T52: Case Study: How FactoryTalk Products Created Success

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Ryan Campbell
Jeremy Hammons
How FactoryTalk Products Created Success

1. Introduction
2. Project Overviews
3. Software
4. Connectivity
5. Redundancy
6. Questions
nne pharmaplan

• **Full-service pharmaceutical engineering and consulting firm**
  – Automation and Controls Integration
  – Electrical Controls and Instrumentation
  – Manufacturing Execution Systems, Manufacturing Intelligence
  – Process and Mechanical
  – Quality and Validation Assurance
  – Architectural and Building Engineering
  – Clean Room Testing
  – Project Management

• **Introduction**
  – Steve Marino, Automation Manager South East
  – Ryan Campbell, Automation Engineer
  – Jeremy Hammons, Automation Engineer
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Project Overviews

- **Greenfield Project, new facility, no existing control system**
  - **Software:**
    - FactoryTalk View SE (Redundant servers Marathon EverRun Virtual software)
    - FactoryTalk Historian
    - FactoryTalk VantagePoint
    - RSLogix 5000
    - GEMS Modules

- **Expansion Project, existing facility, some existing controls**
  - **Software:**
    - FactoryTalk View SE (Redundant servers Marathon EveRrun Virtual software)
    - FactoryTalk Historian
    - FactoryTalk VantagePoint, Factory Talk Metrics (OEE)
    - RSLogix 5000

- **Upgrade Project, existing facility, replace existing controls**
  - **Software:**
    - FactoryTalk View SE
    - OSI Pi (existing)
    - Win 911
    - RSLogix 5000 (Redundant Controllers)
    - GEMS Modules

- **Three very different types of projects with different requirements, but all used the same tools and software from Rockwell Automation.**
How FactoryTalk Products Created Success
Project Overviews (Greenfield Architecture)
How FactoryTalk Products Created Success
Project Overviews (Greenfield Software)

• Domain Controller
  – Security services for the servers, PC, SCADA HMI’s and Panel View+
  – Time Sync

• Redundant HMI Server
  – HMI Screen server
  – Marathon EverRun virtual software
  – RSLinx Enterprise
  – FT Live data server
  – FT alarm and events
  – FT Historian collectors (Store Forward)

• Historian Server
  – Time-series database

• Vantage Point server
  – WEB server for office data viewing

• FTVIEW SE Clients
  – Local screen cache

• ControlLogix Controllers
  – FT Live Data
  – Alarm data (ALMD’s)
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Project Overviews (Expansion Architecture)
How FactoryTalk Products Created Success Project Overviews (Expansion Software)

- **Domain Controller**
  - Security services for the servers, PC, SCADA HMI’s and Panel View+
  - Time Sync

- **Redundant HMI Server**
  - HMI Screen server
  - Marathon EverRun virtual software
  - RSLinx Enterprise
  - FT Live data server
  - FT alarm and events
  - FT Historian collectors (Store Forward)

- **Historian Server**
  - Time-series database
  - PI to PI interface with Historian ME

- **Vantage Point server**
  - WEB server for office data viewing
  - FT Metrics (OEE)

- **FT View SE Clients**
  - Local screen cache

- **ControlLogix Controllers**
  - FT Live Data
  - Alarm data (ALMD’s)
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Project Overviews (Upgrade Architecture)
How FactoryTalk Products Created Success
Project Overviews (Upgrade Software)

- **Domain Controller**
  - Security services for the servers, PC, SCADA HMI’s and Panel View+
  - Time Sync

- **HMI Server**
  - HMI Screen server
  - RSLinx Enterprise
  - FT Live data server
  - FT alarm and events

- **Historian Server**
  - Time-series database

- **Pager PC server**
  - Win-911 Alarm messaging software

- **FT View SE Clients**
  - Local screen cache

- **ControlLogix Controllers**
  - FT Live Data
  - Alarm Data (ALMD’s)
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- Redundant Cisco 3750 Main switches mounted in IT switch closets
- Redundant Cisco 2960 server switches mounted in IT server room for connections to the server equipment
- Rockwell Stratix 8000 Managed Distribution switches mounted in SS cabinets thru-out the facility for connections to the process equipment
- The Stratix 8000 switches use the Cisco IOS and can be expanded to 24 ports, they come in fiber and copper combinations
- The set up and configuration of the stratix switches to the Cisco hardware was seamless and created a unified network that can be easily maintained
- The use of redundant switches and cabling between the main switch stacks gives us the reliability needed for the process control
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Project Overviews (Network Details SCADA)

• Physical connection drawing of the first floor components
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Project Overviews (Network Details Device Level Ring)

- Physical connection drawing showing SCADA network and redundant devices level ring

- Redundant controllers connected to remote racks

- 1756-EN2TR Ethernet modules in the controller rack

- 1783-ETAP switches for connections to remote racks

- Disconnection of any one segment does not affect the system

- The use of the redundant network met the customer requirements for reliability and uptime.
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1. Introduction

2. Project Overviews

3. Software

4. Connectivity

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Software Overview

- **Software**
  - FactoryTalk View SE
    - HMI SCADA
  - RSLogix 5000
    - Process Automation controller programming software
  - GEMS
    - Rockwell Automation library of pre-engineered, pre-built, pre-tested, validated modules.
  - FactoryTalk Historian
    - Historical data collection
  - FactoryTalk VantagePoint
    - Data Visualization and Reporting tool
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FactoryTalk View SE

- Create graphical screens of P&ID’s.
- Create operation face plates for operator control.
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FactoyTalk View SE

- Import Panel View + graphics directly into SCADA application
- Trend screens connect to Historian Server
- Create Tab Navigation with VBA script
  - Bottom tabs display area/ overview screens
  - Side tabs display detail screens
- Alarm History connects to the Alarm and Event database
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RSLogix 5000

- Robust machine control software
- Tag-based for easy integration
- Create modular code using Add-On Instructions (AOI’s).
- Phase manager for ISA-88 structure.
- Multiple programming languages
  - Ladder Logic
  - Sequential Function Chart
  - Function Block Diagram
  - Structured text

- ControlLogix Phase manager
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GEMS Library

- Rockwell Pre-Engineered, Pre Built, Validated library
- Modular components for FT View SE and RSLogix applications
- Fully ISA-88 compliant. Supports the Area-Unit-Equipment Module-Control Module structure.
- Supported globally via Rockwell Automation Technical Support.
- Modules provided:

<table>
<thead>
<tr>
<th>Module</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM_AIN</td>
<td>Analog Input control module</td>
</tr>
<tr>
<td>CM_AOUT</td>
<td>Analog Output control module</td>
</tr>
<tr>
<td>CM_DIN</td>
<td>Discrete Input control module</td>
</tr>
<tr>
<td>CM_DOUT</td>
<td>Discrete Output control module</td>
</tr>
<tr>
<td>CM_M2S</td>
<td>Motor 2-State control module</td>
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<tr>
<td>CM_PID</td>
<td>PID control module</td>
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<tr>
<td>CM_SCNR</td>
<td>Scanner Control Module</td>
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<tr>
<td>CM_TOT</td>
<td>Flow Totalizer control module</td>
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<tr>
<td>CM_V2S</td>
<td>Two State Valve control module</td>
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<tr>
<td>CM_V3S</td>
<td>Three State Valve control module</td>
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<td>CM_VFD</td>
<td>Variable Frequency Drive control module</td>
</tr>
<tr>
<td>CM_VMX</td>
<td>Matrix Valve control module</td>
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<tr>
<td>CM_WS</td>
<td>Weigh Scale control module</td>
</tr>
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</table>

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<tr>
<td>UNIT</td>
<td>Unit Module</td>
</tr>
<tr>
<td>EM_GEN</td>
<td>Equipment Module Template</td>
</tr>
<tr>
<td>EP_GEN</td>
<td>Equipment Phase Template</td>
</tr>
</tbody>
</table>
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GEMS Library HMI Faceplates

- Control Module Faceplate Display
  - (Two State Valve)
    - HMI Faceplates have extensive Help screens
  - P&ID
  - Home Tab

- Device Configuration Tab
  - Config Subscreen Navigation Mode Configs
  - Device Configs
  - Unit Propagation Configs
  - Alarm Configs
  - HMI Interface Configs

- Alarm Monitor/ Interface Tab
  - Two-State Valve Class Possible Alarms
  - Display of Alarm Text, Enabled, Inhibited, Suppressed Status, and Ability to Acknowledge Individual Alarms
  - Alarm Reset

- Ownership, Alarm / Warning Status
How FactoryTalk Products Created Success
GEMS Library HMI Faceplates

- Control Module Faceplate Display
  - (Analog Input)
  - P&ID
  - Process Variable
  - Device ID
  - Ownership / Alarm / Warning / Sim Status

- Home Tab

- Device Configuration Tab
  - Device ID and Description
  - Scaling and Units of Measure
  - Miscellaneous Configurations
  - Decimal Places Affects the Display of Data on the Facemask and Overview Object

- Alarm Monitor / Interface Tab
  - Analog Input Class Possible Alarms
  - "Roll-Up" Status (Any Alarm Active)

- Trend Tab
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GEMS Library PLC Code

• The Rockwell GEMS library was created using Add-On Instructions (AOI’s). This allows easy drag-and-drop implementation of modules to create code. You don’t have to worry about copying multiple rungs of logic.
• The GEMS library is source-protected. This ensures that no one changes anything that would invalidate Rockwell’s testing.
• While you can’t change the logic within the library, there is a wealth of options and configuration that allow you to customize the library to your specific application.
• The logic modules are viewable when online for easy troubleshooting.
• Excel Configuration Spreadsheet is supplied to support the configuration of each CM instance. The spreadsheet is used to download and upload configuration using OPC from the controller. This allows fast and easy implementation of the library
Each module includes the full set of documentation to support the GAMP documentation life cycle for the modules:

- Software Module Functional Specification (SMFS)
- Software Module Design Specification (SMDS)
- Software Module Test Specification (SMTS)
- Rockwell Executed Test Script (.pdf scanned format). This set of documents is used as evidence of the module testing to support validation requirements of the project.
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GEMS Library Benefits in Projects

- Reduced Project Risk
- Reduced Time to Market
- Reduced Project Cost
- Reduced Total Cost of Ownership
- Global Consistency
- Improved quality & functionality

- Having validated library modules means we only had to validate the implementation of the modules, not the functionality.
- Since the library was created and is maintained by Rockwell, it utilizes the latest Rockwell infrastructure.
- Due to the tight timeline of the upgrade, not having to create nor test the library modules, saves a large amount of time on projects.
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FactoryTalk Historian

- Scalable real-time process historian
- Robust and reliable data collection application
- OSI-PI Historian with FactoryTalk connectors for communication with Rockwell controllers
- Integration to FactoryTalk and Integrated Architecture allows for better and faster data collection from machines and devices on the plant floor
- Browse to controller tags for easy setup
- Supplies Historical data to VantagePoint, Excel, or other interface tool for visualization of data
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FactoryTalk VantagePoint

- Create reports and dashboards to visually display data
- Single access point for all system data (Historian, Audit Log, Alarm and Events, other SQL or Oracle databases)
- Reports can be created in real-time through the web portal
- Web-server to supply reports to clients on Business network
- Microsoft Excel Add-In to create batch report data
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Connectivity

- Vision Systems (EWEB module)
- Siemens (cATM module)
- Wireless Gateway (Modbus Module)
- Alarm and Events to Win911 for paging
- Historian ME
How FactoryTalk Products Created Success Connectivity Vision systems (EWEB Module)

- **Rockwell EWEB Card**

  - The vision system used TCP/IP as opposed to ControlLogix’s EtherNet/IP.
  - The EWEB card was used as a gateway to allow communication between ControlLogix and the vision system using TCP/IP.
  - This was used to enter parameters directly from the SCADA system to the vision systems.
  - Data was transferred using Message instructions within the PLC.
  - Allows us to use simple PLC code and HMI faceplates for vision system interactions.
**How FactoryTalk Products Created Success Connectivity Siemens (cATM Module)**

- **Online Development Inc. cATM Card**

- This module was used to communicate with Siemens S7 controllers.
- It was used for PLC to PLC communication as well as data communication to the SCADA and historical systems.
- The cATM card acts like an OPC server in a PLC module.
- The cATM features a web browser based configuration tool for fast and easy setup. This eliminates the need to write message instructions within the PLC.
- Organizes data to a common data format utilizing the FT Live data communication format.
How FactoryTalk Products Created Success Connectivity Wireless Gateway (MNET Module)

- **ProSoft Technologies Inc. MNET Card**

- The wireless gateway used Modbus protocol for data communication
- This card was used for communicating to the wireless gateway and provided the connection to the wireless Hart instruments
- The ProSoft Configuration Builder software is a Windows-based graphical user interface providing simple module and network configuration.
- The card came with sample ladder logic and Add-On Instructions for data transfer between itself and the processor.
- This brought the data into the PLC for historical collection, alarming, and display.
How FactoryTalk Products Created Success Connectivity FT Historian ME

- **Rockwell 1756-HIST Card**
  - The FT Historian ME module collects data in real-time (up to 10ms polled) directly from the PLC.
  - It also archives the data directly to the module (flash memory) which eliminates any issues that could arise from a network failure.
  - The archived data is forwarded to the FT Historian SE using standard PI-to-PI protocol where it is permanently stored and used for reporting.
  - The client needed a reliable solution to ensure data was collected in real-time at high collection rates and secure from loss.
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Connectivity Alarm & Events to Win-911

- **Specter Instruments Inc.**

- A real-time Alarm Notification Software that works with your FT View SE to monitor operations and notify personnel of problem conditions.
- Connects directly to the FT View SE alarm and events server
- Connect to external phone line or 3G Modem for text messaging
- Used for critical alarms that needed immediate attention from personnel.
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Redundancy
- HMI Server Hardware Redundancy
- ControlLogix Redundancy

Other Redundancy
- Network Redundancy
- HMI Server Software Redundancy
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Redundancy HMI Server Hardware

• **Marathon Technologies Inc. EverRun Software**

  - Two (2) CoServers are connected together using Marathon software to create a single virtual image for the HMI server.
  - One (1) FT View SE Server application is installed and runs on the virtual server.
  - Three (3) Windows 20xx licenses are required for the servers (coserver 1, coserver 2 and virtual server).
  - Each server has a set of hard drives configured in a RAID array.
  - This ensures that you have maximum uptime of your HMI screens for data visualization and process control.
  - We used FT Historian Buffering on this server to ensure data collection here if the Historian Server went down.
Redundant Controller Hardware
- Two identical control racks
- 19.5 Firmware required
- 1756-RM redundancy module with dedicated fiber connection
- Ethernet module for SCADA connection
- Redundant Ethernet Module for I/O connections
- Easy configuration, check box enabled
- Automatic IP address failover
- This ensures maximum controller uptime for process control.
- This met customer requirements for hardware failure.
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Questions?

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