MODULAR ENABLED SOLUTIONS FOR THE PROCESS INDUSTRY

David Funderburg, Global Technology Manager
Chemicals and Refining

ISPE Boston Area Chapter Product Showcase
September 18, 2019
MODULAR ENABLED SOLUTIONS FOR THE PROCESS INDUSTRY
Modular enabled solutions for the process industry

Speaker

David Funderburg
- Global Technology Manager
- ABB
- Cleveland, Ohio
Mission of session

Points of value

1. Provide an introduction to modular automation
   - What?

2. Provide details on how modular automation is engineered
   - How?

3. Provide the value of modular automation
   - Why?
The Age of Modular Production

Background

Disruptive Trends

- Business is based on the automation pyramid for decades
- Disruptive trends have strong impact on this architecture

Problem

This threatens conventional business

Customers actively drive those trends – with or without the established technology providers!
Modular Automation
Paradigm Change

World Scale Plants & Multi-Purpose Plants

Industry feedback:
64% of projects today are facing cost overruns
73% are reporting schedule delays

Modular plants

World scale production.... Large modules including modular equipment

Flexible production....individual modules to scale up and re-configure

Today

Tomorrow
Modular Automation
Paradigm Change

World Scale Plants & Multi-Purpose Plants

Modular plants

Today

Tomorrow
Modularization Use Cases

Why Modular Plants? To Cut Cost, Schedule, Risk

Significant capital project costs are reported by industry are due to monolithic automation design concepts for greenfield applications.

- **64%** of projects today are facing cost overruns
- **73%** are reporting schedule delays

Two Use Cases to consider:

- **World scale Facilities**...cost to integrate multiple pieces of process equipment/skids that already include existing automation from various vendors can be a significant percentage of the overall automation budget, plus it’s difficult to forecast (cost of late changes from skid packages).

- **Multipurpose Facilities (Plug&Produce)**...Existing production facilities cannot quickly adapt to new product demand (volume increases or product types) without significant costs to integrate new equipment.
Current Optimization of Project Execution prior to Modular...

Intelligent Projects for World scale facilities

Intelligent projects. Cut cost, schedule and risk.

Intelligent projects transform the speed and quality of project execution through single-source integration of power, automation and telecommunications systems.

- 25% quicker schedule completion
- 20-30% reduction in CAPEX and OPEX
- 60% space savings
- 40% fewer start-up and installation hours
The Age of Modular Production
Disruptive Trend: Modularization

**Driving Forces**

- **Industries:**
  - Chemical, Special Chemical, Fine Chemical
  - Pharmaceutical, Life Science, Oil & Gas

- **Involved Customers:**

  - ExxonMobil
  - BASF
  - Bayer
  - Evonik
  - Merck

- **Market Situation:**
  - Shorter product lifecycle required faster time-to-market
    - Requirement: Flexible, but efficient production facilities

**How to tackle?**

- Vendor’s are cooperating with end-customers on this topic
- ABB is actively involved in 6 pilot applications

**Market voices:**

- Peter Lotz, Merck ‘16: “This is the future of process control”
- Ulrich Christmann, Bayer ‘17: “Modular production is a cornerstone for Industrie 4.0, IoT and IoS”

---

ARC Advisory Group expects that 20-25% of today’s market will move towards modular production!
Bayer Testimonial
Life Science client

Client feedback
Dr. Torsten Knohl, Senior Project Manager, Bayer AG: “We will move from monolithic automation systems for a complete production plant to a more flexible and service oriented plug and produce solution. We will gain fast implementation of production, be able to scale the capacity by numbering up and down the production according to the market, and also improve the capability and speed of product changes. In life sciences the production is now more focused on the patient and the given problem with personalized medicine. The products are no longer a commodity and we move towards very small batches. With the technology and early adoption of the idea of modular automation ABB is the right partner in this area.”

Modular Automation is very important for future production plants and the cornerstone for IoT and Industry 4.0.
BASF – ‘Plug & Produce’ at ARC 2019
Fluor – a global lead in modular construction

Fluor is a global leader in modular construction and one of the first engineering and construction companies to realize the benefits of this approach for our Clients. We have provided modular construction solutions to Clients in the Oil and Gas industry for more than 40 years, executing over 250 module projects globally.
Sadara – world's largest petrochem complex built in one phase

Where could have Modular Automation helped????

**Distributed Automation**

- System network
  - Field network
    - Power automation
    - Process electrification
    - Process instrumentation
    - Safety
  - Local operation
- Operations
- Maintenance

**Sadara Facts**

- 18 distributed control systems over 150,000 I/Os
- 260 redundant controllers, 450 servers and 260 workstation
- 40 Operator consoles across 5 control operator buildings
Sadara – world's largest petrochem complex built in one phase
Where could have Modular Automation helped??
Orchestration of Modular Process Plants

Views of Modular Process Plants

Source: ZVEI presentation
Process INDUSTRIE 4.0: The Age of Modular Production

Modular Automation with Module Type Package (MTP) - a standardized non-proprietary description of modules for the Process Automation.
**Modular Automation**

ABB Web

**Process Orchestration**
Combines the MTPs into a system

**Module Type Packages**
Freely choose the MTP packages from suppliers

---

- Reduced non-standard interfaces
- Reduced commissioning time
- Reduced engineering time
- Better trouble shooting
- Reduced integration time of 3rd party systems

---

Orchestration layer
Operations
Supervisory control

Module layer

Open architecture network

MTP

---

ISPE
Moving towards modular automation for higher flexibility
Intelligent modules with Services, described in Module Type Packages (MTPs)
Moving towards modular automation for **simplified integration**

Mixed architecture

Diagram showing connections between various networks and systems, including:
- System network
- Field network
  - Power automation
  - Process electrification
  - Process instrumentation
  - Safety
- Local operation
- Maintenance
- Operations
- MTP
## Modular automation integration savings

**Integrating intelligent modules**

<table>
<thead>
<tr>
<th>Integrate Intelligent Module via OPC fieldbus</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Solution:</strong> Integrating Intelligent Modules with PLC via OPC with 70 Tags in average</td>
</tr>
<tr>
<td><strong>Integration effort:</strong> about 5h per module</td>
</tr>
<tr>
<td>System 800xA software with basic connectivity</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Integrate Intelligent Module via Modular Enabled Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Solution:</strong> Integrating Intelligent Modules via Modular Automation with 70 Tags in average</td>
</tr>
<tr>
<td><strong>Integration effort:</strong> about 1h per module</td>
</tr>
<tr>
<td>System 800xA Orchestration software with Modular Enabled Connectivity</td>
</tr>
<tr>
<td>➔ 25% cost savings</td>
</tr>
</tbody>
</table>

25% cost savings
Automation for Modular Plants
System architecture

Orchestration layer
- Engineering & Maintenance Module Integration (Plant Configurator)

Module layer
- Engineering & Maintenance Module Integration (Plant Configurator)

Operations
- Controller
- via OPC UA to Module Integrator

Supervisory control
- Controller
- via OPC UA to Module Integrator
- 3rd party PLC

MTP: Modular Type Package
Module Designer – Module Engineering - Overview
Module Designer – HMI Definition

- **HMI**
- **Tag**
- **Services**

**Key Features**

1. **Draw module graphic based on standard elements**
2. **Define default values for each element**
Module Designer – Tag Definition

Select CDT representation of this Tag

Define default values for each CDT
Module Designer – Service Definition

- Create services based on default state machine
- Define service parameter
- Define actions for each step in state machine
Orchestration Designer – Plant Owner - Overview

Process design / Module selection
- MTP Import
- Topologie
- Service Orchestrierung

Module preparation
- Wiring
- Validation

Selection of orchestration platform
- ABB 800xA
- APROL Runtime

SET UP
Orchestration Designer - MTP Import

Import MTP-Files
Orchestration Designer – Topology Definition

Module type library -> one click import of MTP

Plant structure definition via drag and drop

OPC UA server address
Orchestration Designer – Process Flow Definition

- Creation of the recipe structure
- Configuration of service commands
- Parameters for selected service

Diagram showing the process flow with steps like Start, Dose, and End, along with parameters for selected services.
Focus on your core business
Increased efficiency and reduced risk

With modular automation it’s possible to focus on the core business of production and outsource the module handling:

- Reduced risk with deeper expertise
- Reduced commissioning time
Optimized production
Increased efficiency and reduced risk

- Easily integrated modular package units for optimized overall production
- Each module can be optimized individually which saves time and money
- Better trouble shooting
Supplier flexibility
Increased efficiency and reduced risk

**Standardized technology provides:**
- Cost and risk reduction
- Reduced integration time
- Less support and troubleshooting required

**Advantages - module vendors**
- Improved quality
- Improved service
- Increased scope of delivery (e.g. intelligent modules, additional services)
Lower life cycle costs
Reduced total cost of ownership

Lifecycle upgrades can be done in smaller granularities:

- Improved flexibility
- Reduced time and effort
Moving Capex to Opex
Reduced total cost of ownership

- To reduce initial investment and risks
- Modules can be added for specific time period or permanently
Modular Automation
Summary

Focus will continue to be on **Cutting cost, schedule, and risk**

Modular Automation delivers the next step change to reduced investment cost on both

1. **World-Scale-Plants**
2. **Multi-Purpose**

Modular Automation is the next step towards plug & produce

**Modular Automation is THE engineering Digital Use Case in process industries**
## Mission of session

### Points of value

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>What?</td>
<td>How?</td>
<td>Why?</td>
</tr>
<tr>
<td><strong>Provide an introduction to modular automation</strong></td>
<td><strong>Provide details on how modular automation is engineered</strong></td>
<td><strong>Provide the value of modular automation</strong></td>
</tr>
</tbody>
</table>
Q&A and contact information
If you have questions, please contact me further

Speakers
David Funderburg
- ABB
- +1.440.585.7066
- David.Funderburg@us.abb.com

Dean Hammond
- ABB
- +1.609.980.7523
- dean.r.hammond@us.abb.com

Gero Lustig
- ABB
- +496213811722
- gero.lustig@de.abb.com

Michael Cataldo
- ABB
- +1.339.927.2651
- michael.cataldo@us.abb.com

Other contacts