Session - III
Control Philosophy Change with FF

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Emerson Process Management
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- Author
  - Fieldbus, OPC
- FF development teams
  - Function blocks
  - Transducer blocks
  - Safety communication
- ISA
  - SP84 Safety bus
  - SP104 EDDL
- FF Singapore
  - EUC co-founder
  - Marketing president
Section-III Topics

- System Architecture
  - H1/HSE

- Control Philosophy
  - Function Block Diagram Language (FBD)
  - Control in the Field (CIF)

- Intelligent Device Management
  - Electronic Device Description Language (EDDL)
  - Future Device Integration (FDI)
Architecture

H1/HSE
Network Application Tiers
Control Philosophy

FBD
CIF
Recap of H1 Protocol Characteristics

- Data organized by blocks and parameters...
- Real-time and non-real-time channels...
- Synchronized scheduling...
  - Scheduled (cyclic) and unscheduled (acyclic)...
  - Synchronized, minimum jitter for PID control...
- Publisher/subscriber...
  - Peer-to-peer...

Digital closed loop control
No analog

Designed for process control
IEC 61804-2 Function Block Diagram Language

- Resource Block
  - Identification

- Transducer Block
  - Temperature
    - Sensor type
    - Calibration
    - Diagnostics
  - Pressure
  - Valve Positioner

- Function Block
  - AI
    - Unit
    - Simulate
    - Transfer function & range
    - Alarm
  - PID
  - AO
  - ARTH
  - INTEG

Quantity, type, and speed of blocks depend on device
Time Division Multiplexing

**FOUNDATION H1**
- Scheduling
  - Synchronized
  - Precisely periodic (isochronous)

**Other buses**
- "Free running"
- Longer time
- Jitter

\[ OUT = P \times \left( e + \frac{1}{I} \int e \, dt - D \times \frac{dPV}{dt} \right) \]

\[ e = PV-SP \]
\[ dt = \text{sampling interval must be constant} \]

- Constant Macrocycle Period = \( dt \)
- Real-time
  - Periodic (cyclic)
  - Foreground slots
  - Scheduled
- Non-real-time
  - Non-periodic (acyclic)
  - Background slot
  - "Unscheduled"

- No Acyclic
- A lot of Acyclic
- Some Acyclic

\( dt \) ???

Difference is Jitter
3 Ways to Do Closed Loop Digital Control

- **Control in Controller**
  - Traditional way
  - Set macrocycle and control sheet/module time the same

- **Control in the Field**
  - Single loop integrity when used in conjunction with backup LAS
  - Less communication
  - Devices must be on the same bus

- **Operator can't see the difference**

- **80/20 Rule**
H1 communication and execution is synchronized
- Shortest possible time
- Precisely periodic: no jitter

Other buses are not synchronized
- Longer time
- Jitter
Control Strategy
Configuration

- Many different block types available
Fast Loops and Many Loops

- Parallel execution
- Function blocks and links adds to macrocycle
- Monitoring devices do NOT
- When bus is maxed-out on control you can still add some monitoring devices

120 ms (< 50%)

250 ms

PID
AI
Link
AO

TX4
CV4
TX3
CV3
TX2
CV2
TX1
CV1
The schedule is created automatically by the engineering station.

- Can be viewed
- Fast and slow loops can be mixed
- Shortest time depends on block execution speed
Status Propagation

PV is Marked ‘Uncertain’ or ‘Bad’ if Abnormal

and propagated
Fault State

- **Diagnostics**
  - Communication failure
  - Device failure
  - Power failure
  - Other failures

- Predetermined fault state
Availability

- Only a few loops per bus
  - One critical loop per bus
- Redundant interface cards
- Redundant power
- Short circuit protection

- One device per spur
- Control-in-the-field (CIF) with backup Link Active Scheduler (LAS)
Intelligent Device Management

EDDL/FDI
Diagnostics

Classic I/O

H1

Other Buses

Other Buses

Fieldbus Overview - India
Intelligent Device Management

- Identification & information
- Diagnostics, performance analysis, & operational statistics
- Parameterization, ranging, reconciliation, & audit trail
- Simulation and override
- Calibration trim and log
- Document access
- Device event capture & monitoring
- Commissioning

- Maintenance log & service notes
- Device listing
- Maintenance & calibration scheduling
How Long Have You Been Benefiting from EDDL?

Thousands of instrument technicians have been benefiting from EDDL daily since 1992 - without even knowing it is there...

- Commissioning
- Loop Check & Simulation
- Calibration Trim
- Identification
- Parameterization & Range
- Monitoring
- Diagnostics
What is EDDL?

- EDDL is an Electronic Device Description Language
  - EDDL is a text-based language
- Consists of two parts
  - A file that describes the device and the information that it contains (CD, Internet)
  - A host application that reads the file to know how to retrieve the device information (PC software, handheld)
- IEC 61804-3 the only standardized method for device integration
EDDL files and Interoperability

- You only need one PC software and one handheld for all the devices
EDDL: Operating System Independent

- Application on PC or Handheld uses the same EDDL file
- Fully backward compatible
  - New versions of Windows is not a concern

Simple Text File
Same For All Hosts

Win XP
WIN NT
WIN 2000
Unix
Linux
Win CE
EDDL Evolution

- **EDDL**
  - Since 1992 "DD"
  - Describes parameters
  - No appearance
  - List of text

- **Enhancements**
  - Since 2006
  - Describes parameters
  - Describes appearance
  - Visual
Key Features of EDDL Enhancements

- **User Interface**
  - Parameter Organization
  - Images

- **Graphing System**
  - Support for Charts and Graphs

- **Persistent Data Store**
  - Archive and retrieve data
    - E.g. valve signatures
  - Aids diagnostics executed by devices
Uniform Look and Feel

- The **look and feel** of the User Interface is determined by the Host System
  - All devices on a given Host system have the same look and feel.
    - Necessary for efficient utilization by operator and maintenance personnel.

- The **content** of the device display is still determined by the Device Manufacturer in the EDD
EDDL In Handheld Communicator

- Field commissioning
- Field troubleshooting
- Field calibration
EDDL Highlights

- Established, proven (since 1992)
- System Independent (including OS, screen size)
- A single EDDL file for all hosts
- Revision Control
- Testing and Registration
- International Standard
- Uniformity (all devices, all protocols)
- Supported by major suppliers
- New Features are Backward Compatible
  - Preserves investments
- Full support for device functionality
- Easy integration and removal
- Robust
FDT Group joins the EDDL Cooperation Team

- Will use a subset of the OPC UA technology
  - client-server architecture
- Incorporate the advantages of FDT concept and EDDL technology
More Information

- [www.fieldbus.org](http://www.fieldbus.org)
- [www.eddl.org](http://www.eddl.org)