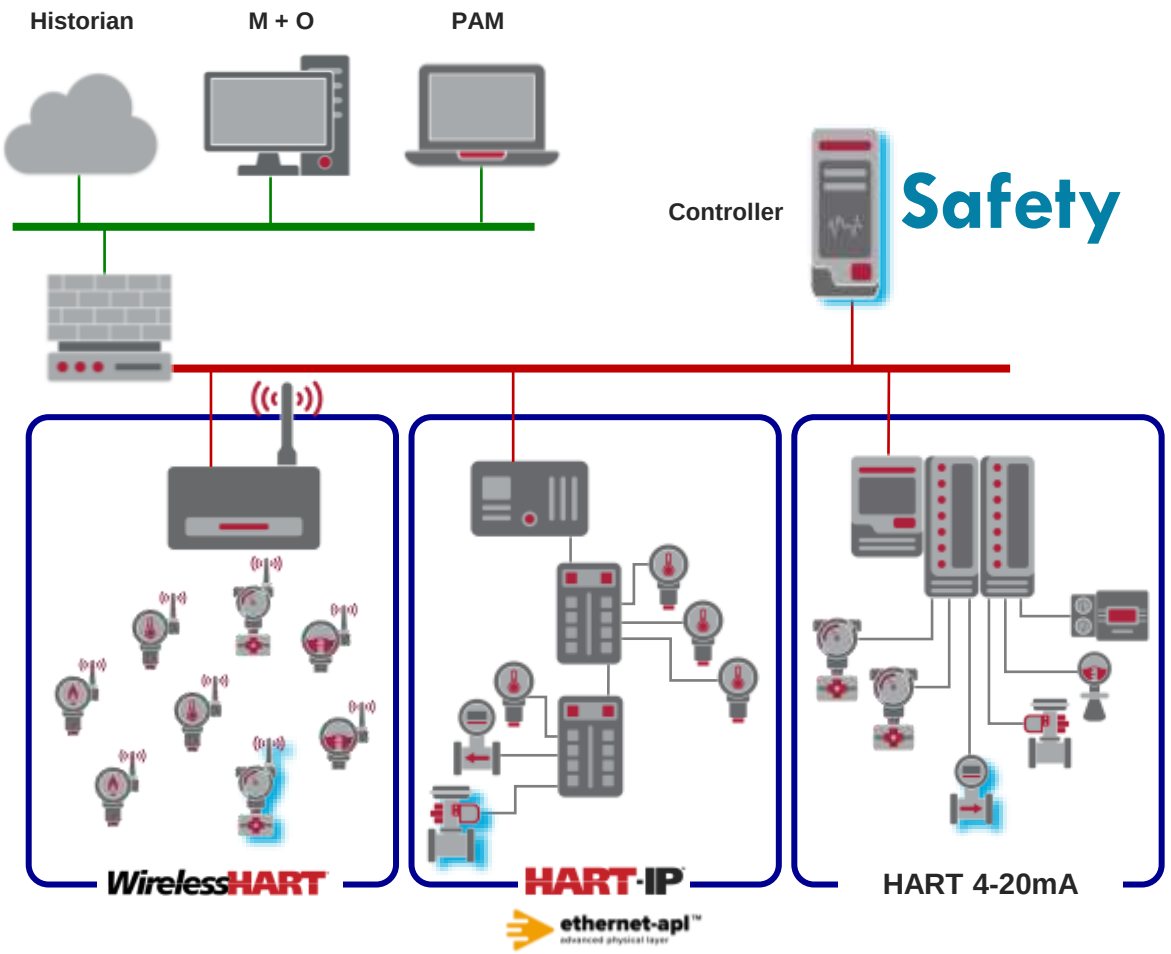
Questions

THANK YOU FOR ATTENDING!

GETTING MORE FROM HART

HART 7.9 Improvements

SafeHART™: Features and Benefits



* SafeHART™ devices indicated by blue shadow

Enables "Safe" 2-way HART® digital communications

- Safe = probability of undetected error very low (e.g., $< 10^{-9}$)

SafeHART™ features

- Compatible HART® 4-20mA; WirelessHART®; and HART-IP®
- Safe and normal communications coexist simultaneously
- No special modifications needed for HART® 4-20mA I/O or WirelessHART® Gateways

SIL-rated HART® 4-20mA can be upgraded to include SafeHART™

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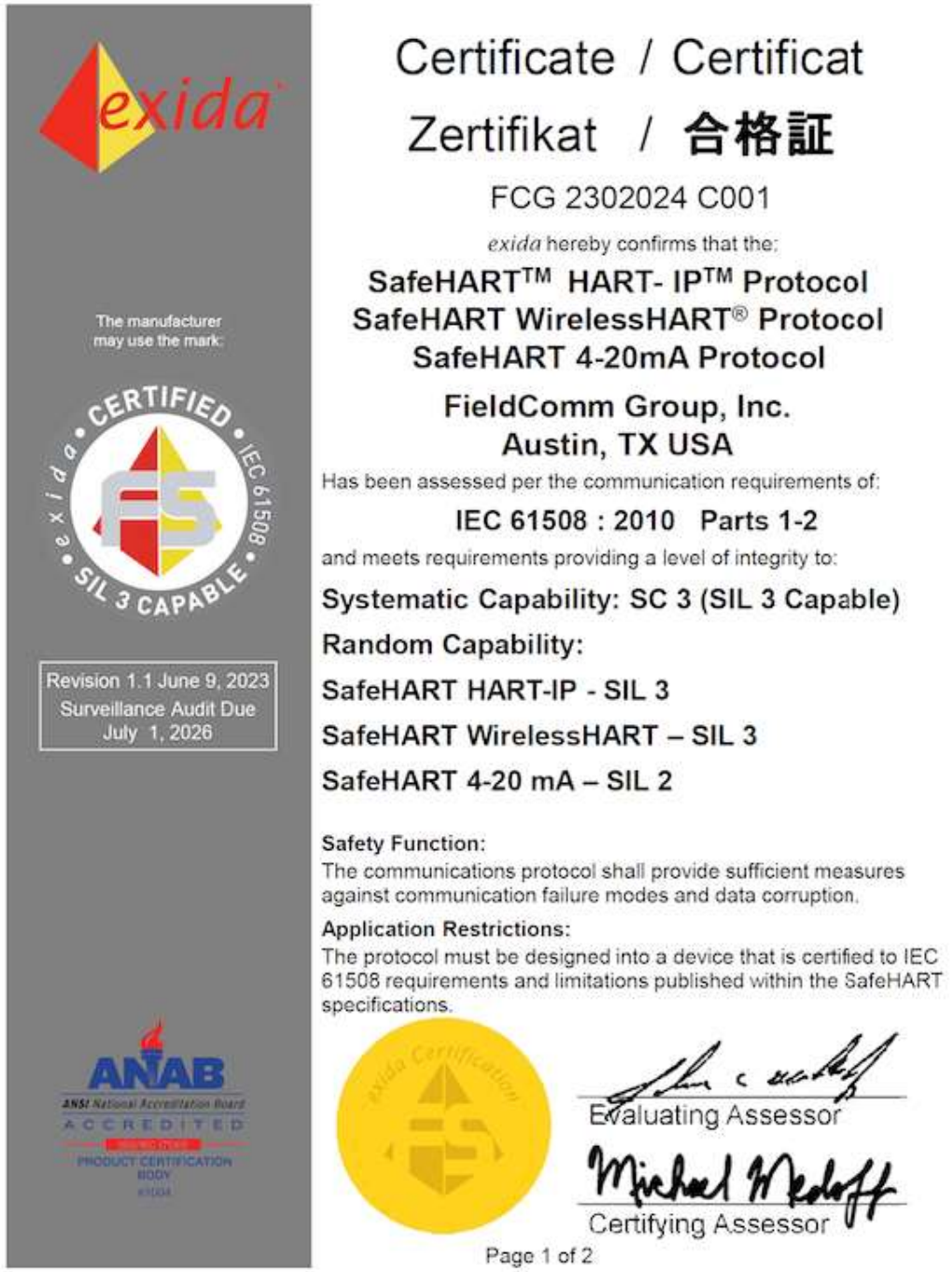
SafeHART – Exida Certified

exida SafeHART™ evaluation

- 2-step Certification process
  - Researcher performs numerical assessment
  - Peer review reviews confirm assessment, generates final report

- Conclusion
  - No changes required to SafeHART™ Protocol as written
  - HART-IP® and WirelessHART® exceed SIL 3 by 105
  - HART® 4-20mA comms meets SIL 2.

- Redundancy to achieve SIL 3 is best practice
  - SIL 2 field devices the majority
  - SIL 3 device require redundant
  - internal hardware (>$$$)



exida

The manufacturer may use the mark:

exida CERTIFIED IEC 61508 SIL 3 CAPABLE

Revision 1.1 June 9, 2023
Surveillance Audit Due
July 1, 2026

ANAB
ANSI National Accreditation Board
ACCREDITED
PRODUCT CERTIFICATION BODY

Certificate / Certificat
Zertifikat / 合格証

FCG 2302024 C001

exida hereby confirms that the:

SafeHART™ HART- IP™ Protocol
SafeHART WirelessHART® Protocol
SafeHART 4-20mA Protocol

FieldComm Group, Inc.
Austin, TX USA

Has been assessed per the communication requirements of:

IEC 61508 : 2010 Parts 1-2

and meets requirements providing a level of integrity to:

Systematic Capability: SC 3 (SIL 3 Capable)

Random Capability:

SafeHART HART-IP - SIL 3

SafeHART WirelessHART – SIL 3

SafeHART 4-20 mA – SIL 2

Safety Function:
The communications protocol shall provide sufficient measures against communication failure modes and data corruption.

Application Restrictions:
The protocol must be designed into a device that is certified to IEC 61508 requirements and limitations published within the SafeHART specifications.

Evaluating Assessor

Certifying Assessor

Page 1 of 2

Digital Write Protect: Features and Benefits

Enables remotely Write Protecting field devices

Benefits:

- Write Protecting without opening field device enclosure
- Simple: write-protected can be normal state
- Prevents well-intentioned field device changes via handhelds
- Digital Write Protect allows plant to set policy and procedure

Features:

- 2 virtual digital safety locks with {Combination + User}:
- Attaching a lock asserts Write Protect
  - Same as HW Write Protect jumper
- Remove lock to remove Write Protect
- 2nd lock could be for supervisor, etc.

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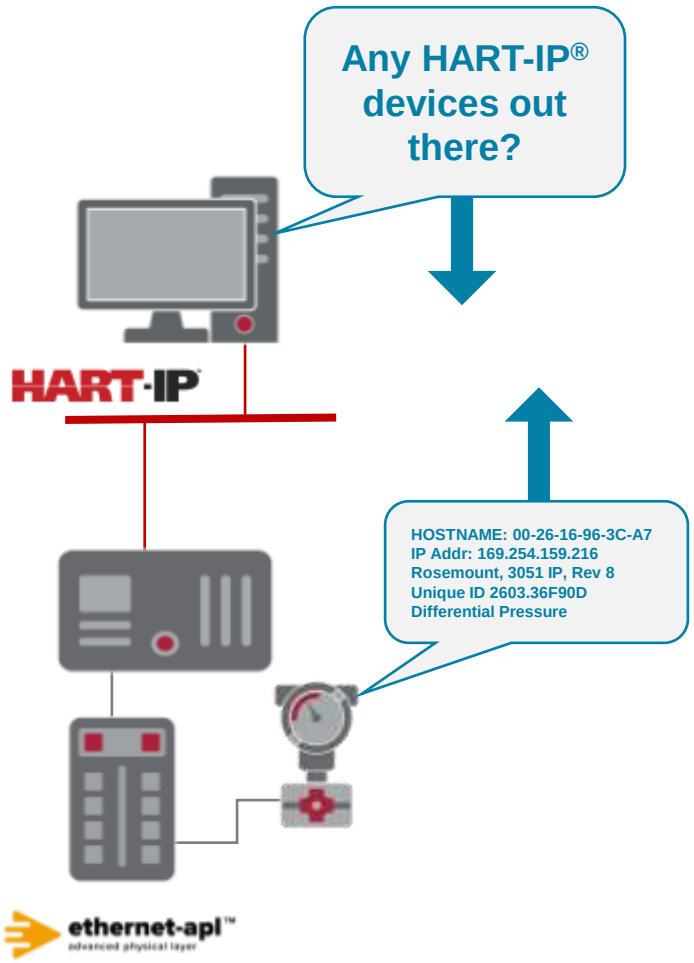
HART-IP® + ZeroConf: Features and Benefits



Zero Configuration Networking

- Enables deploying devices without advance provisioning
- Three internet standards used together to simplify deployment
- Identifying information added to enable auto-creation of annotated HART-IP® device list.

Benefits

- HART-IP® devices can be connected to network straight from the box
- IT infrastructure minimized. DHCP/DNS not required
- Enables self-assignment of unique IP addresses
- Hosts can automatically learn all the HART-IP® devices, their IP address, identity and type of instrument

Features

- IP stacks support ZeroConf standards
- Field device firmware must supply (mostly) static parameters to initialize ZeroConf
- Host does standard DNS query asking for HART-IP® "service" to create a directory

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What's in a Checkmark?
The Value of Registered Products

- FOUNDATION Fieldbus, HART, and FDI Product Registration symbols indicate products have undergone a series of common tests created by collaborative effort of industry experts and administered by FieldComm Group as an independent third-party.

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Registration Means Interoperability

- Testing and registration is key to interoperability
- It ensures specific devices and systems conform to the same standard
- It benefits users - product will provide a consistent level of functionality and interoperability regardless of the vendor or other devices used

FieldComm Group is one of the few automation industry organizations with a registration program requiring mandatory testing of critical elements of its technology.

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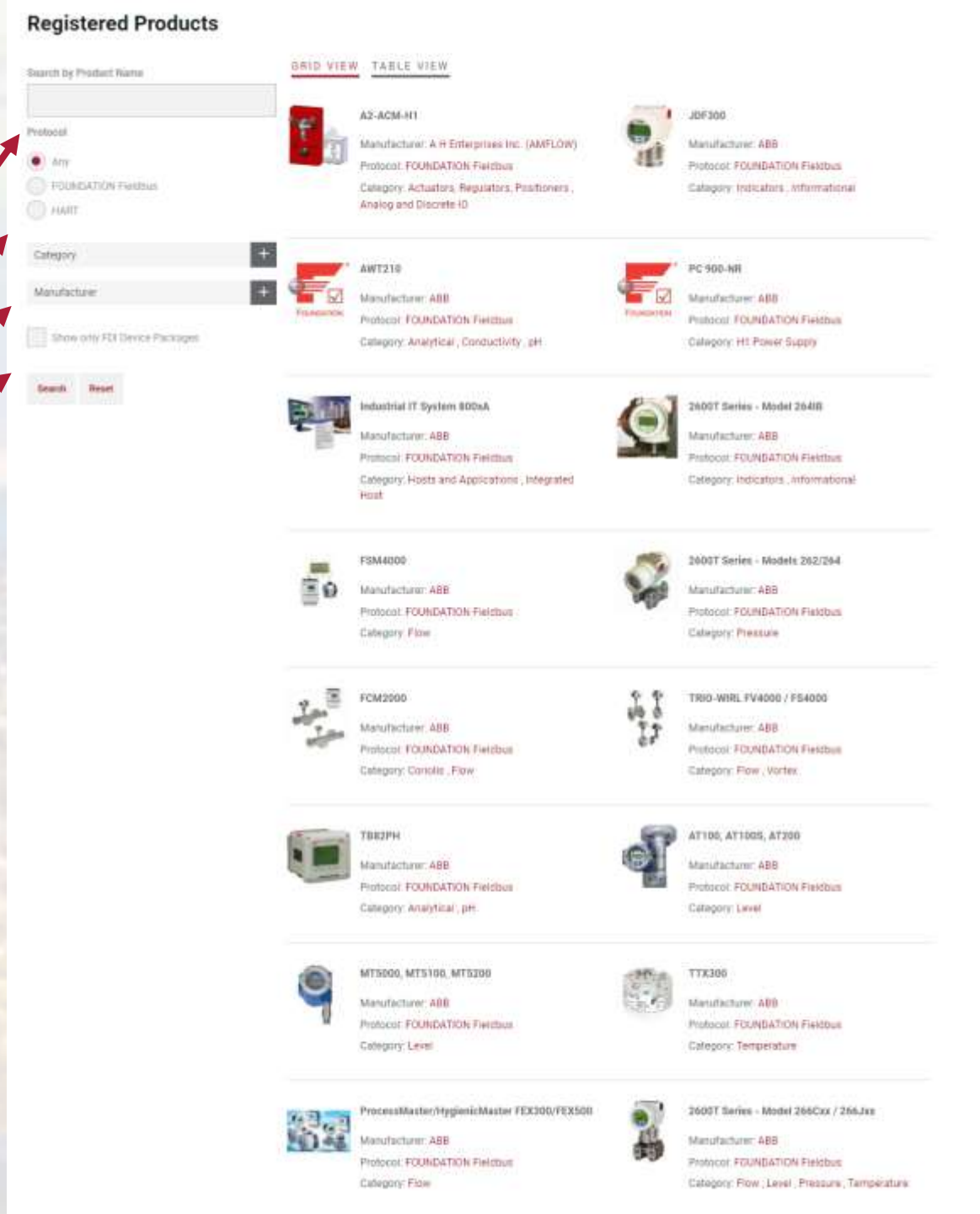
Registered Products: Lots of Choices!

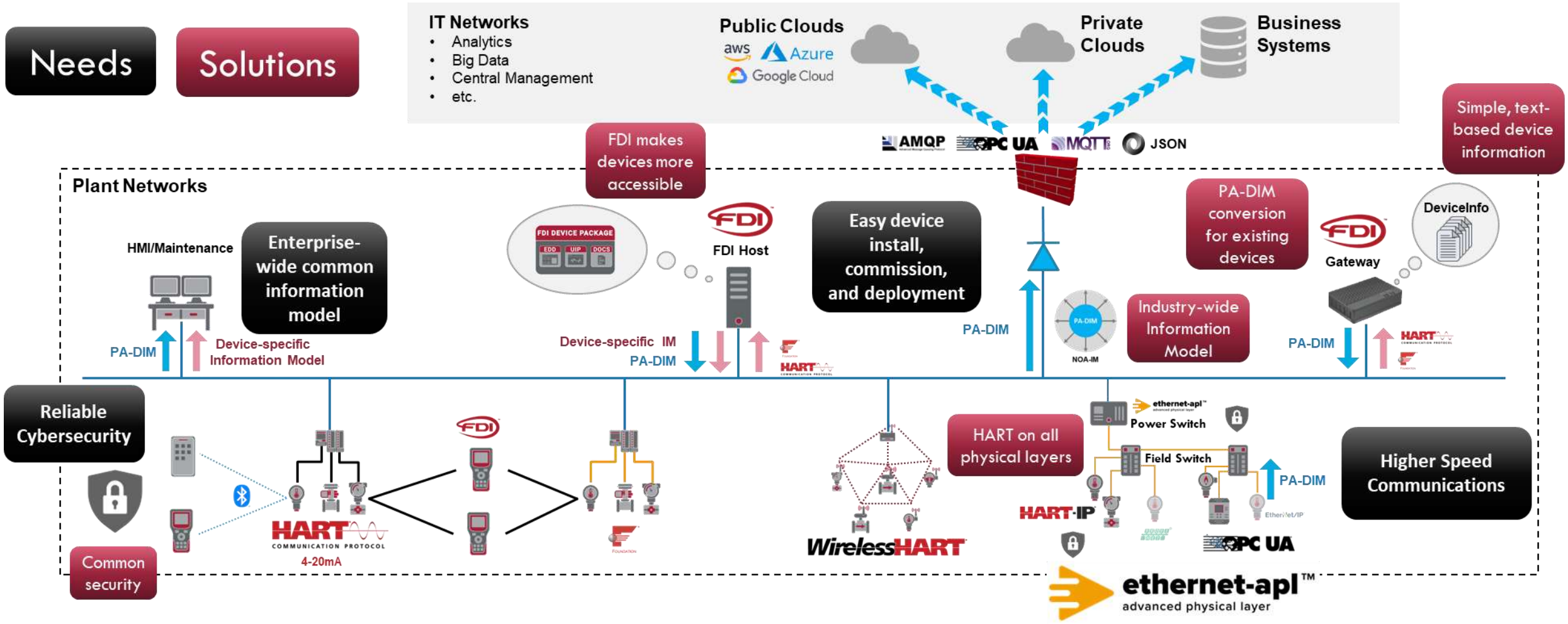
- Hundreds of developers, thousands of products
- Search by technology, category, manufacturer or specific product, FDI Device Package availability



FieldComm Group Product Registry

https://www.fieldcommgroup.org/registered-products

The Plant of Tomorrow



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