

LISTEN.
THINK.
SOLVE.SM

Fieldbus Instrument Networks for the Process Industry

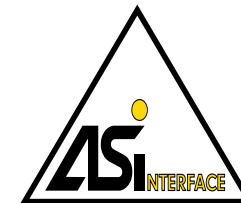
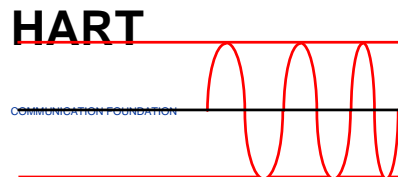
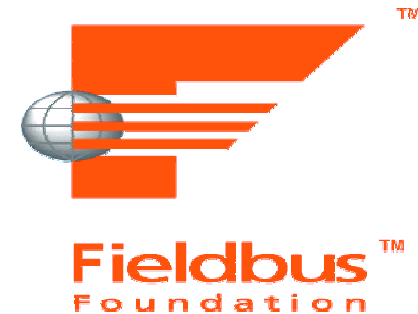
What are they, why do I need them, and how are they used?

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Rockwell
Automation

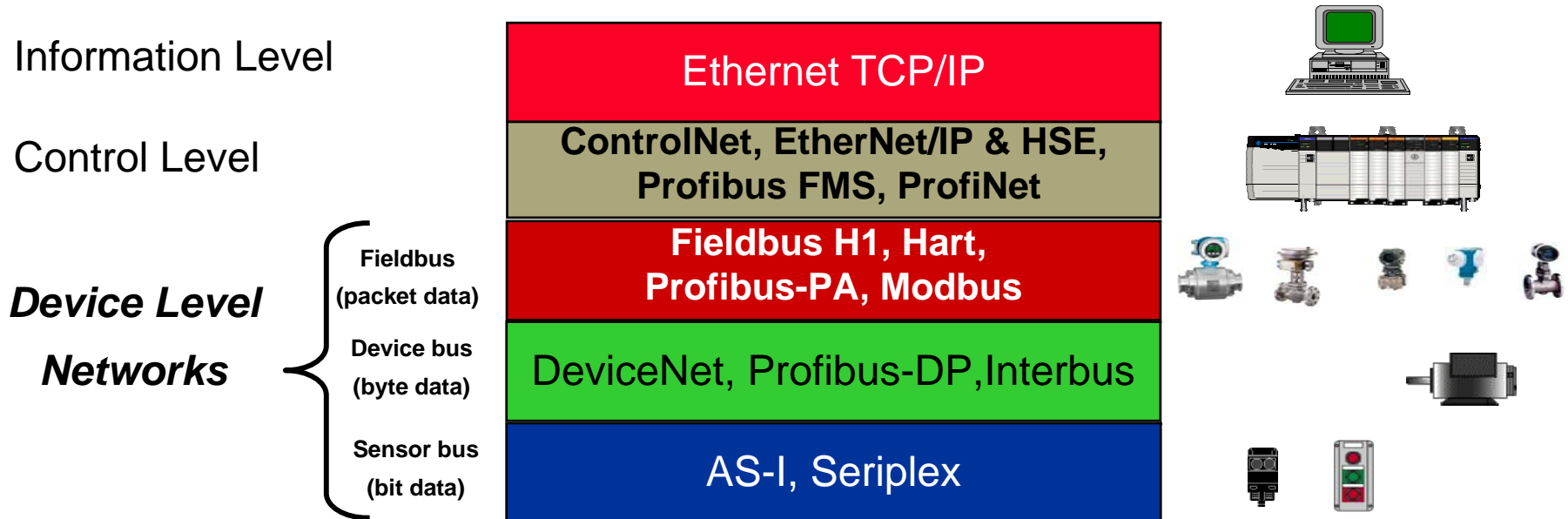
Variety is the spice of life - but when looking for a Field Device Network it can be confusing!

- A variety of “field” networks are available in the industrial automation environment; however, confusion arises because their capabilities overlap and are not understood
 - DeviceNet
 - Profibus DP/PA
 - Foundation Fieldbus
 - Hart
 - ModBus
 - AS-i
 - Seriplex
 - Interbus
 - others



The different Networks used in Process Automation can be categorized based on their design capability

A Manufacturing Network classification Chart

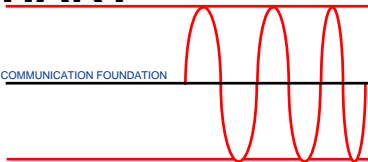


Device networks (field buses) are different than Communications Networks

- Characterized by using “Smart” Devices
 - In process automation Device networks are replacing traditional 4-20ma devices
 - In industrial automation Device networks are replacing discrete I/O
- Networks typically provide power to the device
- Open but with Rules

HART

COMMUNICATION FOUNDATION



Sensor Bus Networks (bit Data)

- Bit Data
- Inexpensive physical media
- Direct sensor / actuator connect
- Quick and easy installation
- Combines easily with higher level networks
- Single master
- Wire Length limited (100m /Segment)
- Limited Data (4 bits data in/out per device)
- No device programming over network
- AS-i is simply a better way then traditional wiring to connect field devices to the control system.



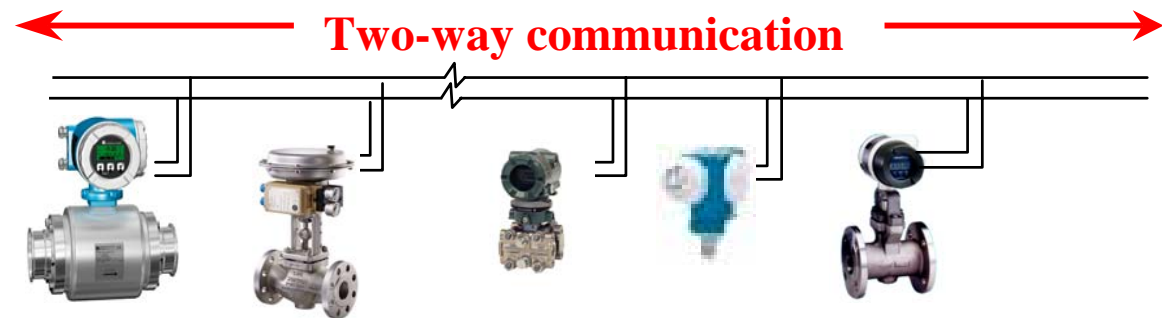
Device Bus Networks

- Byte Data
- Inexpensive physical media
- Discrete side of the industry (Sensors, Drives, I/O, Weighing systems)
- Quick and Easy installation
- Combines easily with higher networks
- Multi-master
- Wire length limits (DNET 500m, ProfiDP 1200m)
- Data Rate (DNET 500Kbps, ProfiDP 12 Mbps)
- Nodes (DNET 64 , ProfiBus 32)
- Price (DNET approx 20-30% less expensive)
- In general Device Bus Networks are designed for the discrete side of the industry. Ideally suited for the drives and starters where more diagnostic information is shared from the individual devices to the control system.



Fieldbus is an enabling technology....

- Provides an open, distributed, all-digital, two-way communication network (LAN - Local Area Network) for “intelligent” field devices in the process industries
- enables multiple (and different vendors) field devices to be connected to the same pair of wires.
- replaces traditional point-to-point wiring between traditional “non-intelligent” field devices and controllers



First there was ModBus

- Invented by Modicon in 1979
- First steps in a true process network.
- Devices configured and calibrated over network
- Very simple Master/Slave token passing protocol
- Media standard RS232 or RS422/485 wiring
- Up to 247 devices
- 250 bytes per packet
- A very widely used protocol that is primarily used in industries that are looking for a network that is easy to use and also allows the technicians to maintain instrumentation in the field.

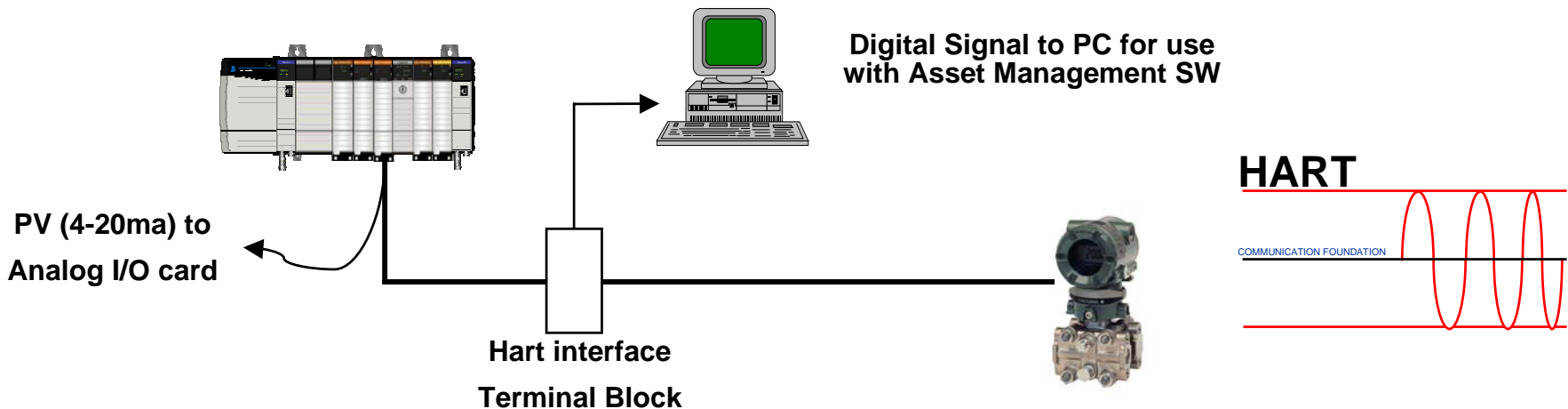


Then there was HART

Highway Addressable Remote Transmitter

The key requirement for a "Fieldbus" is a Smart Transmitter or field device, Hart devices added digital capability (Smarts) by adding a microprocessor to the analog transmitter

- Analog (4-20ma) was the signal standard and was used for the Process Variable (PV)
- Digital signals were encoded on the analog signal and could be used for the PV, but the real value was in the additional diagnostic data available from the transmitter

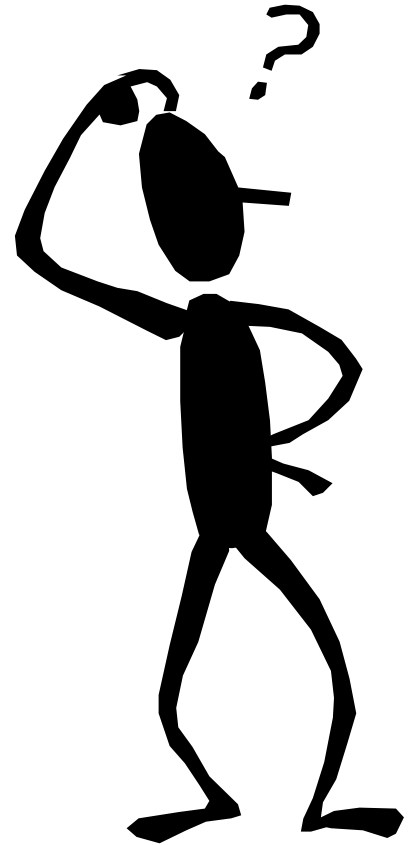


Then there is a Fieldbus standard...

IEC 61158

IEC 61158, was to provide a standard for the simple digital replacement to the 4-20_{ma} standard

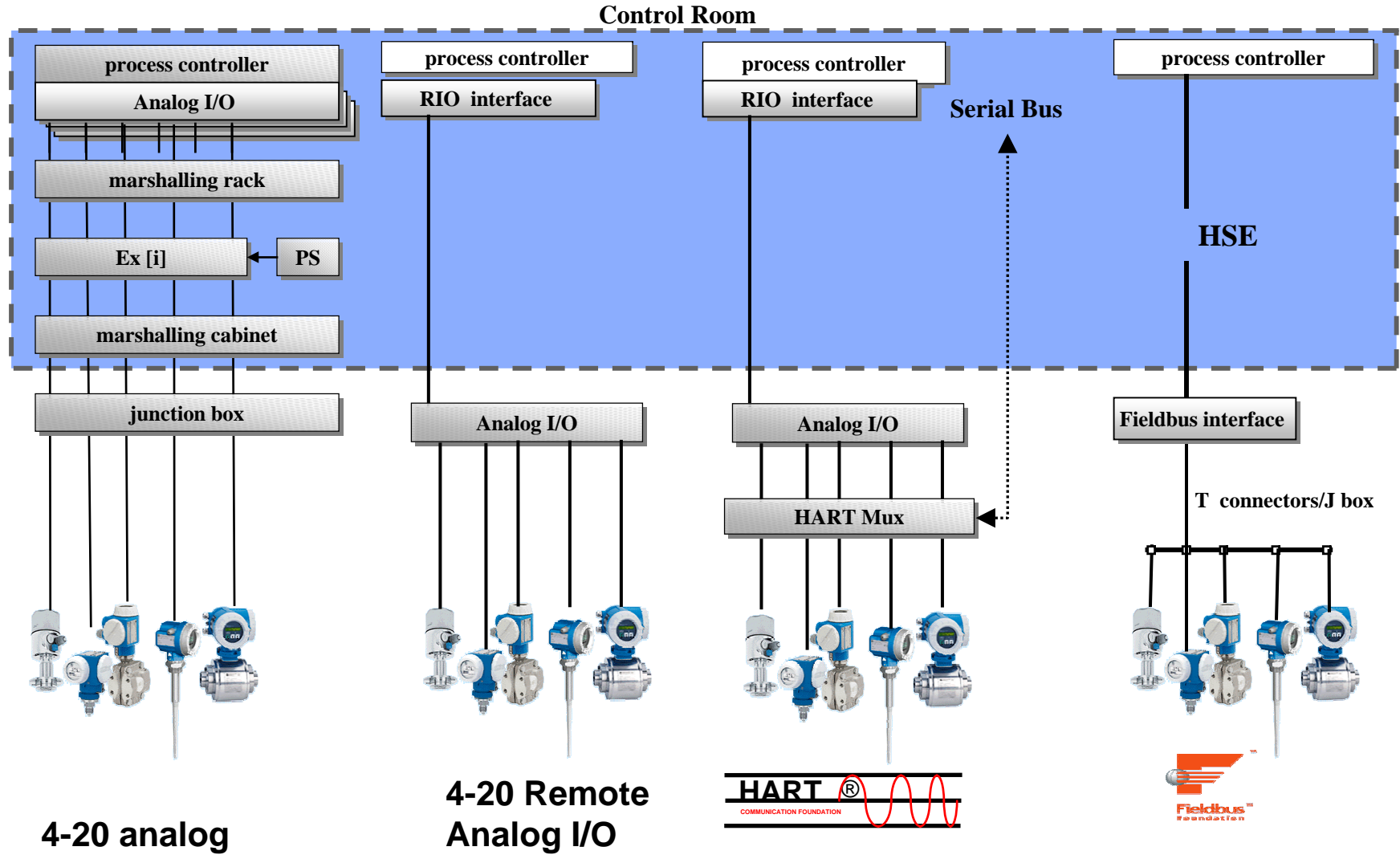
- Conceived in 1985, started in 1988
 - 1993 published part 2, which was for physical layer
 - 1996 published part 2 second edition
 - 2000 published parts 3 - 6, for 8 part protocol
 - Type 1 - resembles FF H1 & PA
 - Type 2 - ControlNet
 - Type 3 - Profibus-DP
 - Type 4 - P-Net
 - Type 5 - FFB HSE
 - Type 6 - SwiftNet
 - Type 7 - WorldFIP
 - Type 8 - Interbus-S



Why FOUNDATION Fieldbus/ ProfiBus PA Provides Operational / Application Benefits

- **Use of live plug/unplug wiring** - reduced maintenance costs
 - Eliminate bench calibration/configuration
 - Simple wiring diagnostics and loop identification
 - Eliminate range changes
 - Supports simpler plant record keeping/actions (i.e. Asset Management)
- **Improved data quality** - increased reliability
 - eliminate offset corruption (i.e. analog input card offset, analog noise)
 - eliminate conversion corruption (i.e.a/d,d/a conversion, factor errors)
 - access to values in engineering units generated within the field devices
- **Improved / Remote preventative or predictive maintenance** - reduced maintenance costs, increased up time
 - Access to multiple soft and hard alarms - increased uptime
 - Reactive pre failure measurement device health indicators
 - Proactive access to measurement device health status

FOUNDATION FieldBus continues the shift from analog cable to a digital LAN... which changes the way you must think about I/O



4-20 analog

4-20 Remote Analog I/O



FOUNDATION Fieldbus H1/ ProfiBus PA a Plant Floor LAN for Process Control

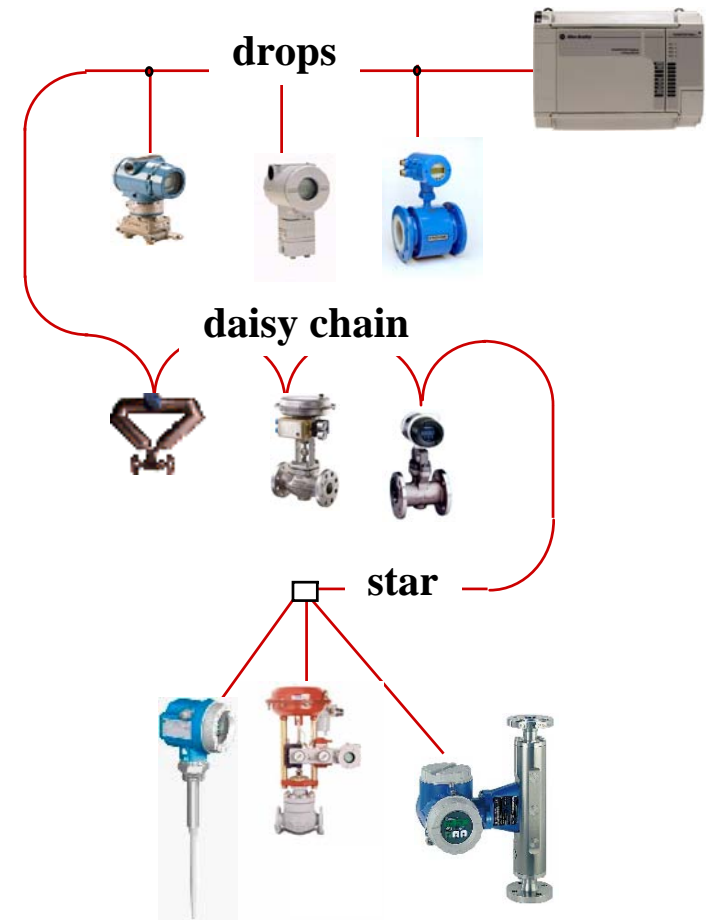
- True Digital - Distributed Control (Robust Architecture with deterministic operation)
 - Control of the Process can now be situated where you want it - in the host controller, in the field, or both.
- Device Interoperability (Non Proprietary)
 - Any Fieldbus Foundation - registered device can work with other registered device regardless of the supplier
- Easy System Maintenance (Forward Looking Technology)
 - Self-Diagnostics field devices report on their status and health
 - Remote reconfiguration and setup

Foundation fieldbus-H1 is used and supported throughout the world, and truly complements any process control system

Flexibility in the FF - H1 Physical Layer

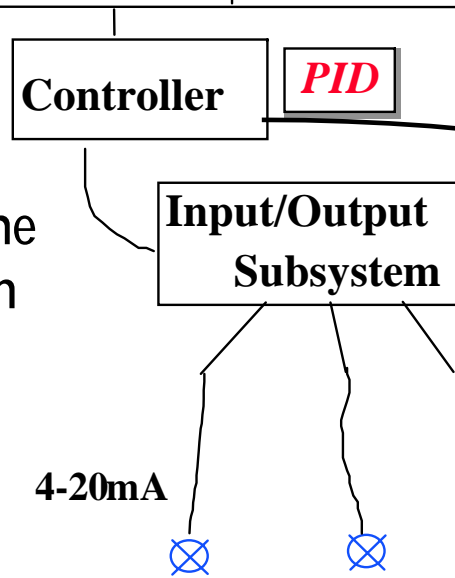
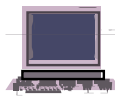
- Follows IEC 61158 Physical Layer
 - Twisted pair
 - Power on the bus
 - Data rate 31.25 kbit/s (H1)
- Up to 32 devices per segment (depends on several factors)
 - 4 devices in Class I, Div. 1 (I.S.)
 - 8 to 10 devices Class 2
 - Host system must support the number of function blocks needed for transmitters
- Shielded twisted pair wiring
- Distances up to 5700 ft. (more with repeaters)
- Intrinsically safe by design

Multiple Topology Options



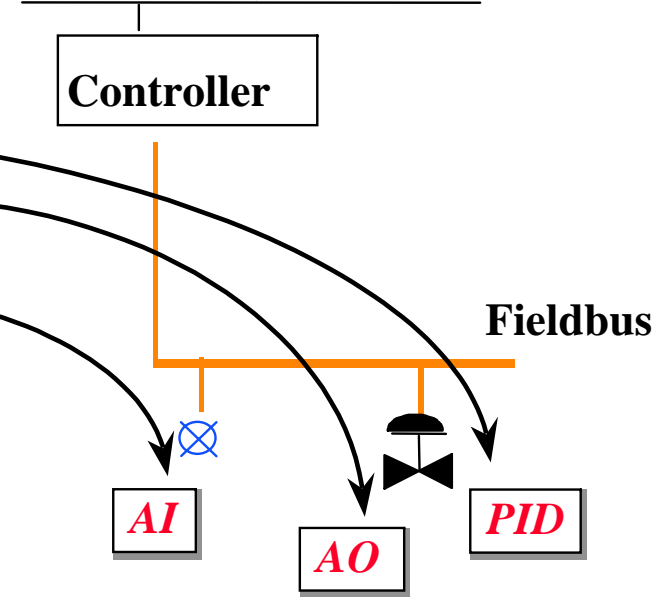
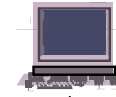
Foundation Fieldbus is shifting the process control strategy paradigm

Traditional Control System Network



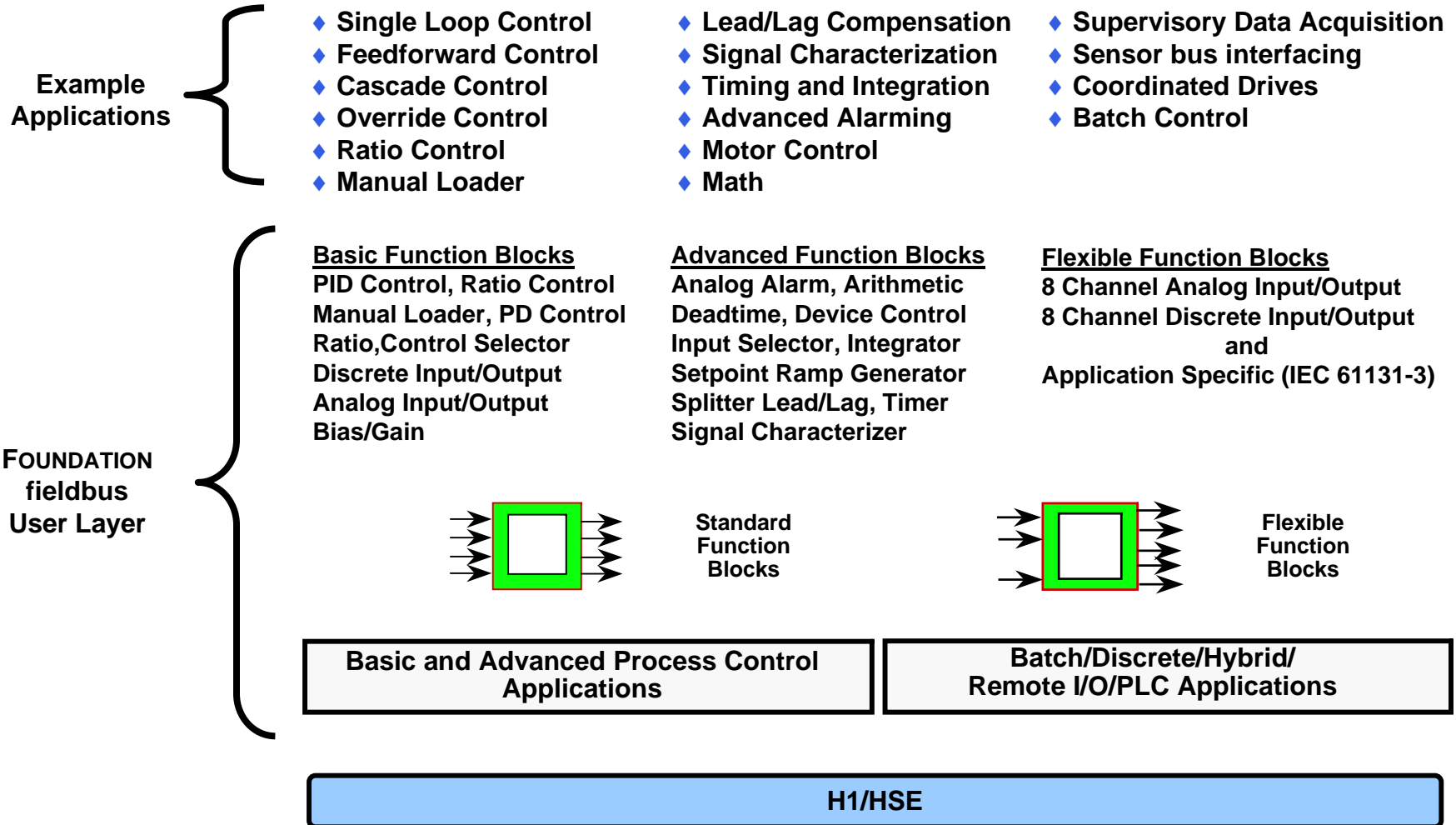
Traditional methods had the loop closure in the process controller

Control System Network using FF-H1



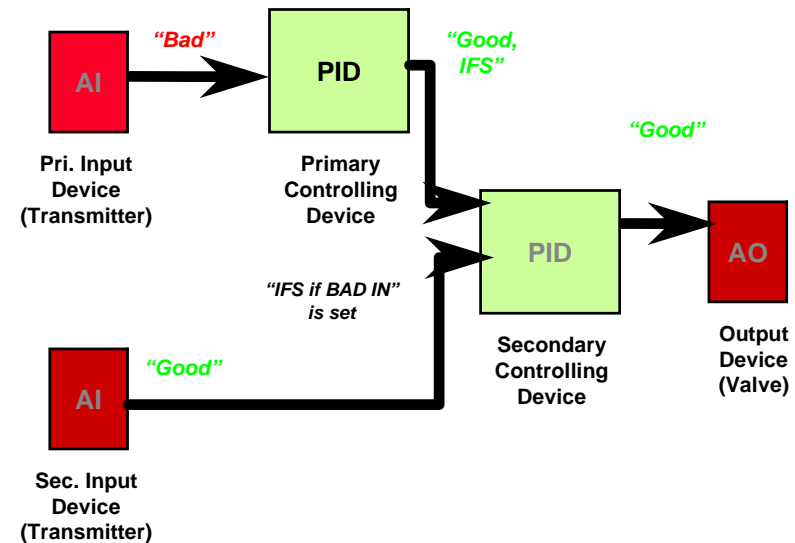
Foundation Fieldbus enables you to distribute the loop closure from the process controller to the field instrumentation

Foundation Fieldbus is much more than a Device Network...it can provide DCS type control functionality



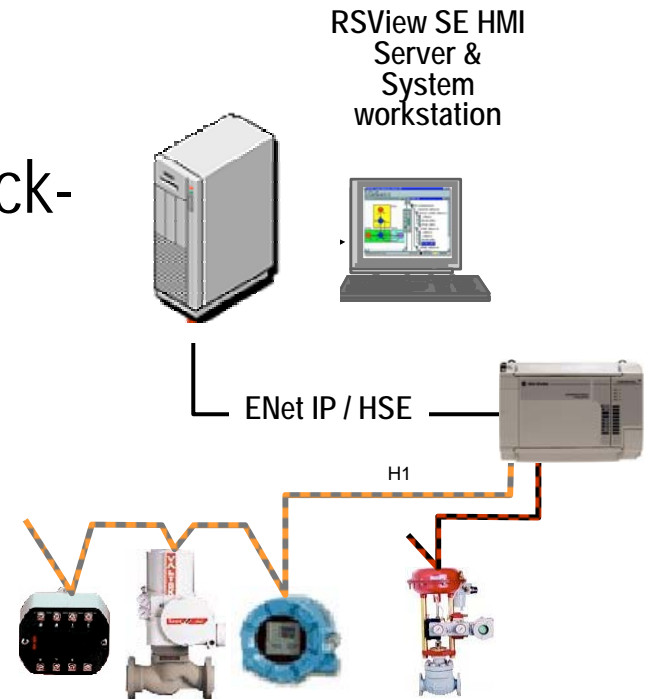
Alarm Detection And Reporting is built into the Function Blocks

- Alarm Detection & Reporting per FB
 - Alarm Summary for each Condition
 - Status
 - Report Ack, Operator Ack
 - Alarm Conditions
 - Hi, Hi-Hi, Lo, Lo-Lo,
 - Dev Hi, Dev Lo, Discrete, etc
 - Alarm Parameters
 - Limit, Priority
 - Local Time Tagging
- Supports SOE Data Logging
 - Buffers alarms
- Broadcast via Factory Talk

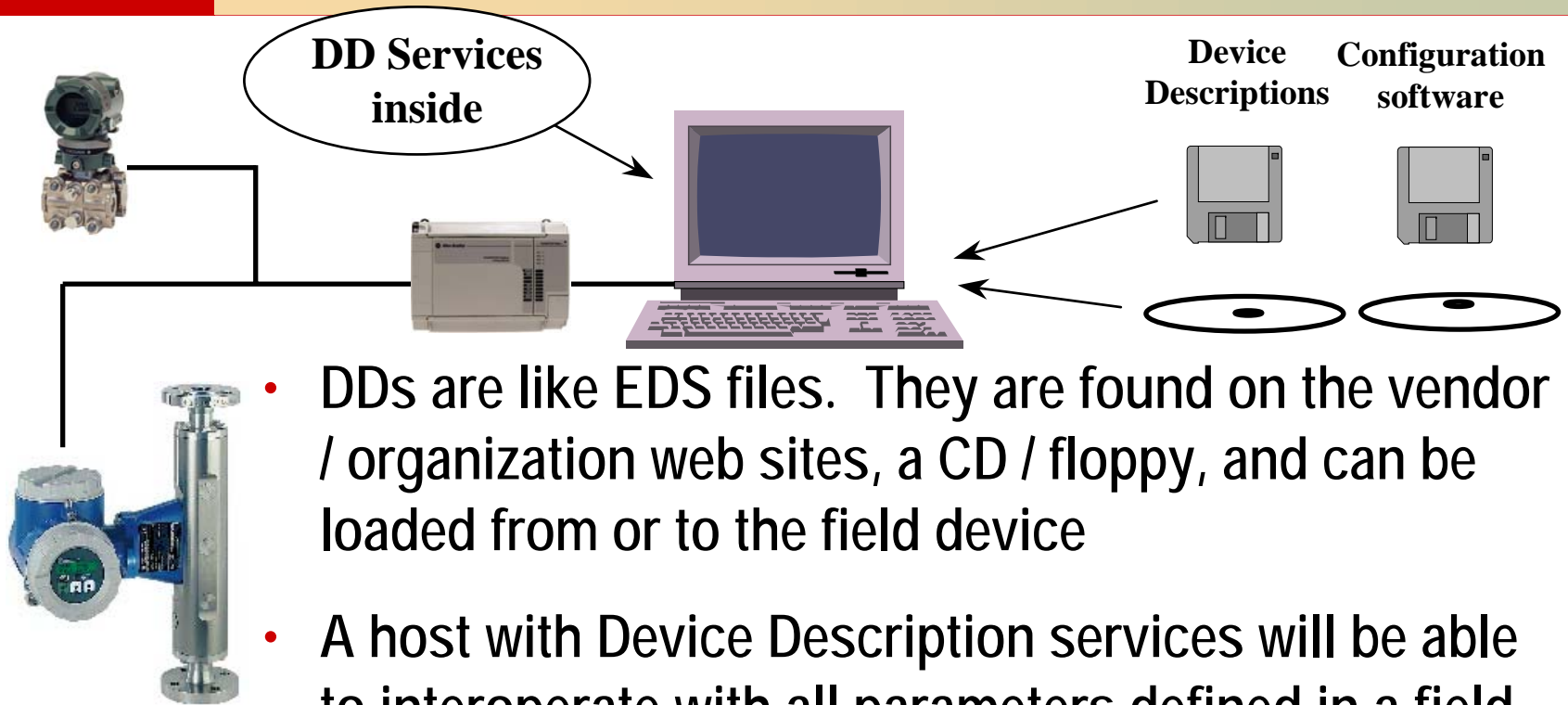


Defined Function Block "Views" define a structure for Displayed data

- Consistent data and format for Operator interfaces
- Parametric Set of Parameters
- Efficient access for detail displays and check-pointing
- Four standard sets of views:
 - Operator Dynamic Parameters
 - Operator Static Parameters
 - Other Dynamic Parameters
 - Other Static Parameters



Device Descriptions (DD) are the key to interoperability / Multi-Vendor Function Blocks



- DDs are like EDS files. They are found on the vendor / organization web sites, a CD / floppy, and can be loaded from or to the field device
- A host with Device Description services will be able to interoperate with all parameters defined in a field device's DD
- Devices are certified for interoperability by the Fieldbus Foundation

Basic Comparisons of Network Types

	FieldBus	Device Bus	Sensor Bus
Device Cost	\$1,000-\$10,000	\$100-\$1,000	\$50-\$250
Installer	Instrument Technician	Electrician	Electrician
Information	Multi-variable / Diagnostic	On/Off, Status	On/Off
Data Packet Size/Rate	128 bytes / 31.25 Kbps	8 Bytes / 500 Kbps	4 bits / 167 Kbps
Nodes	32	64	31
Industry Service	Process	Discrete	Discrete