FieldComm Group Technology Update

FieldComm Group – the home of process automation communication technologies

Hisashi Sasajima
FieldComm Group: Connecting the World of Process Automation

- **FIELDCOMM GROUP TECHNOLOGY UPDATE**
  - FDI: Field Device Integration
  - APL: Advanced Physical Layer
  - Foundation Fieldbus Usability
  - Plant of the Year Award 2018

FieldComm Group is the home of the HART, FOUNDATION Fieldbus and FDI Technology standards

Hisashi Sasajima
Director of Marketing, Asia Pacific
NOA – NAMUR Open Architecture
NAMUR - Basic Facts

- NAMUR – International User Association of Automation Technology in Process Industries

- Members:
  - Companies operating process plants (e.g. BASF, Bayer, BP, Dow, Evonik, …)
  - Companies offering engineering services in process industries (e.g. Infraserv, …)
  - Organizations with a technical or scientific purpose (e.g. TH Ingolstadt, TU Dresden, Fraunhofer, TU Munich, …)

- Membership is not open for:
  - Suppliers and manufacturers of automation technology components and systems
  - Individuals
NAMUR Open Architecture

- Based on existing standards;
  - FDI and OPC UA technology
  - Field Networks
- Open for new approaches within IIoT and I4.0 concepts
- No risk on availability and safety for installed base
- Enables significant improvement of cost per sensor
NOA – NAMUR Open Architecture
Approaches to Delivering Field Data to the Cloud
(Example: Implementation of NOA using FDI and OPCUA)
FDI: Field Device Integration
FDI is the enabler for I4.0 and IIoT

FDI enables access to device information (OT level) for plant and enterprise wide monitoring and optimization (IT level), across various communication protocols.
Physical devices are virtualized in software as FDI Device Packages. Packages are imported into an FDI Server. Clients including systems, handhelds and cloud services get information from the server.
FDI: ONE DEVICE - ONE PACKAGE - ALL TOOLS

FDI SOLVES THE PROBLEM OF INTEGRATING FIELD DEVICES WITH THE MULTITUDE OF NETWORKS, OPERATING SYSTEMS AND CONTROL SYSTEMS

- One software package per device
- All files required to support device included
- Cloud library, FieldComm Group maintained
FDI saves costs for vendors and users

An objective of FDI is to dramatically simplify software installation, configuration, maintenance, and management of field instruments and host systems.
FDI saves costs for vendors and users

Before FDI

200+ downloadable files available for a common flowmeter

FDI

FDI brings standardization to the packaging and distribution of all the software and tools

ONE Device
ONE Package
ALL Tools

FDI

Only one FDI Device Package is needed for a successful integration with a host
FDI Device Packages – The Core of FDI

- The FDI Device Package is the core component of an FDI enabled system.
- An FDI Device Package is a single software package that contains all tools, device information and user interface plug-ins needed for the device.

FDI Packages use the Open Packaging Convention to bundle all parts into a single file *.fdix.

The EDD describes user interfaces, business logic and defines the syntax and semantics of available device information.

A UIP is a programmed user interface. This is an optional component that allows more flexibility than the mandatory UID.

Attachments can be device pictures, registration certificates, user guides, and protocol integration text files.
FDI Cyber Security Considerations

- FDI Device Packages a digitally signed
  - By the originator over the entire contents of the FDI package before making it available.
  - To ensure Integrity and Authenticity

- FDI host systems
  - Check the digital signature before allowing the FDI Package to be loaded
  - Provide a secure “Sandbox” to execute programmatic UIPs
    - Prevent access to any system resources outside this “sandbox” (e.g. the internet) and thereby limits adverse effects an errant or compromised UIP can have on the system
Human readable access to device information

UID
- EDDL based
- Parameterization, diagnosis

UIP
- .NET or HTML5 based
- Advanced UIs and graphics
OPC UA DI – Protocol Independent Access to Device Information

**IIoT Services**
Can be available on premise or in the cloud

**OPC UA Clients**
Have access to the parameter set of the Information Model. Read only access to device parameters and status information.

**FDI Clients (full featured)**
Have access to the entire Information Model, render UID and host UIPs. Can read from and write to device parameter nodes. Execute logic.

**FDI Host with Information Model Facet**
Has knowledge about the device data, functions and how to access this data through the imported FDI Device Package. Maps device data to the OPCUA Information Model.
OPC UA Device Information Model (DI) for machine readable information

The OPCUA Device Information Model provides machine readable information

FDI client provides human-readable information for device parameterization

The FDI Device Package represents a device type

OPC UA Information Model (DI)

Types

Instances

Catalog

Business Logic Processor

Business Logic

Communication Server

Import

OPCUA Client

Algorithms

Algorithms

FDI Client

UI Processor

UID

OPCUA Client

OPCUA Information Model (DI)
FDI Packages + OPCUA + Registration = Secure Stress-Free Integration into I4.0 world

- A Product being registered by FieldComm Group undergoes a rigorous testing process to ensure interoperability.
FDI allows the connection of field devices to the cloud

Services, Applications, Algorithms

FDI (IEC 62769)
» Device Information Model (OPCUA, IEC 62541-100)
» Virtual device objects

Communication
» OPCUA (IEC 62541)

Objects - “Things”
» Real devices

MES, CMMI, Engineering, ERP, …
Data Collection, storage, analysis
Device Integration Before FDI

One Device

- EDDL File (1) Usually per host
- EDDL File (2) Usually per host
- DTM File (1) May vary by OS rev
- DTM File (2) May vary by OS Rev
- App File (1)

Multiple Integration Files/Drivers

Host #1 (EDDL based)
Host #2 (EDDL based)
Host #3 (FDT Frame)
Host #4 (FDT Frame)
Host #5 (CustomApp)

FDI – Field Device Integration

FDI Device Package

- EDD
- Device
- Definition
- Business
- Logic
- User
- Interface
- Description
- UIP
- User Interface
- Plug-in,
- Device
- Applications
- (Optional)
- Attachments
- Manuals
- Certificates
- Protocol Specific
- Files
- (GSD/ML/etc.)

One Device

Host #1
(Native FDI host)

Host #2
(Native FDI host)

Host #3
(FDT Frame – FDI DTM)

Host #4
(FDT Frame – FDI DTM)

Host #5
(CustomApp – FDI UIP)
FDI – Field Device Integration

- Blending the best of what you already use

The Device Package: The Heart of FDI

FDI Host

FDT/FDI Host

FDT2 Frame

FDI Device Package

Host #1 (Native FDI)
Host #2 (Native FDI)
Host #3 (FDT Frame – FDI DTM)
Host #4 (FDT Frame – FDI DTM)
Host #5 (Custom App – FDI UIP)

EDD Device Definition
EDD Logic User Interface
UIP User Interface Plug-in, Device Applications (Optional)
Attachments Manuals, Certificates, Protocol Specific Files (GSD/ML/etc.)

Authentication Integrity

The best of EDDL
The best of FDT

One Device One Device Package

Manila, Philippines 11 April 2018
FDI supports new protocols

FDI TODAY

Future Protocols….
New Protocols

- Additional protocol drivers will be integrated via OPCUA
- No impact on FDT Tools and Components.
What’s Next for FDI?

Provide machine readable information for any client

FCG and OPC Foundation have set up a joint working group to:

- Fulfill i4.0 requirements
- Implement NOA requirements
- Enhance FDI and OPCUA specifications to add semantic information (e.g. units)
- Specify protocol independent Process Automation device information model to improve interoperability

FDI Device Package to FDT
Advanced Physical Layer
Emerging Technologies

- There are at least two emerging IEEE and IEC standards that will have application in the IIoT / Industrie 4.0 environment
  - Advanced Physical Layer
  - Time Sensitive Networks (TSN): IEEE802.1 TSN Task Group
Advanced Physical Layer

- **IEEE 802.3cg 10SPE**
  - Standardizing a Physical Layer for Ethernet that is full duplex, two-wire, 1 KM in length, having simultaneous power and signal on the same wire-pair
  - Low enough in power to meet the requirements of Intrinsic Safety for field devices

- Collaboration among PNO, ODVA, and FieldComm Group to create a companion standard to the IEEE 802.3 cg 10SPE and specify the details of an Intrinsically Safe solution in the IEC

- The FieldComm Group plans to develop a field level communication protocol using these standards when available
Advanced Physical Layer

Main Requirements

● Trunk
  o Full Duplex
  o Trunk cable length 1000 m, 10Mbit/s full duplex
  o Power feed capability for switches and 50 field devices
  o Installation in hazardous areas Zone1 / Class1 Div1

● Spur
  o Full Duplex
  o Spur cable length 200 m
  o Support of intrinsically safe wiring concept (like FISCO), classic IS
  o Low power spur, power for field device ~500mW
  o Installation in hazardous areas Zone 0 / Class1/Div1
Advanced Physical Layer

Ethernet in the Field – Basic Topology

- Switch
  - Ethernet
  - Power Supply
- Zone 2 / Div 2
  - “Trunk” ex-e
    - 2 – Wire with Power 1000m
- Zone 1 / Div 1
  - Spur: Ex-i
    - 2 – Wire with Power 200m
- Zone 0 / Div 1
- Field Switch
- Field Device
- Field Switch
- Field Device
- Field Device
- Field Device
TSN Objectives in Industrial Networks

- TSN allows maintaining determinism with the confidence of being able to satisfy the requirements of less demanding traffic sharing the medium. The meaning of convergence in TSN is the successful convergence of critical control, non-critical control, and data streams on a single network.
TSN Objectives

• Convergence of multiple applications, which share a common network and each get the required Quality of Service (QoS).

• Standardized interface for end stations to gain guaranteed Quality of Service (QoS) for:
  o Real-time communication,
  o Bounded low latency,
  o High availability.
Enterprise-Control System Architecture Model to Service oriented Architecture Model
PLANT OF THE YEAR AWARD

- Recognizes innovative use of FOUNDATION™ Fieldbus, HART or WirelessHART Communication in real-time industrial process plant applications
- Is the only public award presented to end user companies to recognize ingenuity in the application of our technologies
- Recipients of the award set a positive example for the industry worldwide for their use of the valuable information in their smart devices
Why the Award is Given

- To recognize the people, companies and plants using the advanced capabilities of HART, WirelessHART or FOUNDATION Fieldbus technologies in real-time applications

- To use their success stories to educate others on how the use of smart device technology can improve operations, lower costs and increase plant reliability.
Where in the World Are the Plants of the Year Located?

On Five Continents!

Asia
- Kashima, Japan

Europe
- Hammerfest, Norway
- Gersthofen, Germany
- Százhalombatta, Hungary

Africa
- Sasolburg, South Africa

North America
- Alberta, Canada
- Detroit, Michigan
- Deer Park, Texas
- DeLisle, Mississippi

South America
- Barcelona, Venezuela
- Wando, South Carolina
## Previous Recipients 2002 - 2017

<table>
<thead>
<tr>
<th>Company</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>DuPont De Lisle</td>
<td>USA</td>
</tr>
<tr>
<td>Detroit Water &amp; Sewerage Dept.</td>
<td>USA</td>
</tr>
<tr>
<td>BP Cooper River</td>
<td>USA</td>
</tr>
<tr>
<td>Clariant Antioxidants</td>
<td>Germany</td>
</tr>
<tr>
<td>Sasol Solvents</td>
<td>South Africa</td>
</tr>
<tr>
<td>BP Canada Energy</td>
<td>Alberta, Canada</td>
</tr>
<tr>
<td>Statoil Ormen Lange</td>
<td>Norway</td>
</tr>
<tr>
<td>PDVSA</td>
<td>Venezuela</td>
</tr>
<tr>
<td>Mitsubishi Chemical</td>
<td>Japan</td>
</tr>
<tr>
<td>MOL Danube Refinery</td>
<td>Hungary</td>
</tr>
<tr>
<td>Shell Scotford Upgrader</td>
<td>Canada</td>
</tr>
<tr>
<td>Monsanto Muscatine</td>
<td>USA</td>
</tr>
<tr>
<td>Dow Chemical</td>
<td>USA</td>
</tr>
<tr>
<td>Nucor Steel</td>
<td>USA</td>
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CONGRATULATIONS!

FieldComm Group
2017 Plant of the Year

Shell Prelude FLNG
Floating Liquefied Natural Gas

Manila, Philippines 11 April 2018
Why Shell Prelude Was Selected

- Integrated 8,000+ FOUNDATION Fieldbus devices and 4,500+ HART devices connected to their DCS, PLCs, Safety Systems and Fire & Gas systems 24/7 to bring about significant reliability and performance improvements to plant operations
- Integrated valve diagnostics from 2,500 valve positioners
- Use of advanced diagnostics and device alerts enable predictive and targeted maintenance

“FieldComm technologies are used extensively in every phase of the Shell Prelude FLNG project, and form the backbone of the intelligent predictive maintenance system…enabling unprecedented levels of remote support and deep-level diagnostics."  
– Kyle Dickson, Control & Automation Engineer Shell Prelude
Why Shell Prelude Was Selected

- First large scale deployment of Device Templates
  - Ensured uniformity in configuration and reduced review of configuration parameters by a factor of 20
  - Staff was able to perform 500+ loop checks per week
  - Concept is currently being standardized in the technology to bring these benefits to all users
Benefits are Attributed to Digital Transformation

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Savings (time)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Device commissioning and loop checking</td>
<td>80% (due to device templates)</td>
</tr>
<tr>
<td>2. Valve positioner loop check procedure</td>
<td>&gt; 80% (due to digital)</td>
</tr>
<tr>
<td>3. FAT testing all device types</td>
<td>&lt; 3 days compared to &gt; 2 days to test just 3 device types</td>
</tr>
<tr>
<td>4. Error identification and correction</td>
<td>Digital allows for quick determination between process problem vs instrument problem</td>
</tr>
</tbody>
</table>

The thousands of people that made it possible now need to reduce to about a hundred + the IIoT once in operation.
More Than Just a Solid Hull

- Solid configuration and commissioning procedures are a big first step

But what about once it’s started?
The Basic Strategy  – Fix Before IT Fails!

“Proactive maintenance on Prelude is an integrated process embedded in the facility from day 1 rather than an added procedure on an already operating facility.”

- Rong Gul, Senior Automation Engineer for Prelude

“Being in a particularly remote, isolated location, Prelude depends on having a fully realized, remote-monitoring group of engineers, conducting surveillance and advising on device issues.”

- Kyle Dickson, Control & Automation Engineer Shell Prelude
- >200 km (125 miles) is the distance from the Prelude field to the nearest land mass
- 4 soccer fields, laid end to end, would be shorter than the facility’s deck – 488m x 71m (1,600 feet x 233 feet)
- 175 Olympic-sized swimming pools could hold the same amount of liquid as the facility’s storage tanks
- 6,700 horsepower thrusters will be used to position the facility
- 93 meters (305 feet) is the height of the turret that runs through the facility
- 14 production facilities and rising 8 stories above the deck
- 20-25 years is the time the Prelude FLNG facility will stay at the location to develop gas field
- 50 million liters of fresh water drawn in from the ocean per hour to cool the natural gas
If pictures are worth 1,000 words…

Taking Shape | Shell Prelude: https://www.youtube.com/watch?v=pqREfZNFGDc

Around the world | Shell's Prelude: https://www.youtube.com/watch?v=b7LH-A2rkOY

Journey to Australia | Shell's Prelude: https://www.youtube.com/watch?v=tFCY1MyDIDw

Mooring the largest floating facility ever built | Shell's Prelude: https://www.youtube.com/watch?v=FDIldnIRVU4
Floating Forward

Shell’s results are amazing and should inspire others

- Use of advanced diagnostics and rationalized device alerts enable predictive and targeted maintenance
- Commit to create a culture and work processes that achieve lasting change by digitally integrating and utilizing smart device information
A Word About the IIoT

- What is the IIoT? IoT?

Scheduled for full operation in 2018, IIoT will improve safety and reliability and enable real-time remote process and diagnostic data.
Thank You for Attending!

- Enjoy the rest of the conference.
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Attention: FieldComm Group President
FieldComm Group
9430 Research Blvd., Ste. 1-120
Austin, TX 78759, USA
Voice: (512) 792-2300
Fax: (512) 792-2310
http://www.fieldcommgroup.org

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