Advanced Digitalization for Agile Project Execution

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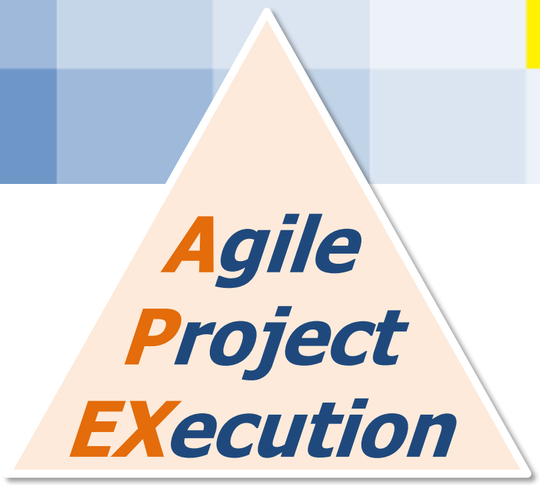


Scenario

- Products and Projects

yesterday

  - Product developments according to technological improvements and marketing strategies
  - Project execution according to best engineering practices

- Not enough any more:

today

  - Technological developments to favorite efficient/flexible project execution and minimize risk
  - Make use of IIoT technologies (Cloud Enabled Execution, Virtual Testing, Flexible Binding, Bulk Engineering, …)

APEX in a nutshell

- Why change the current Execution Model?
  - Drive from Industry : Get automation off the critical path
  - Customers Reduce CAPEX budget : Focus on Capital Efficiency
  - Apply Enabling Technologies : Smart IO & Virtualization
- Design standardization & modularization to save cost
- Reduce project schedule risks by removing hardware and software inter-dependencies (decoupling)
- Improve Commissioning workflow with remote support
- Execution Flexibility and Lifecycle Management

Agile Project EXecution

Customer expectations for Industry specific issues

Challenges

- Reduce unnecessary work
- Minimize customization
- Validate software without HW FAT
- Prevent design recycle and HW/SW rework
- Minimize unnecessary HW
- Eliminate / minimize physical, data & schedule dependencies
- Simplify 3rd party package I/F configuration
- Accommodate change easily & less impact
- Less effort in Alarm management & Cyber Security
- Reduce effort of Documentation
- Challenge traditional approaches

Approaches

Smart Engineering

- Re-usable Applications
- Secure Remote Testing
- Smart JB designs
- Virtualization

Delivery Excellence

- Consistent Risk Mitigation
- Knowledge Management
- LEAN execution
- Basic Design Toolkit

ICSS Technology

- Networking
- Modularity/Standards based Design
- Independent (parallel) phases
- Flexible Binding at site
- Built-in Management of Change

Generic Benefits

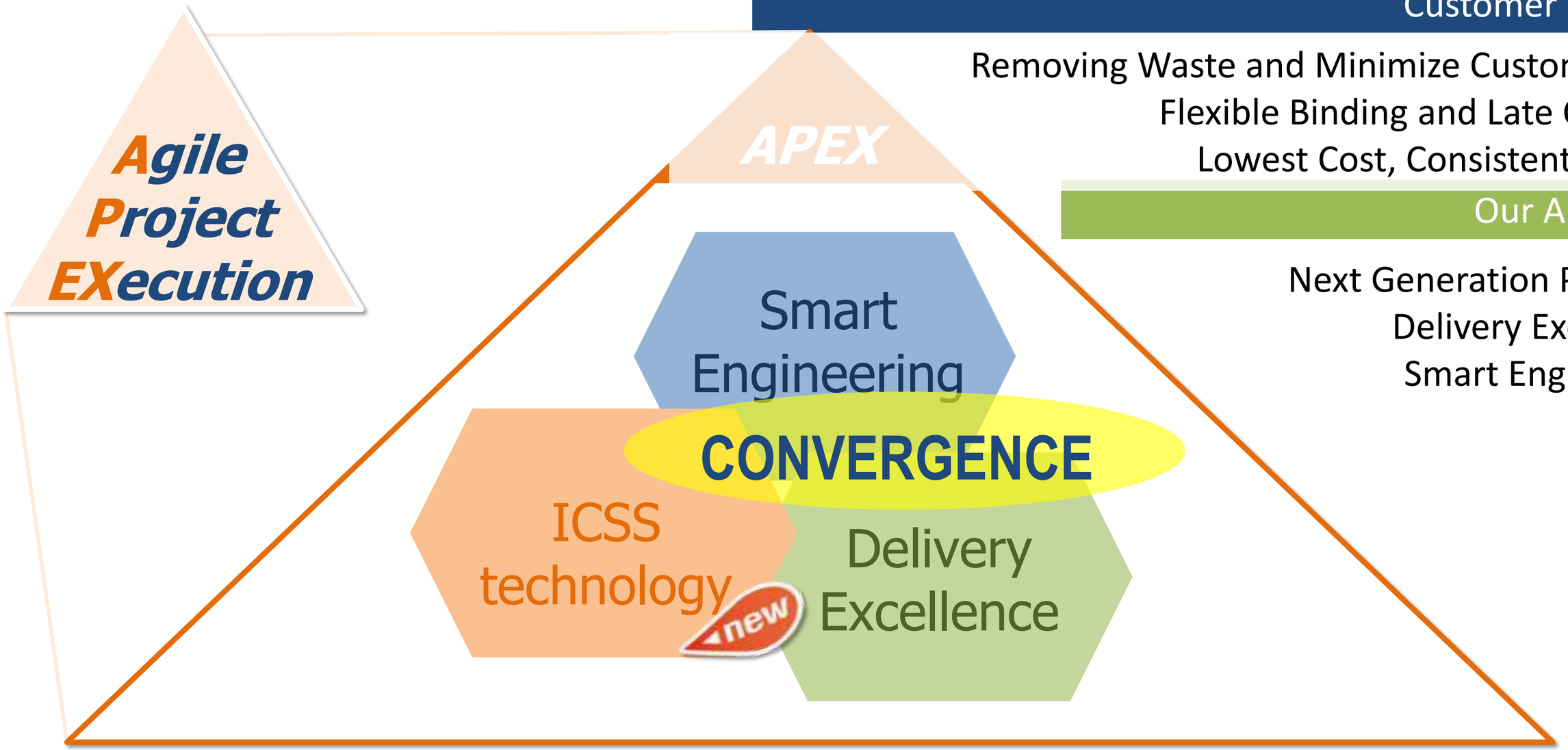
- Predictable and modular Engineering
- Optimized Engineering and Space Utilization
- Minimize Travel (Reviews, Testing, Validation)
- Optimized project execution
- No Engineering Surprises
- Validated & proven Integration
- Early Plant Startup
- Easy Modification
- Reduced Footprint

AGILE PROJECT EXECUTION

Benefits: Removing waste and Reducing cost

What is our approach

APEX, Removing waste and Reducing cost in all Projects



Customer Benefits

Removing Waste and Minimize Customization
Flexible Binding and Late Changes
Lowest Cost, Consistent Quality

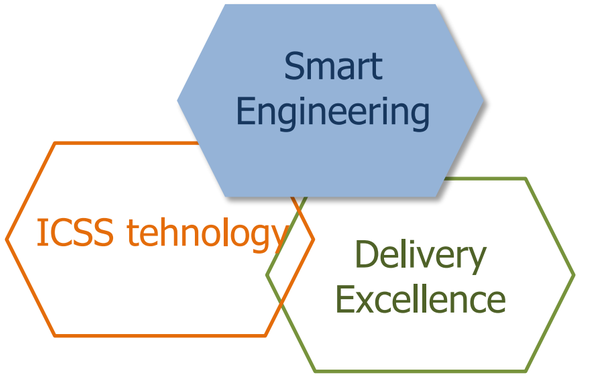
Our Approach

Next Generation Platform
Delivery Excellence
Smart Engineering

APEX Smart Engineering

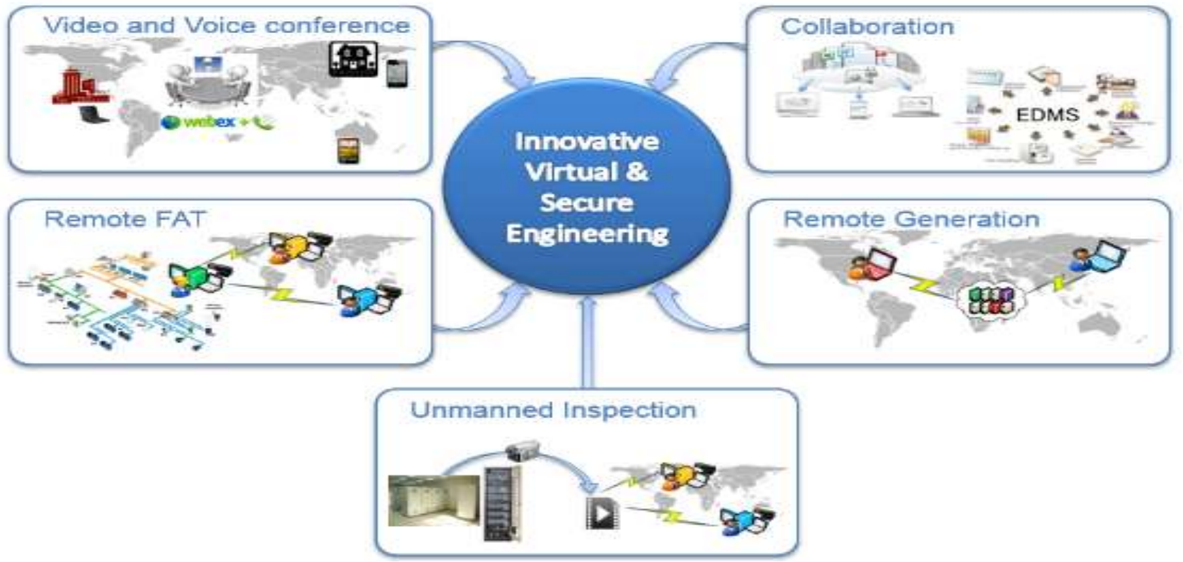
Customer Benefits

- Predictable Engineering, No Engineering Surprises
- Optimize Space Utilization (Power, Weight, Cooling)
- Minimize Travel (Reviews, Testing, Validation)
- SEPARATING LOGICAL FROM PHYSICAL

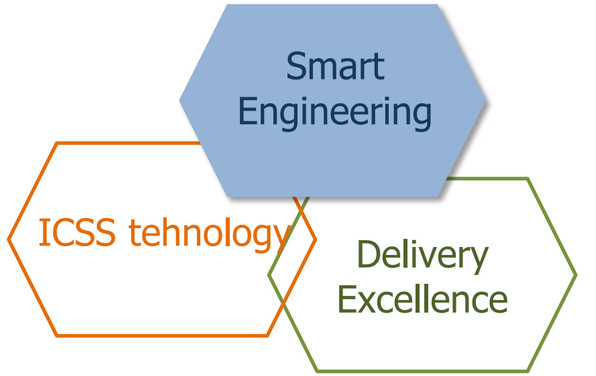


Our Approach

- Module (class) based engineering
- Re-usable Applications
- Standard Panels
- Global PC
- Preconfigured switches
- Virtual (remote) test

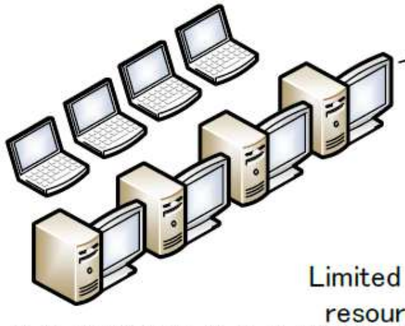


APEX Smart Engineering



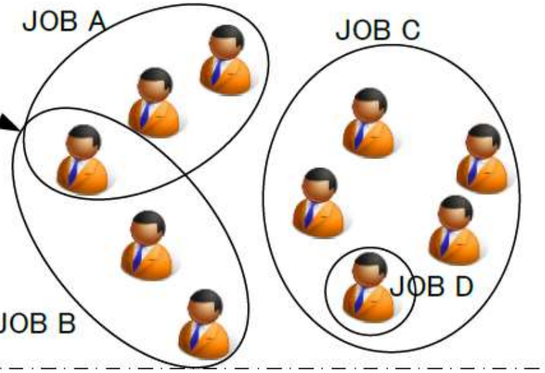
APEX Smart Engineering

Today



Limited H/W resources

Shortages of num of H/W resources
Difference of REV
Schedule adjustment
Maintenance of H/W
Power consumption
Upon finishing the work, need to return resources immediately



Decrease the time and expenses dramatically

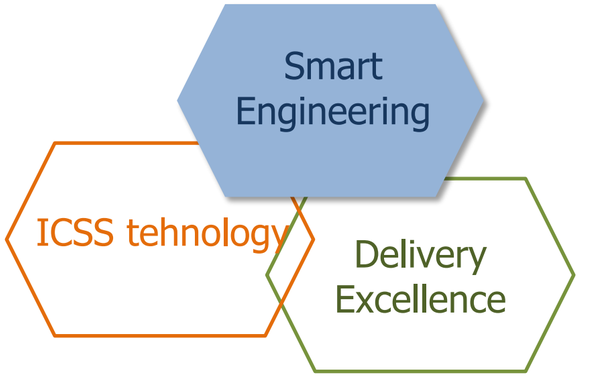
yi-CLOUD

VES

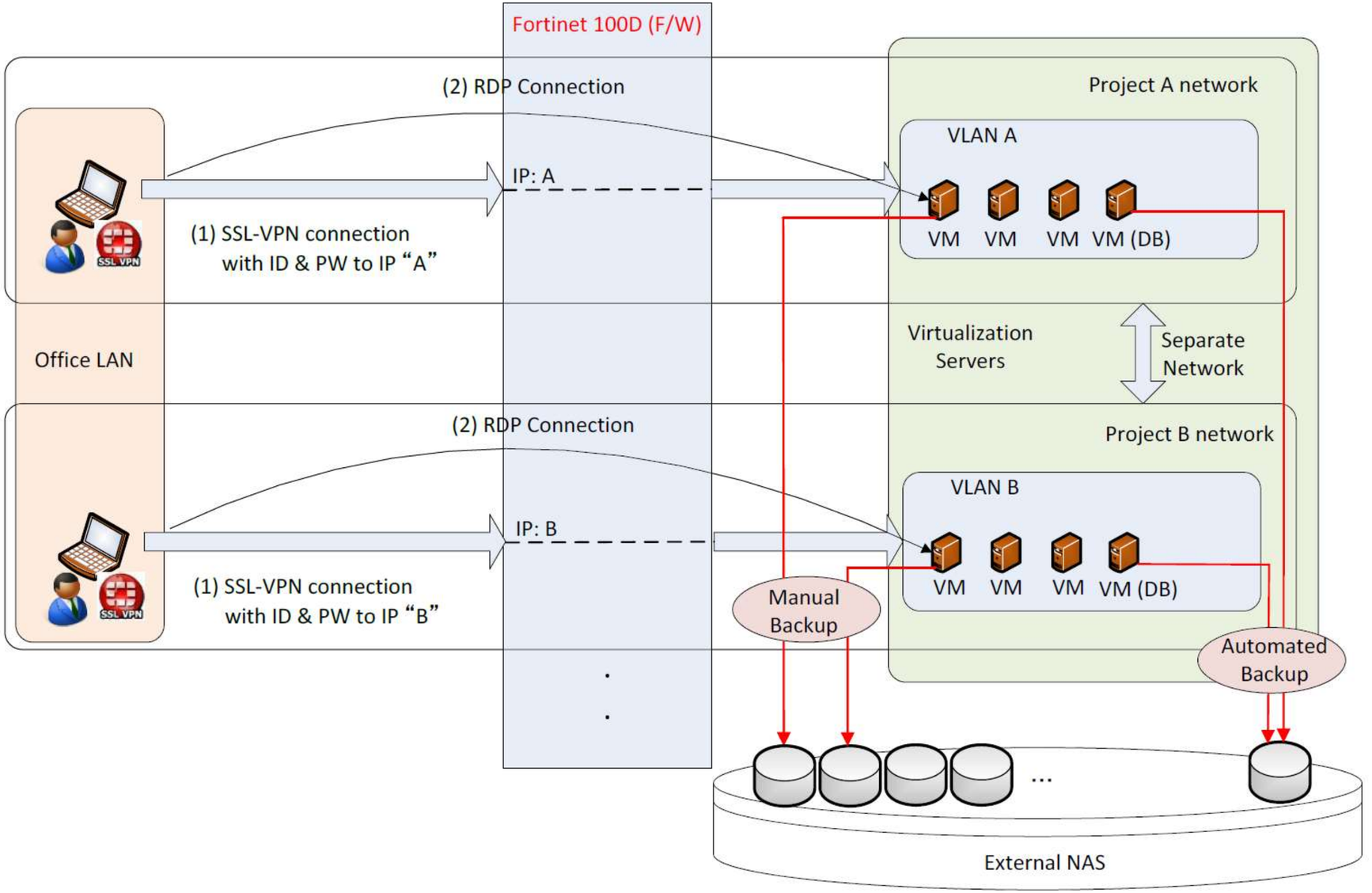
Data Library

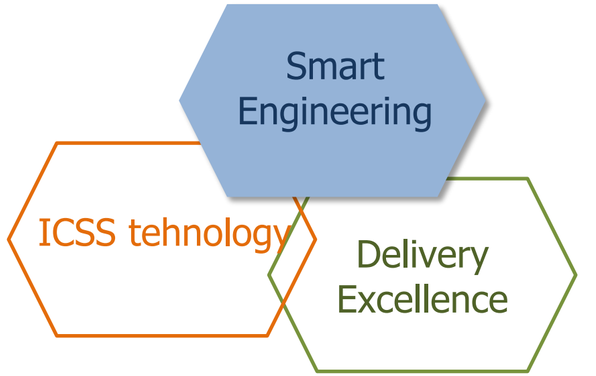
Copy VMs fast & easily
Utilize Data Library
Create more VMs, using less resources,
Save VMs with them being terminated after finishing work,
Simplify administering machines

Remote engineering from his/her own desk.
Utilize multiple VMs (avoid multiple rev issues)
Enable restart/shutdown remotely



APEX Smart Engineering

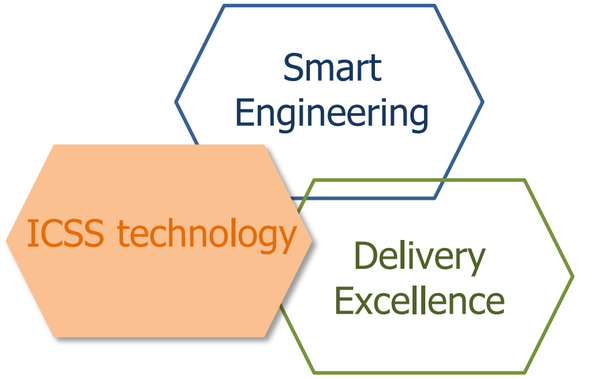




APEX – Technology

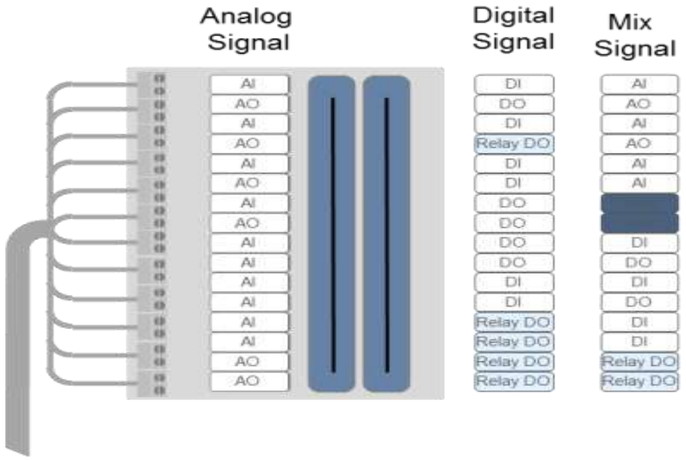
Customer Benefits

- Early Plant Startup
- Easy Modification
- Reduced Footprint



Our Approach

- Network-IO
- System Independent Loop Check (without FCS CPU)
- Flexible Binding at site
- Built-in Management of Change



I/O Backplane

Universal I/O Module

- 16 Channels IO
- Signal: AI/AO/DI/DO
- Software Configurable
- HART 7 Support
- Full Redundancy

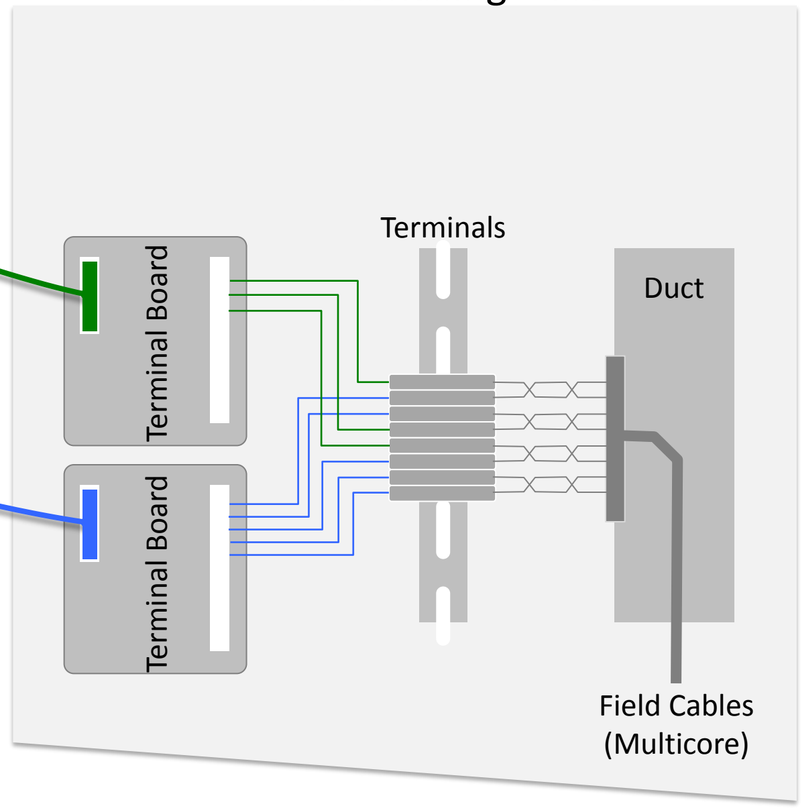
Signal Conditioner (Optional)

- Wide range of I/O
- Pulse, Relay, DO, etc.

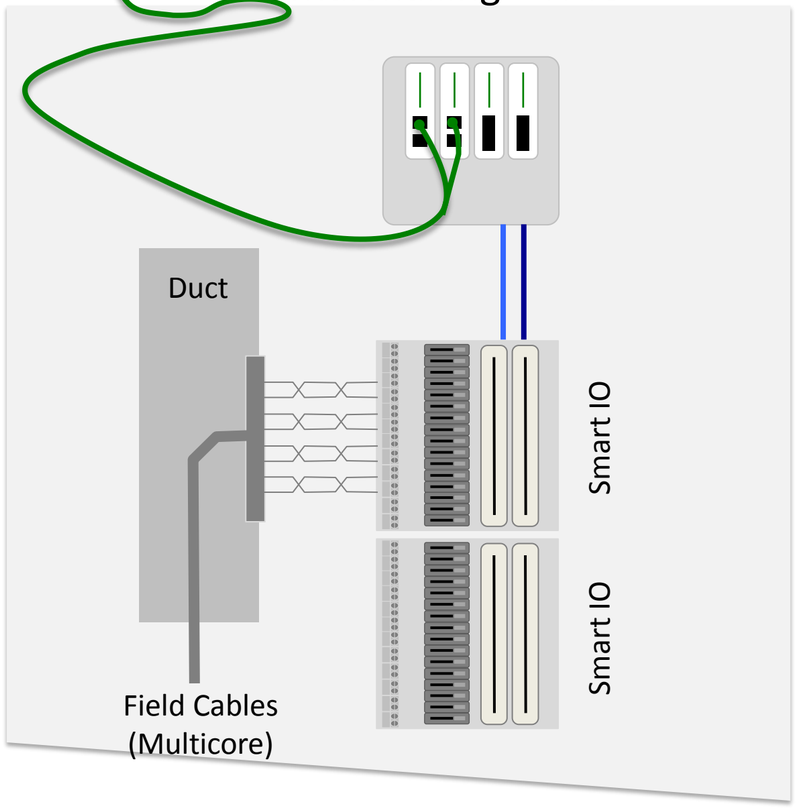
Termination Block

No need for Marshalling Cabinets !

Marshalling – FIO



Marshalling – N-IO



Field Wiring Reduction by Smart JB

Prefabricated
System Cable

Marshalling - **FIO**

Terminals

Terminal Board

Terminal Board

Duct

Homerun
Cable

LCR

Field

Instrument JB

LCR

FO Cable

Field

Smart JB – **N-IO**

Smart IO

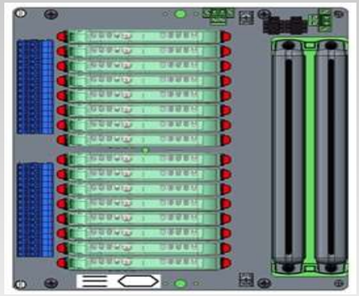
Smart IO

N-IO for Hazardous Applications

Non-IS

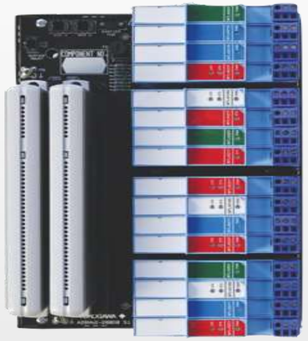
N-IO

Intrinsic safety



IS base plate

H-System



IS base plate

4500 series

Yokogawa

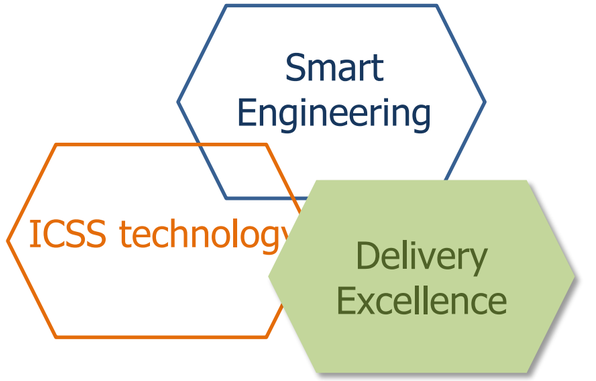
P+F

MTL

APEX Delivery Excellence

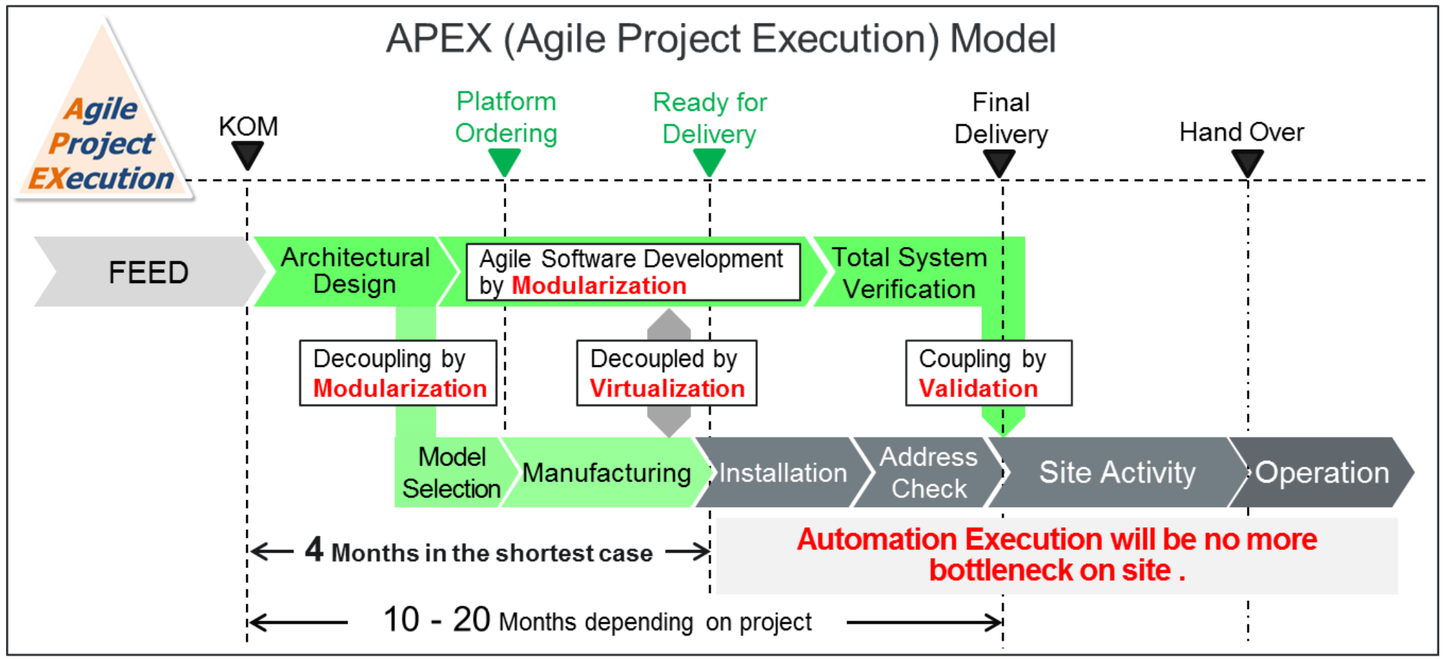
Customer Benefits

- Minimize Waste
- Robust time management
- Validated & Optimized Integration



Our Approach

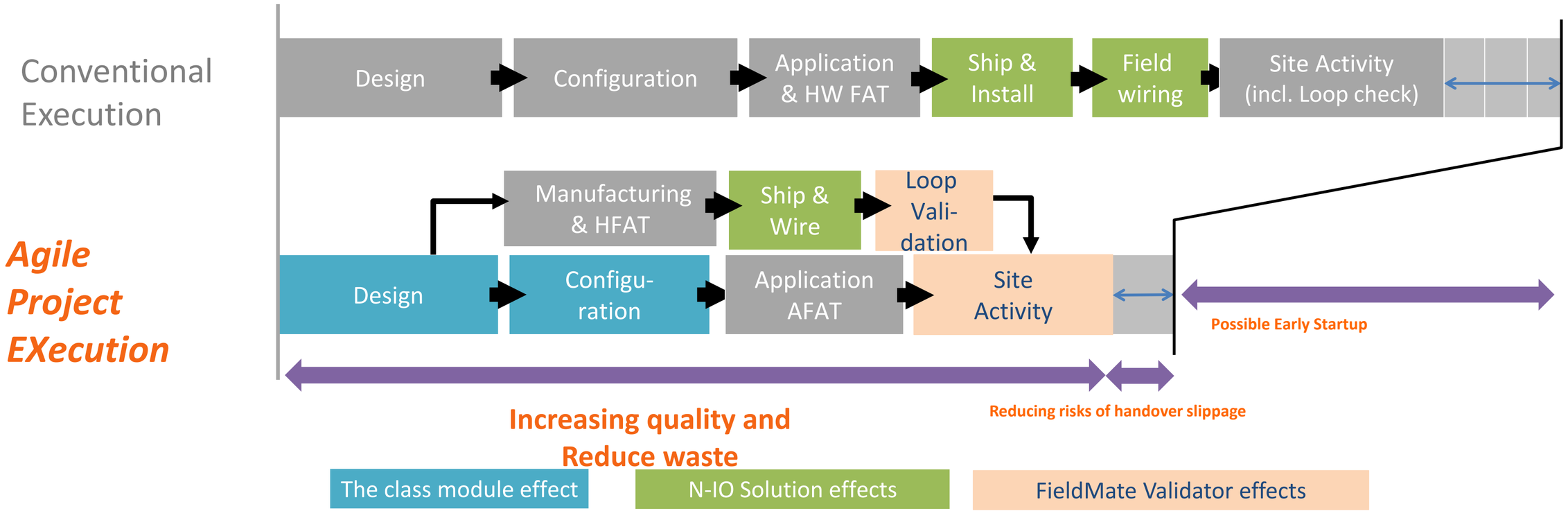
- Consistent Risk Mitigation
  - Standard Panels
  - Global PC
  - Preconfigured switches
- Functional Safety Management
- LEAN execution based on 3R
- Basic Design Toolkit



LEAN: reduce waste through innovation
3R: Right people, Right location, Right timing

Shorter project execution

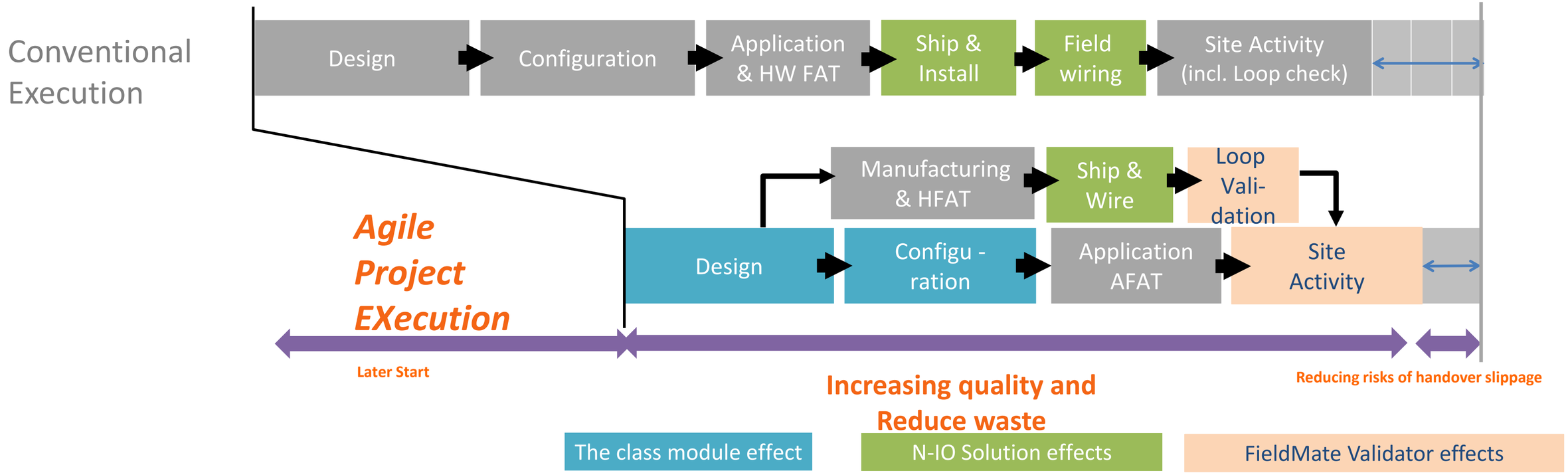
Solution platform
that exceeds the capabilities of
conventional production control systems



HFAT: Hardware FAT
AFAT: Application FAT

Tolerate delays in project execution

Solution platform
that exceeds the capabilities of
conventional production control systems



Tangible APEX Benefits

APEX and how we deliver DIFFERENTIATING value

APEX: Competitive Project Execution model
applicable to all projects

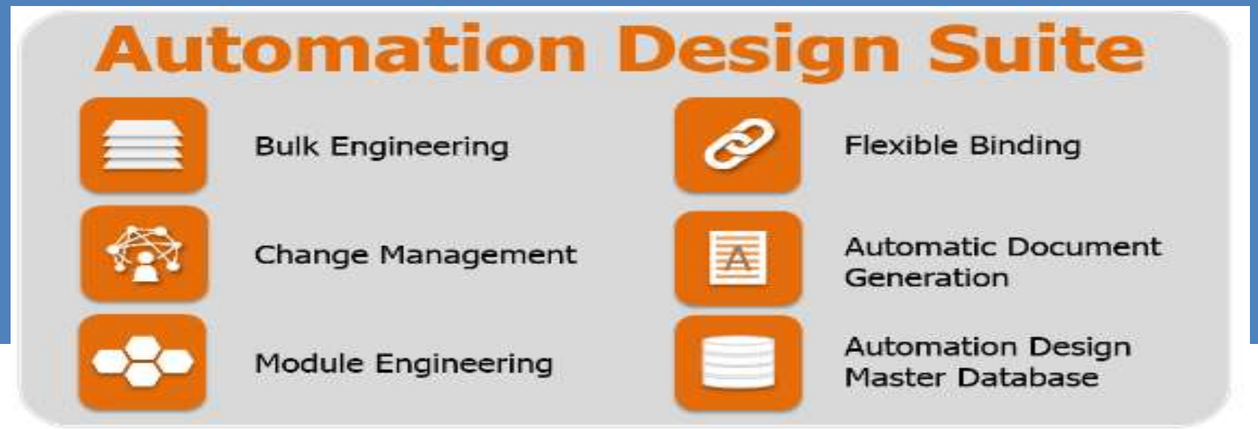
Apex Generation Platform:

ADSuite	Automation Design Suite Master Database
Network-IO	Universal I/O and signal conditioner
Validator	FieldMate Validator N-IO loop commissioning software
Integration	DCS-ESD, DCS-subsystems

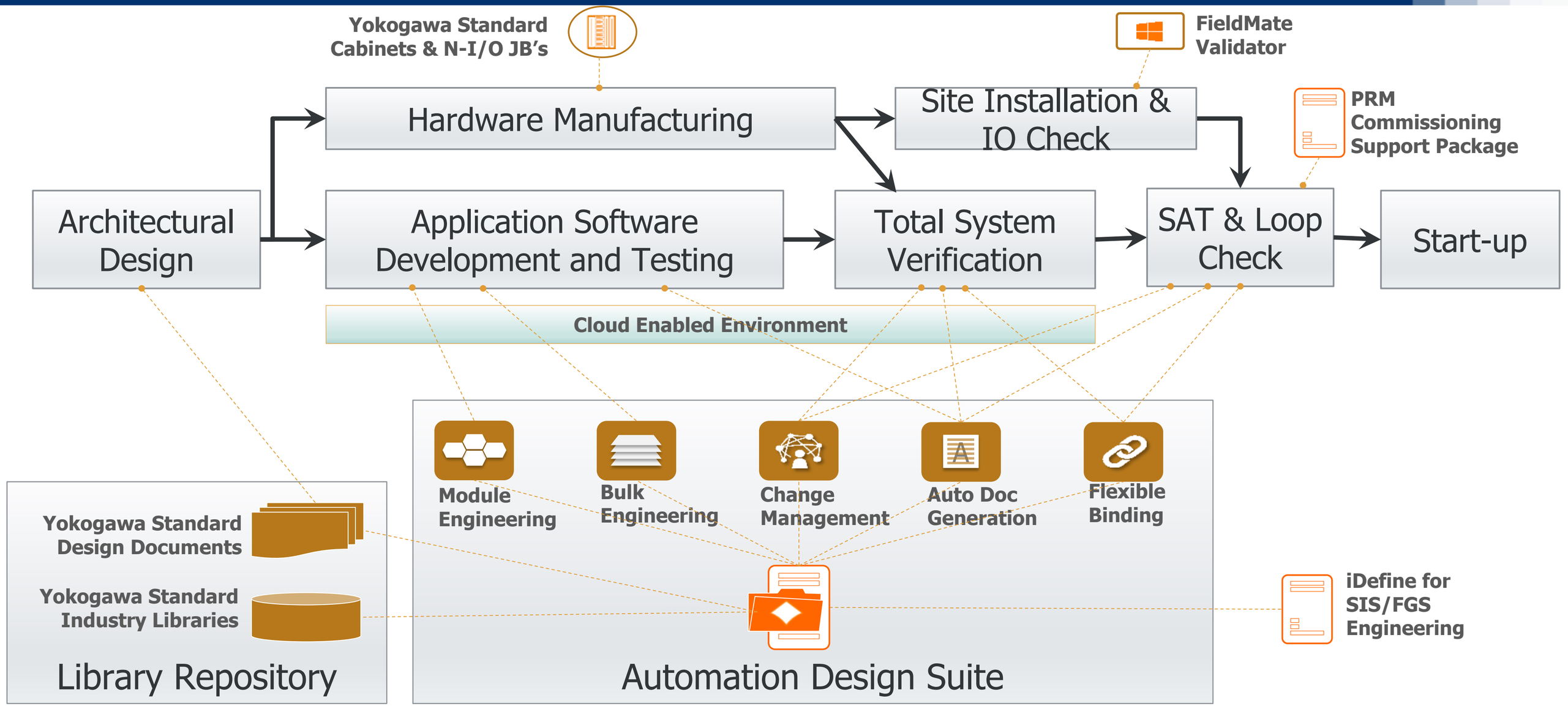
Agile
Project
EXecution

CENTUM VP R6 ADSuite

New Engineering Environment Benefits

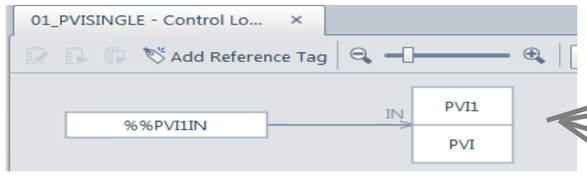


Technologies and tools used in APEX

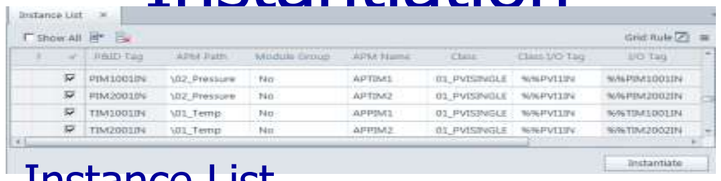


Class, Instantiation, Module binding

Class module

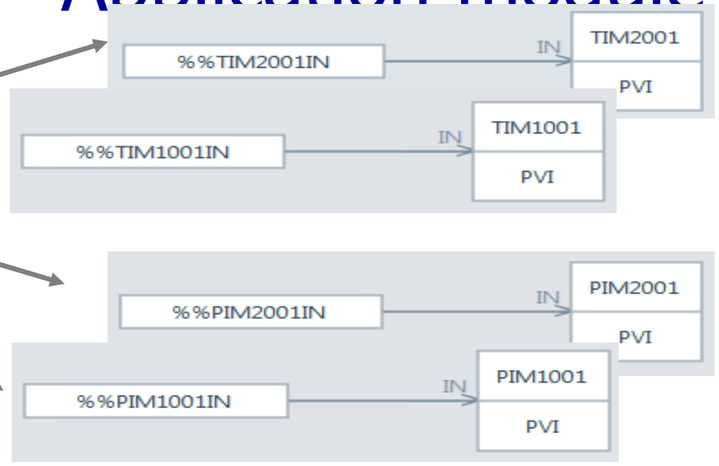


Instantiation

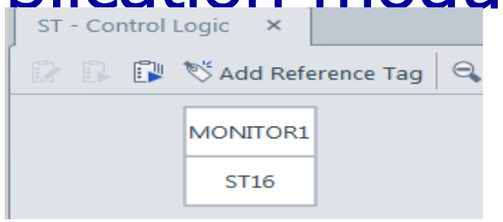


Instance List

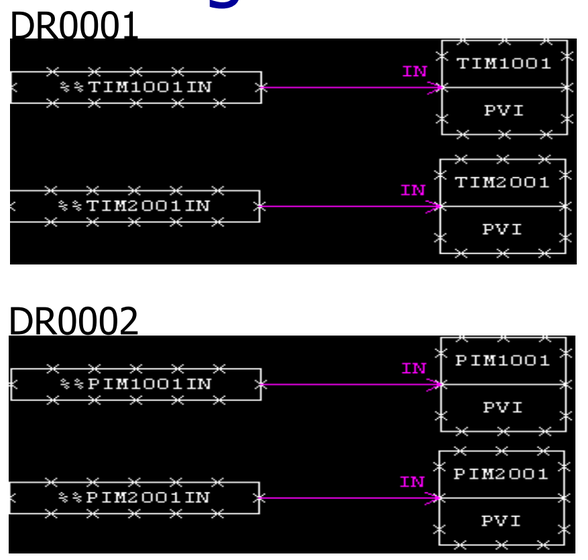
Class-based Application module



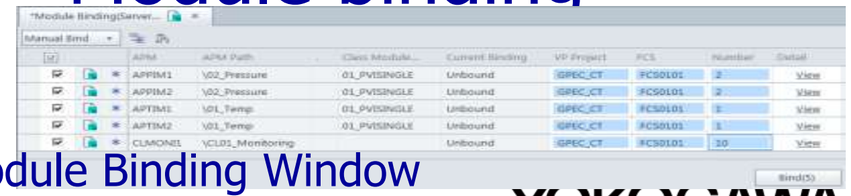
Classless Application module



Drawing module

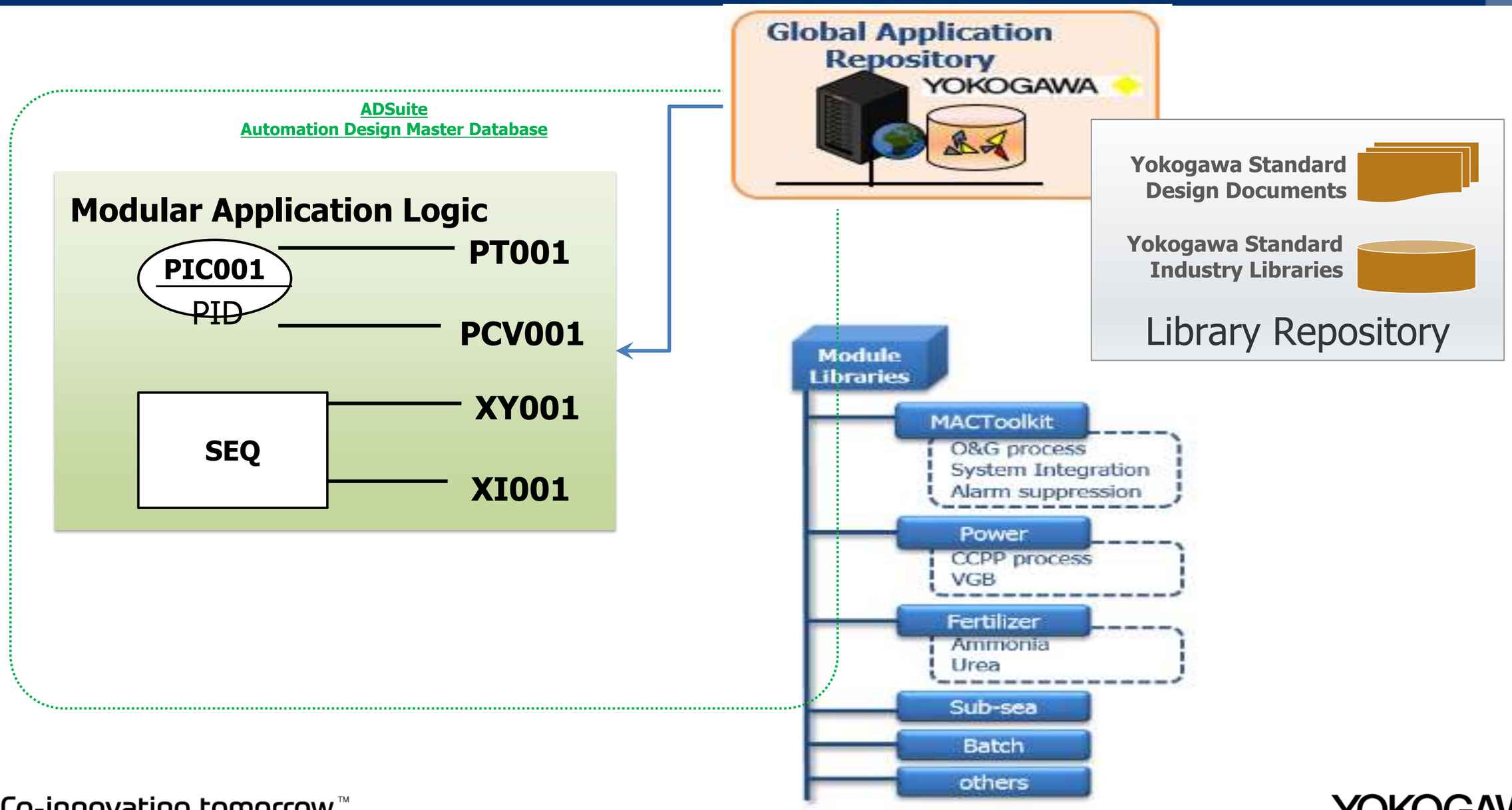


Module binding

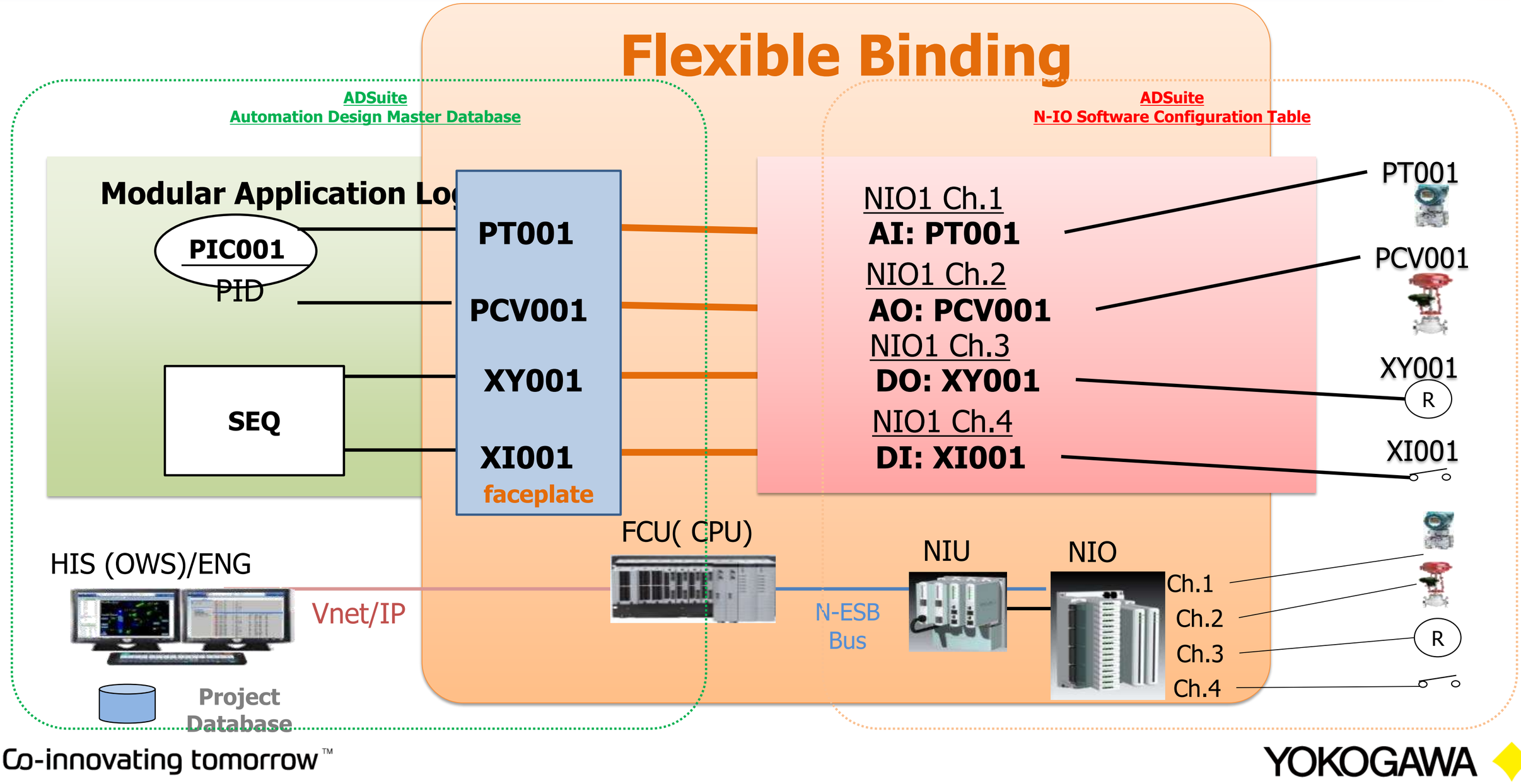


Module Binding Window

ADSuite: Modular Engineering ……. Anywhere

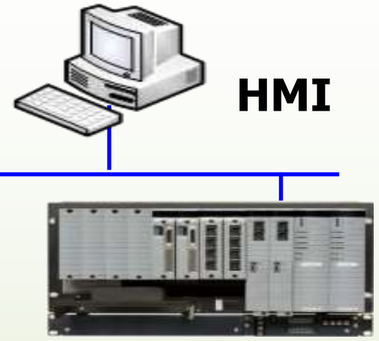


ADSuite + N-IO = Flexible Binding

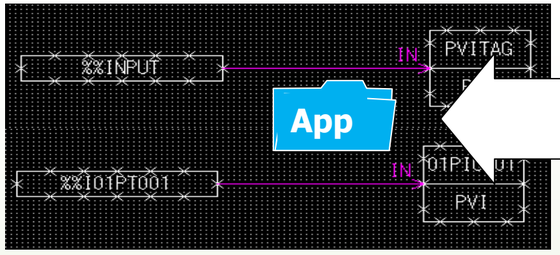


SILC: System Independent Loop Commissioning

Factory work without I/O
- Application coding by using labels
- Application FAT



HMI



Controller

Binding

AD Suite Master Database

STEP 1-4 shows SILC workflow.

STEP 1
Get I/O Tags & information

STEP 4
Return fixed I/O information

STEP 3
Generate reports automatically

STEP 2
Device parameter setting & loop check

Concurrent work

Site work without HMI and Controller
- Install and wiring
- Devices parameter setting
- **I/O check**

N-IO

FieldMate Validator

Avoiding Project Delays

SEE CLEARLY

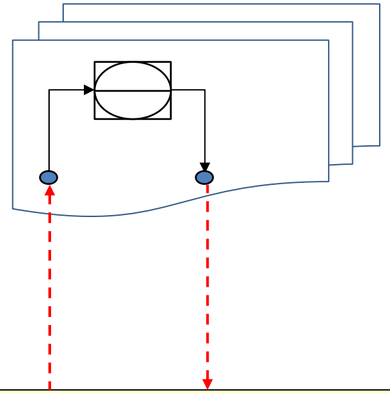
KNOW IN ADVANCE

ACT WITH AGILITY

Reduce delays and be assured of starting production on schedule

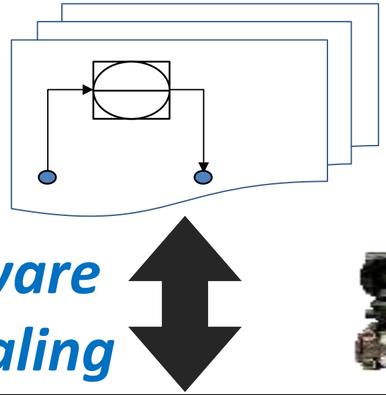
Application validation during FAT

Designed & constructed on site



Virtual I/O wiring

Last minute software marshaling



Smart Configurable IO

Integration

Different Field Digital Communication Protocols

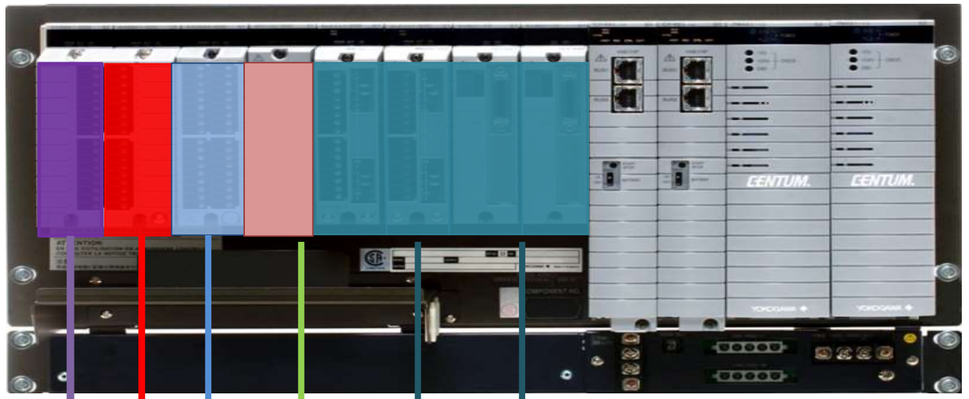
ALP121
PROFIBUS-DP Module

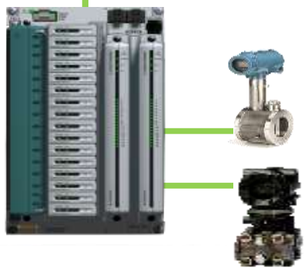
ALF111 FOUNDATION fieldbus Module

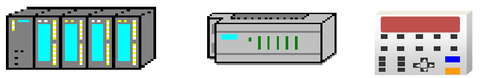
HART I/O Module

A2EN402/404
N-ESB Bus Coupler Module

ALE111
Ethernet Communication Module







Modbus®

EtherNet/IP™

DeviceNet™

PROFIBUS®

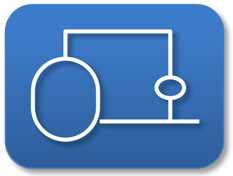
Fieldbus Foundation

HART® COMMUNICATION FOUNDATION

ISA100Wireless

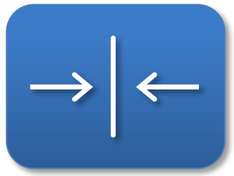
Unified Gateway Station – Seamless Operation

Operate and monitor your sub-systems in **CENTUM**, like **CENTUM**.



Graphic

Trend



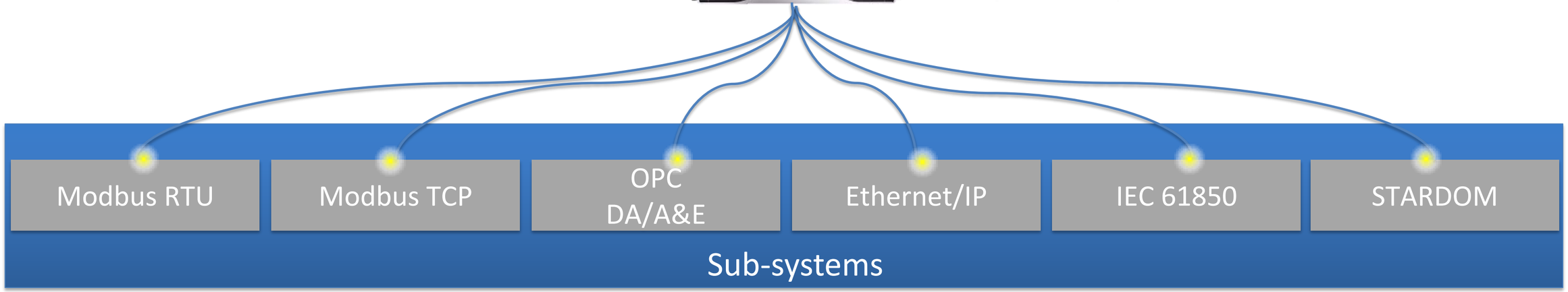
Tuning

Alarms

… and more

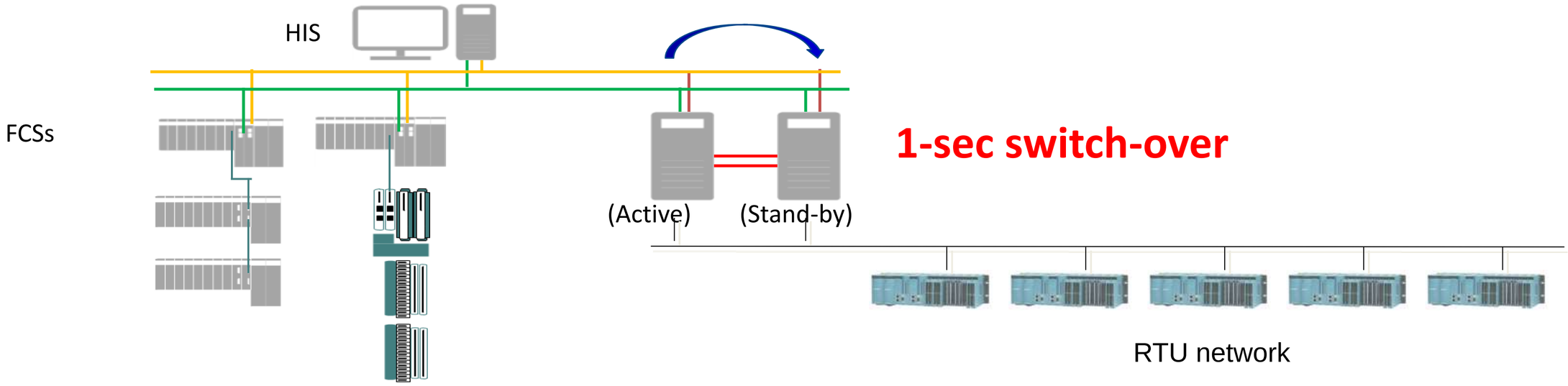
UGS

Unified Gateway Station



UGS Redundant communication

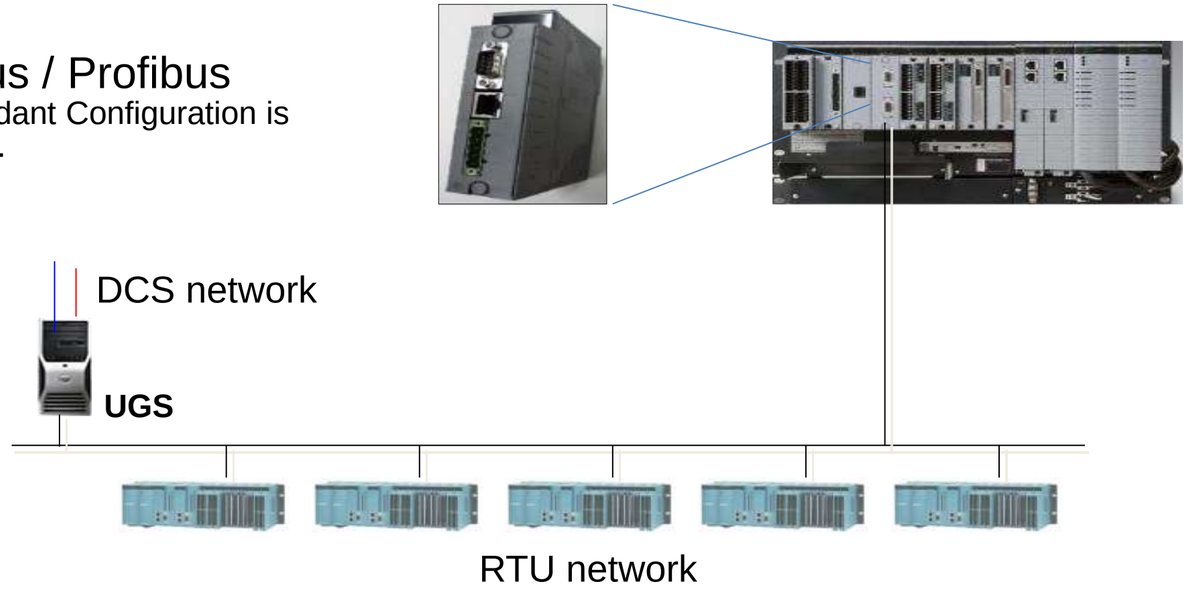
- Simple Architecture
  - Just add one more UGS2 with same configuration (such as Vnet/IP address) for redundant communication.
  - No extra software license is necessary for redundant configuration
  - No FT(Fault Tolerant) Server, no extra L2 switches, no shared disk as HA cluster are necessary



“Optimal” integration with subsystems

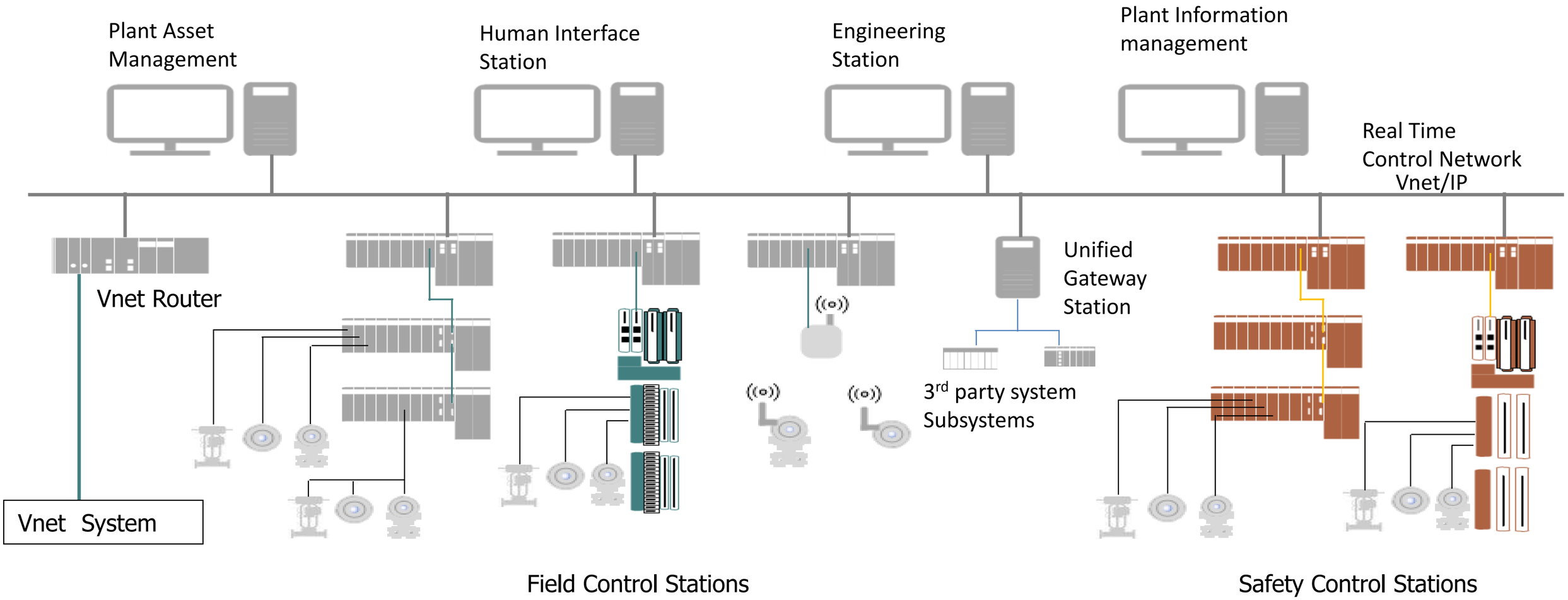
- Sub-system communications
  - Data for HMI: OPC Client (redundant) workstation can manage up to 100,000 TAGs
  - Data for control logic: put (redundant) link module in one rack of the related CPU
  - Integrated Control+Safety system provides optimization + performance at the same time

Modbus / Profibus
- Redundant Configuration is available.



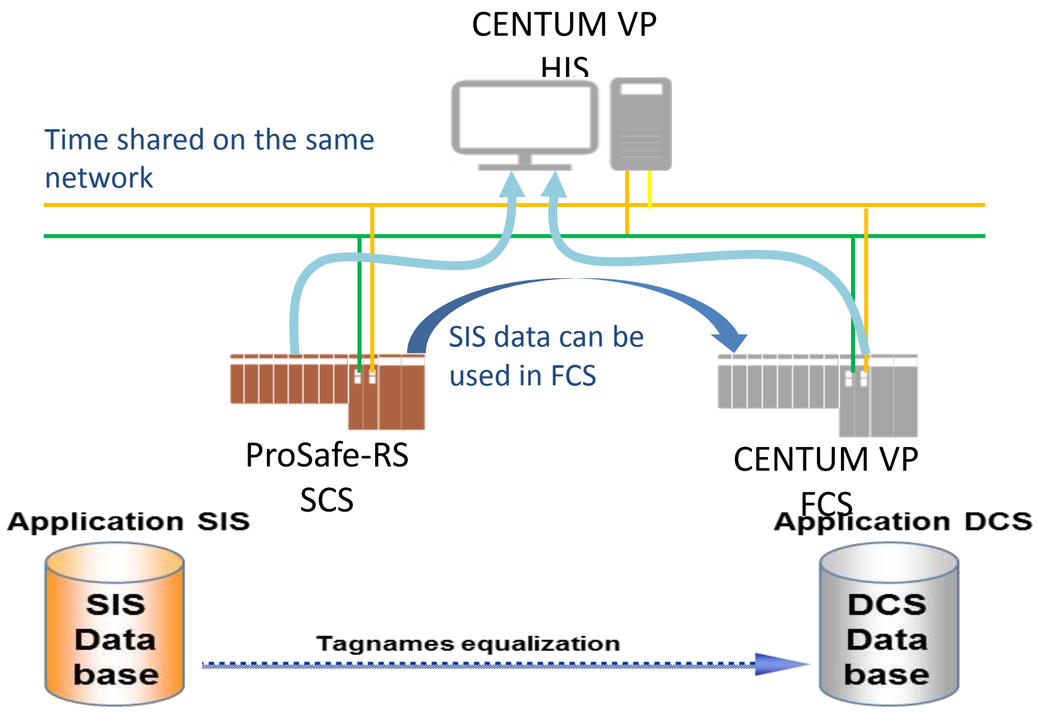
	UGS	Distr. communication modules
Benefits	- Lower Controller CPU load - High throughput - Multiple protocols - A&E by OPC A&E	- Simple reliable industrial solution - Subsystem data directly available in DCS controller for control/logic functions
Drawbacks	- Unreliable IT technology - Subsystem data NOT directly available in DCS controller for control/logic functions	- Affecting Controller CPU load (to be distributed among the DCS controllers) - Not supporting A&E with timestamps

Integration with Safety System



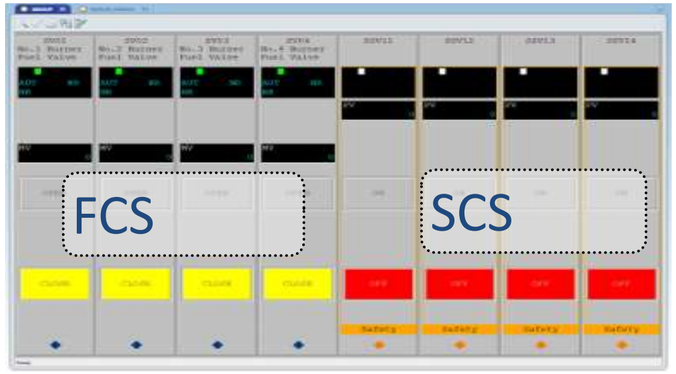
Safety System Integration

- DCS and SIS are 'truly integrated'
  - SIS and DCS data are within the same window
  - SIS data can be used in the FCS
  - Sequence of Event (SOE) data from the SIS and DCS are integrated

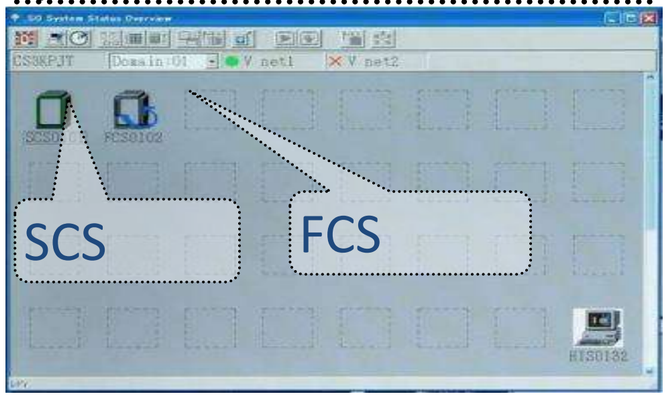


Integrated Monitoring
- Faceplate
- Trend
- Graphic
- System status
- Alarm
- SOE

SCS and FCS Faceplates



System status



SOE Viewer

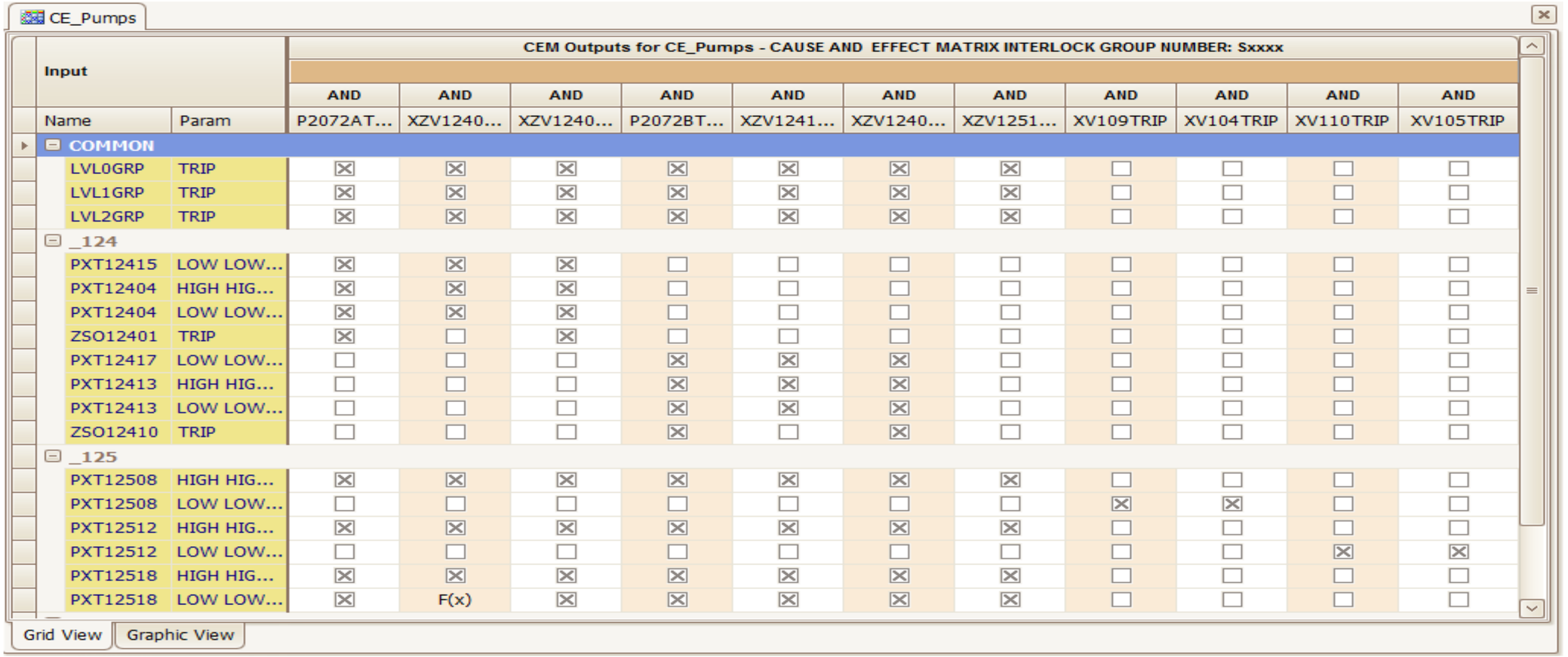
FCS and SCS information integrated

	07/02/09 16:49:35.960	FCS0101:%D...				.7 t/h HI
	07/02/09 16:49:35.960	FCS0101:%D...				.7 t/h HI
	07/02/09 16:49:31.911	SCS0107				
	07/02/09 16:49:31.911	SCS0107				
	07/02/09 16:49:31.911	SCS0107				
	07/02/09 16:49:29.960	FCS0101:%D...	FI307	FI307	Water line 207	PV = 58.5 t/h HI
	07/02/09 16:49:29.960	FCS0101:%D...	FI337	FI337	Water line 237	PV = 58.5 t/h HI
T	07/02/09 16:49:27.911	SCS0107	Burner 3 flame loss	TRUE		
	07/02/09 16:49:27.911	SCS0107	ANN0001	Burner 3 flame loss ALM		
	07/02/09 16:49:24.960	FCS0101:%D...	FI215	FI215		PV = 960.0 t/h HI
	07/02/09 16:49:22.960	FCS0101:%D...	LI202	LI202	Drum Level	PV = -30.0 mm LO
	07/02/09 16:49:14.960	FCS0101:%D...	FI215	FI215		PV = 0.9 t/h HI Recover

16:49:29.960 FCS0101:%D...
16:49:27.911 SCS0107

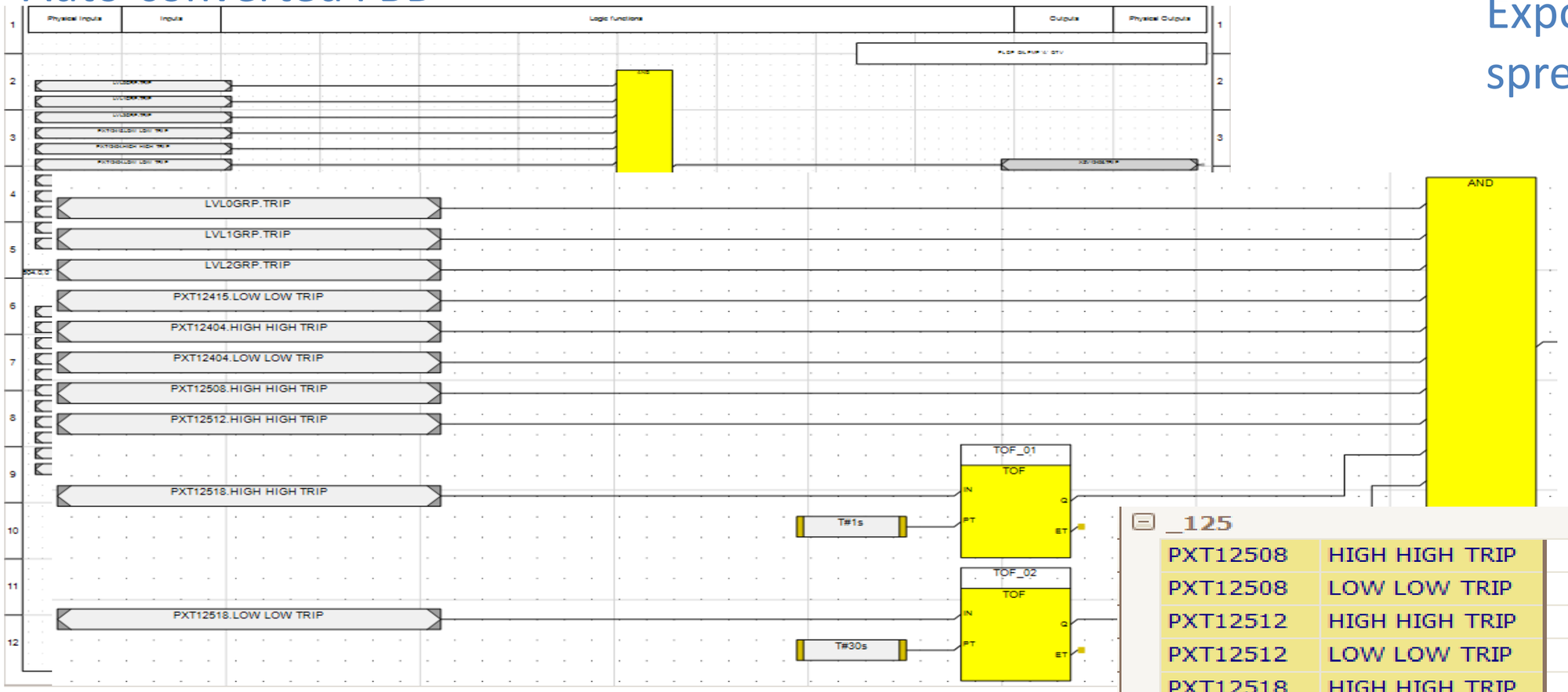
Cause & Effect (C&E)

User can directly implement C&E diagram which is automatically converted into FBD by just clicking ‘Graphic View’ tab.



FBD generated from C&E Module

Auto-converted FBD



Exported to excel spreadsheet

Microsoft Excel 97-2003 Worksheet

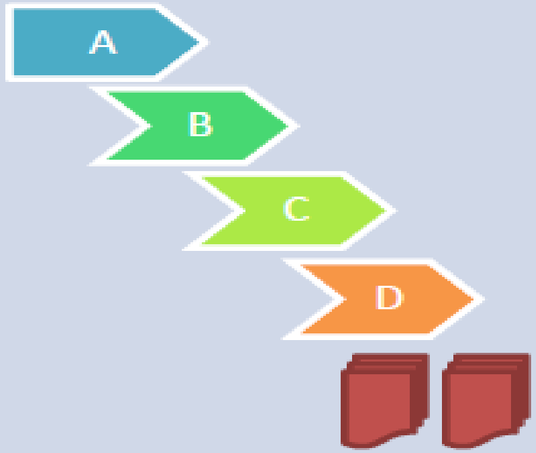
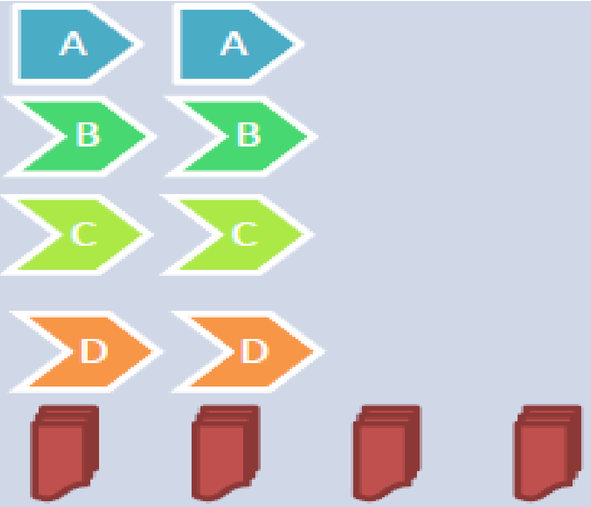
_125			
PXT12508	HIGH HIGH TRIP	☒	☒
PXT12508	LOW LOW TRIP	☐	☐
PXT12512	HIGH HIGH TRIP	☒	☒
PXT12512	LOW LOW TRIP	☐	☐
PXT12518	HIGH HIGH TRIP	☒	F(x)
PXT12518	LOW LOW TRIP	☒	F(x)
XV109_IT	Default	☐	☐

Logic can be added in auto-converted FBD

→ shown as ‘F(x)’ in C&E

Summary

From Waterfall to Agile

WATERFALL	FAST TRACKING	AGILE
		
Scope completely defined at the beginning; Customer and project team have the complete knowledge; Project planned from the beginning; **A unique final deliverable;** **No interaction with the customer**	**Scope** kept **partially open;** **Overlapped phases;** Shorter cycles; More **interaction** with the customer; **Partial deliverables.**	**Scope** kept **open;** Iterations based for **continuous** results **delivery;** **Team integrates the customer;** Focus on **delivering value to customer;** **Team** made up of individuals with **cross-functional skills, self-organized**

Source: laSalle Almere

Conclusion: APEX Value by phase

Project
Lifecycle

yi-MAC
Innovative MAC

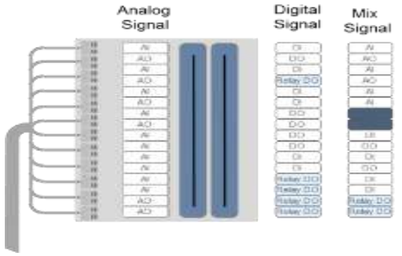
APEX
Agile Project Execution

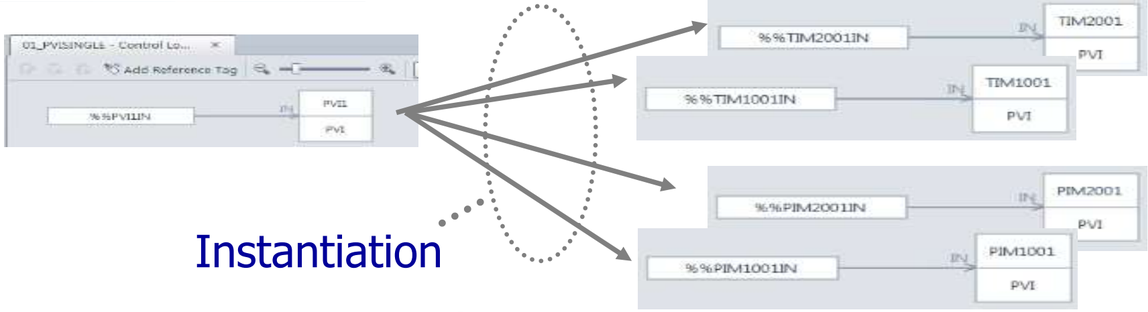
- ICSS technology
- Smart Engineering
- Delivery Excellence

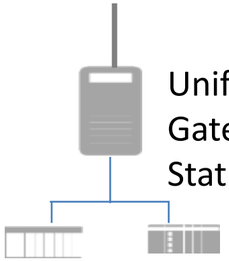
FEED	Execution	Testing / Commissioning	Operations
○ Single Point of Responsibility	○ Optimize Total Automation Investment ○ Improve Project economics	○ Flawless Start-up & Commissioning ○ Flexible binding	○ **Reduce Total Cost of Ownership** ○ Maximize Lifecycle value
○ **Standard** Design of Cabinets, reduced Rack-room space ○ Standard Functional Design of Application ○ Standard Design of smart JB's, optimized cable routing	○ **Reduce** Execution **dependencies** ○ Getting ICSS off from Project critical path ○ Optimize project execution in terms of timelines and effort ○ **Reduce** engineering **complexities** and improved quality ○ **Simplify** documentation ○ Reduced footprint and cabling related work ○ Reduce travel	○ More time for Application software and System (CPU) cabinets shipments ○ **Reduce** construction and **Commissioning** effort ○ Ease of Bulk changes , **Management of change** ,Auto documentation etc. ○ Shorter **loop checks** and standard commissioning procedures	○ Reduce maintenance effort ○ Maintain latest documentation

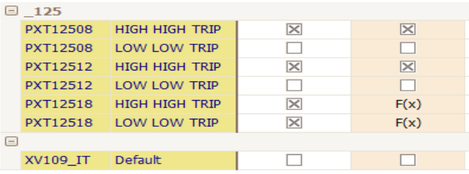
ICSS for APEX: Overview

- N-IO, AD-Suite, FM-Validator
  - Flexible Binding
  - SILC: System Independent Loop Commissioning
  - Smart Junction Box
- AD Suite
  - Module based engineering
  - Separation between logical and physical
  - Bulk Generation
  - Auto Documentation with Module
  - Industry Library (DCS/SIS)
- Standardization
  - Standard Cabinet / Hardware Design
  - Global PC
  - Preconfigured network Switches
- Integration
  - Smart and flexible integration with subsystems (UGS)
  - Complete DCS-SIS integration (CentumVP+ProsafeRS)
  - Easy configuration from C&E diagrams (iDefine)
  - Structured Systematic Approach for FSM requirements (Yokogawa)









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PXT12508	HIGH HIGH TRIP	☒	☒
PXT12508	LOW LOW TRIP	☐	☐
PXT12512	HIGH HIGH TRIP	☒	☒
PXT12512	LOW LOW TRIP	☐	☐
PXT12518	HIGH HIGH TRIP	☒	F(x)
PXT12518	LOW LOW TRIP	☒	F(x)
XV109_IT	Default	☐	☐

Co-innovating tomorrow™

Thank you

Any question ?