Fieldbus Foundation

“Changing the Playing Field

Richard J. Timoney
President & CEO
Fieldbus Foundation

New Dehli, India
29 November 2007
End users are seeking a single, open architecture for information integration
  - Remove constraints of closed, proprietary systems
  - Free their plant's profit potential
  - Provide the highest level of process integrity

End users want a truly scalable control solution
  - Integrate installed assets
  - Co-exist with legacy systems
  - Protect valuable investments

Leading Edge technology
  - Built on standards to provide easy expandability
An Automation Infrastructure

More than just a digital replacement for 4-20mA technology.

Supplier neutral and standards-based. Provides end users with a common framework to implement and manage strategies for operational excellence.

FOUNDATION technology is a unified infrastructure.

- Manages data, communication, plant assets, and plant events.
- Provides highly distributed control functionality and interoperability between devices and subsystems.

The scope of FOUNDATION technology really makes it a process automation infrastructure... one of the most advanced and scalable available.
Attributes Of A Managed Infrastructure

- Extensive Block Model
- Common Data
- Common Time
- Determinism
- Publish and Subscribe
- High availability
- Standards Based Control Network
- Network Management.

FOUNDATION technology incorporates the key aspects of a Collaborative Process Automation System.
Process Integrity

✓ Extensive Function Block Structure.

• Enables control in the field for single loop integrity and higher process availability.

✓ Network management and Link Active. Scheduler.

• Ensures the network will remain up and running.

• Redundancy is available down to the I/O layer.

✓ Safety instrumented system (SIS).

• New Blocks.

• Will revolutionize the way that end users approach safety and critical control systems.

According to NIST (U.S. National Institute of Standards and Technology), the inability of control systems and operating personnel to control critical conditions costs the U.S. economy at least $20 billion a year.
FOUNDATION™ for Safety Instrumented Functions
End User Demonstration Project
Mission: Catalyze Development of Critical Mass of SIF Products

- Development of Best Practices and Guidelines
- Quantify Reduction in Total Cost of Ownership
  - CAPEX - Less Hardware, Less Power, Smaller Footprint, Faster Commissioning
  - OPEX - Advanced Diagnostics, Increased Test Interval, Improved Asset Management
End User Demonstration Project Participants

End User Demonstration Sites
BP – Gelsenkirchen, Germany – Honeywell Logic Solver
Chevron – Houston, TX – Emerson Logic Solver
Saudi Aramco – Dhahran – Triconex Logic Solver, Yokogawa Logic Solver
Shell Global Solutions – Amsterdam – HIMA Logic Solver

Emerson
HIMA
Honeywell
Invensys - Triconex
Yokogawa

Logic Solver
Engineering Workstation
Asset Management
Basic Process Control System

Logic Solver

Level
Pres
Temp

Magnetrol
Siemens Milltronics
ABB
E+H
Smar
Yokogawa

Valve

BIFFI
Dresser-Masoneilan
Emerson
Metso
TopWorx
Westlock/Tyco
Yamatake

Moore
MTL
P+F

ABB
E+H
Smar
Yokogawa

Other Providers
Fieldbus Diagnostics
Risknowlogy
RuggedCom
Softing
TÜV Rheinland
TÜV SÜD

© 2007 Fieldbus Foundation
Business Intelligence

- Support of business processes, production management, asset management and enterprise level applications.
- Provides enhanced capabilities for tracking, tracing, validation, and regulatory compliance both for continuous and batch/hybrid process industries.

FOUNDATION technology provides a high degree of business intelligence at the infrastructural level through publish/subscribe technology.
Standard Diagnostics based on NE107

Step 1: Communications

Step 2: Electronics

Step 3: Actuators, Elements, Valves, Connections

Step 4: Process and Equipment

Asset Management

Device Management

FF Device Status

Control System

New Delhi, India
29 November 2007
NE107: “Self-Monitoring and Diagnosis of Field Devices”

- Diagnosis results must be reliable
- The diagnosis results must always be viewed in the context of the application.
- Internal diagnosis categorized into 4 standard status signals
- Configuration should be free, as reactions to a fault in the device may be very different depending on the user's requirements
- The plant operator to see only these status signals
- Detailed information can be read out by the device specialist
Standard Diagnostic Scope

Standard Diagnostic Alarm scope is Resource/Transducer Alarms.

Process Alarms are managed by existing Function Blocks alarms.

<table>
<thead>
<tr>
<th>Alarm Type</th>
<th>Relation</th>
<th>Failure Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process Alarm</td>
<td>Process / Environment</td>
<td>Process failures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Faults in the process</td>
</tr>
<tr>
<td>Device Alarm</td>
<td>Instrument</td>
<td>Sensor/Actuator element failures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Faults in the sensor or actuator element</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electronic failures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Faults in the electronics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Configuration/servicing failures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Installation faults, fault during start-up</td>
</tr>
<tr>
<td></td>
<td>Process / Environment</td>
<td>Process induced failures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Faults due to process influence</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Faults due to non-compliance with specified operating conditions</td>
</tr>
</tbody>
</table>
Example Workflow: Diagnostic Condition

Operator’s Console

Maintenance Console

Standard EDD Diagnostic Menu for device specific information

<table>
<thead>
<tr>
<th>MAINT_ALM</th>
<th>Active</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAINT_ACTIVE</td>
<td>Clogged Pressure Sensor</td>
</tr>
<tr>
<td>RECOMMENDED_ACTION</td>
<td>Clean Sensor</td>
</tr>
</tbody>
</table>

New Dehli, India
29 November 2007
Open Scalable Integration

- High Speed Ethernet (HSE) - The key to scalability.
  - Provides a mechanism to connect multiple H1 segments without gateways.
  - All of the functions that are available on H1 are also available on HSE.
- FOUNDATION systems can be expanded without the need to shut down the process.
- Devices can be added or swapped “hot”, and the technology supports online firmware downloads and upgrades.

FOUNDATION technology offers unlimited scalability, and can be implemented in the smallest to the largest process automation systems.

The openness of FOUNDATION technology and its non-reliance on a particular operating system or supplier platform make it easy to adopt new standards.
EDDL Cooperation Team
EDDL Cooperation Phase 1

Phase 1 - Completed

- Graphing – Use EDDL for graphical display of static Y-t and XY data
- Charting – Use EDDL for graphical display of real-time data from device
- Enhanced User Interface – Use EDDL to describe screen layout
- Enhanced Data Storage – Use EDD to securely store data on the host

Phase 1 Technical Specification is IEC 61804-3
Phase 1 Interoperability Guideline is IEC 61804-4
OPC UA Client Applications - Step 1

- Simple and complex device integration requires only EDDs
- Advanced requirements may need Optional OPC Device Application
March 6, 2007: FDT Group and ECT agree to work on unified solution for device integration

FDT Group will join ECT as a voting member

Front Row: Hans Georg Kumpfmuller (Siemens), Ron Helson (HCF), Flavio Tolfo (FDT Group), Martin Zielinski (Emerson), Dieter Schaudel (E+H)

Back Row: Edgar Kuester (PNO), Klaus Peter Lindner (E+H), Richard Timoney (FF), Thomas Burke (OPC), Achim Laubenstein (ABB)

Not Shown: Hartmut Wuttig (ABB), Helmut Walraffs (Invensys)
itm Field Device Integration Concept

ECT Phase 2 Client Applications Step 2 → Field Device Integration

Step 2 – User Interface
- Optional OPC Client Device Application
- OPC UA Interface
- OPC UA
- Complex Devices
  - EDD
  - EDD

Graphical User Interface
- DOM

Advanced User Function
- Basic Device Methods
- Data & State Model
- DIM

New Delhi, India
29 November 2007

© 2007 Fieldbus Foundation
Why Join Together?

Combine the benefits of both technologies into one common standard

+ Platform independence
+ Robustness
+ Ease of use
+ Uniform look and feel

+ Flexibility
+ Unlimited Functionality
+ Unique Features
+ Nested Communication

+ One Solution means also only once the effort
Continuous Improvement
FOUNDATION™ Registered Host Program

Evolution of the Host Interoperability Support Test (HIST)
Weakness with the current HIST model

No fundamental requirements
- Host can choose which features to support
- Lack of specific features has led to interoperability issues
- Inconsistent implementations

Not all features appropriate to all hosts
- Some feature would cause interoperability issues
- Users ask – which do I need?

Only a feature test – no functional testing
- Features were “demonstrated” not “tested”
Host Profiles

Class 61 – Integrated Host

Class 62 – Visitor Host

Class 63/64 – Bench Host

Operations

Engineering

Maintenance

Note: Illustrations are examples only. Supplier defines host!

New Delhi, India
29 November 2007
Host Profile Registration Process

Modeled after the Device Registration Process
- Process requirements
- Top level process – how to get “Registered”
- Revision (re-test) rules

Suppliers granted use of registration mark
- Product advertising (website, collateral, etc.)
- Linked with the registered product page

End Users want it!
- Ranked high in the EUAC “Top Ten”
- Better compliance testing
- Cleaner registration model – easy to understand
HSE Remote I/O
(HSE-RIO)
✔ Develop use cases and requirements for HSE RIO including discrete I/O and gateways to other lower level networks (e.g. HART, Profibus, Modbus, ASI, DeviceNet, etc.) that are interoperable using function blocks and EDDL.

■ Develop an project plan for HSE RIO which includes:
  ➢ Solutions to the use cases and requirements using FOUNDATION™ technology.
  ➢ Requirements for device interoperability and network configuration.
  ➢ Development cost and schedule for validation of HSE RIO technical specifications
  ➢ Device interoperability test and registration procedures

■ Demonstrate interoperability of HSE RIO devices at end user sites.
**FOUNDATION™ for HSE RIO Schedule**

**2007**
- ✓ Full Team Use Cases Meeting hosted by P+F – Mannheim, Germany  
  May
- ✓ EUAC Review of Use Cases  
  May
  
  **Main EUAC Comment:** Major Host Suppliers must support HSE
- ✓ Full Team Teleconference, Use Cases Completed  
  Jun
- ✓ Call for Interest in Participation – Specifications, Prototypes, Demo  
  Aug
- ✓ Review Preliminary Specification Development Plan with TSC  
  Oct
- ✓ Spec Development Kickoff Meeting hosted by Emerson – Pittsburg  
  Oct
- ■ TSC Approval of Project Management Plan  
  Dec

**2008**
- ■ Full Team Meeting in – Review Draft Preliminary Specifications  
  Feb
- ■ Draft Preliminary Specification  
  Jun
- ■ Preliminary Specification  
  Dec

**2009**
- ■ End User Demonstration – City of Calgary  
  Jun
- ■ Final Specification  
  Dec

New Delhi, India  
29 November 2007
FOUNDATION™ for Wireless Specification Development Project (WSD)
Develop use cases and requirements for device wireless communication in monitoring, control and safety applications that is interoperable using function blocks and EDDL. Use cases and requirements for host wireless applications such as hand held configuration and maintenance devices may also be developed.

Develop an implementation plan which includes:

- Solutions to the use cases and requirements using wireless communications technologies developed in accordance with ISA SP100 and future IEC work. The solutions must include requirements for device interoperability and network configuration.
- Development and validation of profile specifications
- Development of device interoperability test and registration procedures
Wireless Development Phases

Phase 1 – Wireless HSE Gateway

Wired H1 field devices with function blocks connected to Linking Devices with wireless HSE for monitoring, control and maintenance.

Phase 2 – Wireless Field Devices

Wireless field devices with full H1 field device user layer functionality.
AN AUTOMATION INFRASTRUCTURE FOR OPERATIONAL EXCELLENCE
ARC study: *Fieldbus Foundation dominates fieldbus protocols in process industries*

Survey shows fieldbus protocols have gone “mainstream”

- Process fieldbus market reached USD $831.7 million in 2006
- Market covers protocols included in the IEC 61158 standard
- FOUNDATION technology accounts for over two-thirds of process fieldbus revenue
# Total Shipments of Fieldbus Solutions for Process Industries by Communication Protocol

<table>
<thead>
<tr>
<th>Protocol</th>
<th>2006 Revenues</th>
<th>2006 Revenue %</th>
<th>2011 Revenue</th>
<th>2011 Revenue %</th>
<th>CAGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOUNDATION Fieldbus</td>
<td>566.6</td>
<td>68.1%</td>
<td>1,714.2</td>
<td>75.2%</td>
<td>24.8%</td>
</tr>
<tr>
<td>Profibus PA</td>
<td>263.8</td>
<td>31.7%</td>
<td>564.1</td>
<td>24.7%</td>
<td>16.4%</td>
</tr>
<tr>
<td>Other</td>
<td>1.3</td>
<td>0.2%</td>
<td>1.5</td>
<td>0.1%</td>
<td>3.6%</td>
</tr>
<tr>
<td>Total</td>
<td>831.7</td>
<td>100.0%</td>
<td>2,279.8</td>
<td>100.0%</td>
<td>22.3%</td>
</tr>
</tbody>
</table>

Figures in Million $
Markets Served

950,000 devices

Over 11,000 Systems
Market Distribution

- Oil & Gas: 17%
- Refining: 15%
- Chemical: 23%
- Petrochemical: 10%
- Pharmaceutical: 3%
- Food & Beverage: 4%
- Pulp & Paper: 5%
- Electric Power: 10%
- Mining & Metals: 3%
- Water & Waste: 4%
- Other: 6%

Industry
Cumulative Registered Device Registrations

FOUNDATION Fieldbus
Product Registration Trend

- Cumulative Re-Registrations
- Cumulative New Registrations

New Dehli, India
29 November 2007

© 2007 Fieldbus Foundation
An Automation Infrastructure for Automation Excellence

Thank You