Simplifying the Complexity of Engineering a Process with FOUNDATION™ Fieldbus

By
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Honeywell Industrial Control
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Simplifying Engineering with FF

- What is FF Technology?
- What Needs to be Engineered?
- What Documentation Needs to be Changed?
- Making it Bearable with Tools
What is FF Technology?

- Dramatically Different
- Digital, Process Control
- Low Speed w/ bus power
- High Speed w/o power
- Robust User Layer
- Extendible & Add'l Function Blocks
- Device Description Files
- Data Link Synchronization
What Needs to be Engineered?

- Wiring Topology
  - Home run, spurs, multi-drop, not pt-to-pt
  - 1900m + 120m total spurs (fn of number of Devices)
What Needs to be Engineered?

- **Power Distribution**
  - Cost Savings
  - Adequacy
  - Redundancy

**DCS/PAS**

24vdc
What Needs to be Engineered?

- **Function Block Residency**
  - “IN” with input and “OUT” with output
  - Control-in-the-Field?
  - The Rest…?
    - Best-of-Class
    - Control Latency
    - Co-location vs. Bridging
What Needs to be Engineered?

- Network Scheduling
  - Macrocycle
  - Sub-schedules
  - Latency
  - Bandwidth Usability
What Needs to be Engineered?

- Network Scheduling
  - Macrocycle
  - Sub-schedules
  - Latency
  - Bandwidth Usability

[Diagram showing network scheduling with execution, publication, and agent indicators.]

- Total duration of scheduled activities: 250 msec
- Time used by publications: 32.30%
- Time available for unscheduled traffic: 67.70%
What Needs to be Engineered?

- VCRs
What Needs to be Engineered?

- VCRs

e.g., 12 VCRs
What Needs to be Engineered?

- VCRs
- Address Limitations
What Needs to be Engineered?

- VCRs
- Address Limitations
- Overall System Capacity
  - Traffic Routing
  - Weakest Links
  - The Pyramid
Fig 1 – Generalized System Communications Architecture
What Needs to be Engineered?

- VCRs and Link Objects
- Address Limitations
- Overall System Capacity
  - Traffic Routing
  - Weakest Links
  - The Pyramid

Fig 1 – Generalized System Communications Architecture
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Simplifying the Complexity of Engineering a Process with FF

**What Needs to be Engineered?**

- VCRs and Link Objects
- Address Limitations
- Overall System Capacity
  - Traffic Routing
  - Weakest Links
  - The Pyramid

**Fig 1 – Generalized System Communications Architecture**
Dealing With All This!

- Lots of Benefits, but…
- Lots of Responsibilities too!
Dealing With All This!

- Lots of Benefits, but…
- Lots of Responsibilities too!
  - Hundreds of parameters per device
    - Physical Device Parameters
    - Network & System Parameters
    - Transducer Parameters
    - Function Block Parameters
- Need to Change Documentation
- Need Tools to Help!
Changing Documentation?

- P&ID Drawings
- Loop Drawings
- SAMA or Control Strategy Drawings
- Data Sheets
- System Drawings
Changing Doc’n - P&ID Drawings

• Not much change

• ISA S5.1
  • Dotted line with circles to represent the multi-drop signal line.
Changing Doc’n - P&ID Drawings

Fieldbus with PID in the host

From Fieldbus User Network, Gary Addison, Equistar Chemicals LP

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ISA–The Instrumentation, Systems, and Automation Society
Changing Doc’n - P&ID Drawings

Fieldbus with PID in the field devices

From Fieldbus User Network,
Gary Addison, Equistar Chemicals LP
Changing Doc’n – Loop Drawings

• Conventional…
  • Devices…
  • through marshalling…
  • to controller termination
Changing Doc’n – Loop Drawings

• With FF… “Segment Drawings”
  • Show all devices
  • Show power introduction
  • I. S. barriers (optional)
  • Terminator locations
  • Length of home runs
  • Length of each spurs
  • Types of wires used

• Used by
  • Technicians
  • Engineering
Changing Doc’n – Loop Drawings

From Fieldbus User Network, Bud Szoke, Keyspan Energy Canada

Power Conditioners

24vdc Terminators & Expanders

Power & Lengths

Devices
Simplifying the Complexity of Engineering a Process with FF Control Strategy

- Function Blocks
- Interconnections
- Location of Blocks
- Creation:
  - By Configuring Engineer
  - Using Control System Builder
- Look for a Single Drawing (integrated)
Changing Doc’n – Data Sheets

- As useful as ever, but...
- More data!!!
  - Current Draw
  - Network Addresses
  - VCRs available & Used
  - Permanent Function Blocks
  - Instantiated Function Blocks

- Now Self-Documenting:
  - Serial Numbers
  - Model Numbers
  - Revision Numbers
Changing Doc’n – System Drawings

- Station
- Redundant Process Servers
- Station
- Non-Redundant Process Server

- Ethernet
- Supervisory Net
- Redundant Controller
- Non-Redundant Controller
- I/O Net
- Remote I/O chassis
- Non-Redundant with Net I/O
- Remote Net I/O
- Common Downlink Net
- Supervisory ControlNet
- Non-Redundant Controller
- Non-Redundant PLC with local I/O
Making It Bearable with Tools

- Is Fieldbus Complex or Simple?
  - It’s complex! but..
  - Tools can make it look simple!

- Look for help from experienced DCS/PAS system vendors.

- Look to see if Fieldbus is integrated or merely interfaced.

- Does it provide off-line (before device availability) configuration support?
Making It Bearable with Tools

• Does it provide device templates and block templates…?
  • to avoid re-defining every parameter value for every instance?
  • Can user establish/override values?
  • Can user add non-device-vendor supplied attributes?

• Can user drag-and-drop templates onto a drawing to create elements of an interconnected control strategy?
The “Physical” Tree

- Microsoft Explorer Familiarity
- Start at Interface Module.
- Links are Subordinate to FIMs
- Devices are Subordinate to Links.
- Blocks are Subordinate to Devices.
- Parameters are Subordinate to Blocks.
Simplifying the Complexity of Engineering a Process with FF

- Microsoft Explorer
- Familiarity
- Start at Interface Module.
- Links are Subordinate to FIMs
- Devices are Subordinate to Links.
- Blocks are Subordinate to Devices.
- Parameters are Subordinate to Blocks.

The "Physical" Tree
The “Strategy” Tree

- Microsoft Explorer Familiarity
- Start at Controller
- Control Modules are Subordinate to Controller
- Function Blocks are Subordinate to Control Modules
- Parameters are Subordinate to Function Blocks.
### The "Strategy" Tree

- **Microsoft Explorer**
  - Start at Controller
  - Control Modules are Subordinate to Controller
  - Function Blocks are Subordinate to Control Modules
  - Parameters are Subordinate to Function Blocks.

#### Parameter Configuration

<table>
<thead>
<tr>
<th>Condition</th>
<th>Limit</th>
<th>Unit</th>
<th>Priority</th>
<th>Alarm Disable</th>
<th>Time of Last Change</th>
</tr>
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<tbody>
<tr>
<td>HI HI</td>
<td>95%</td>
<td>%</td>
<td>10</td>
<td></td>
<td>12/31/1971 20:00:00.0000</td>
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<td>HI</td>
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<td>%</td>
<td>7</td>
<td></td>
<td>12/31/1971 20:00:00.0000</td>
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<td>DEV HI</td>
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<td>%</td>
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<td></td>
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<td>0</td>
<td>✓</td>
<td>12/31/1971 20:00:00.0000</td>
</tr>
<tr>
<td>LO LO</td>
<td>5%</td>
<td>%</td>
<td>0</td>
<td>✓</td>
<td>12/31/1971 20:00:00.0000</td>
</tr>
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<td>ALARM_HYS</td>
<td>0.5%</td>
<td>%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Alarm Configuration

- **DISCRETE**
- **FAIL**
- **ACCEPT**
- **IGNORE**

- **BLOCK ALARM**
  - Time of Last Change: 12/31/1971 20:00:00.0000

[Image of process parameter configuration interface]
Device Object Instantiation

- Create an instance of a device model that corresponds to a device being delivered.
- Drag and drop onto appropriate link.
Device Commissioning

- Place the available device on the link.
- Find the device on the Physical tree.
  - PD_TAG
  - Address
  - Unique Device ID
- Match it up with pre-configured device.
- Commission it (loads it).
- Start up device & blocks
Device & Block Monitoring

Monitor the physical tree for link, device, and block status.
Device & Block Monitoring

- Monitor the **Physical Tree** for link, device, and block status.
- Monitor the **Strategy Tree** for control strategy and block status.
Device & Block Monitoring

- Monitor the Physical Tree for link, device, and block status.
- Monitor the Strategy Tree for control strategy and block status.
- See live values and statuses on chart.
### Simplifying the Complexity of Engineering a Process with FF

- **Process Alarms detected by device fully integrated with DCS/PAS process alarms.**
- **Device Alarms detected by device fully integrated with device hardware and I/O alarms.**
- **Device Alarms detected by interface fully integrated with device hardware and I/O alarms.**

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Area</th>
<th>Point ID</th>
<th>Alarm</th>
<th>Priority</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>22-Aug-01</td>
<td>11:01:59</td>
<td>pa62d</td>
<td>CMLX5</td>
<td>PVHIGH</td>
<td>H 10</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>22-Aug-01</td>
<td>11:01:59</td>
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<td>CMLX5</td>
<td>PVHIGH</td>
<td>H 12</td>
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<td>DIAG</td>
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<td>Battery Not OK</td>
<td>56.7407</td>
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<tr>
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<td>H 10</td>
<td></td>
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</tr>
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<td>10:53:39</td>
<td>pa62d</td>
<td>CMLX5</td>
<td>FState</td>
<td>H 02</td>
<td></td>
<td>100</td>
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<tr>
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<td>CMLX023</td>
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<td>22-Aug-01</td>
<td>10:53:35</td>
<td>pa62d</td>
<td>CMLX5</td>
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<td>H 10</td>
<td></td>
<td>100</td>
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<tr>
<td>22-Aug-01</td>
<td>10:41:59</td>
<td>pa62d</td>
<td>CPM1</td>
<td>DIAG</td>
<td>H 00</td>
<td>Battery Not OK</td>
<td></td>
</tr>
</tbody>
</table>

**Alarm has been acknowledged but has not returned to normal**
Maintenance Data Access

- Reports from database of devices
Maintenance Data Access

- Reports from database of devices
- Bad & Uncertain values
  - Propagation and reaction
Maintenance

- Reports from database of devices
- Bad & Uncertain values
  - Propagation and reaction
- Events recorded on change
  - Integrated with conventional
Maintenance Data Access

- Reports from database of devices
- Bad & Uncertain values
  - Propagation and reaction
- Events recorded on change
  - Integrated with conventional
Device Replacement

- Replacing Similar Devices
- Decommission Old
Device Replacement

- Replacing Similar Devices
- Decommission Old
- Commission New
Device Replacement

- Replacing Similar Devices
- Decommission Old
- Commission New
- Reclaim parameter values
- Note Differences

Replace:
Reconcile Differences
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- What is FF Technology?
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- What Documentation Needs to be Changed?
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Summarizing…

• FF Technology…

• …Is Complex

• …Is “Cultural” Change

• …Requires Advanced Tools

• Tools are Growing in Strength

• Goal is Engineeringless Interoperability (ELI)
Thank You!

Questions?

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