With over 20 years of experience, Malisko Engineering has become an industry leader in Manufacturing Automation Integration. We are experts at designing and implementing quality automation production systems that help manufacturers maximize their successes.
AGENDA

- Introductions
- What is the Connected Enterprise and why do you need it?
- Infrastructure
- Virtualization’s Role in the Connected Enterprise
- Remote Desktop Services and Thin Clients
- Connected Enablement: A Project Example
- Summary
- Questions
INTRODUCTIONS

Steve Schneebeli
Director of Engineering / IT
Malisko Engineering, Inc.

Dan Jacoby
Automation Solutions Consultant
Malisko Engineering, Inc.
**WHO IS MALISKO ENGINEERING?**

• Specialists in manufacturing automation and validation
• Founded in 1994
• Headquartered in St. Louis, Missouri USA
• Rockwell Automation Solution Partner for Control, Process, Information, Industrial IT and Power Quality & Energy Management
• Emphasis is Food & Beverage, Pharmaceutical, Brewing, Life Sciences, Dairy, Specialty Chemical.
LOCATIONS

CORPORATE HEADQUARTERS
500 N Broadway
Suite 1600
St. Louis, MO 63102

REGIONAL OFFICES

1009 Grant Street
Suite 200
Denver, CO 80203

316 N Barstow Street
2nd Floor, Suite A
Eau Claire, WI 54703

Malisko Western Regional Office
Phoenix Park Area
Eau Claire, WI
What is the Connected Enterprise?
The Challenge: Customers Increasing need for Information

- ISA-95 → International Standard for developing an automated interface between enterprise and control systems.

- System Integrators historically lived in Levels 0, 1, and 2 of the ISA-95 Hierarchy.

- Integrating elements of Levels 3 and 4 are increasingly being asked of System Integrators, especially with regard to how data flows.
LNS Research (advisory and benchmarking services consulting company)

- Manufacturers ranked disparate systems and data sources second behind lack of collaboration as their top business and operational challenges
ISLANDS OF AUTOMATION

• Traditional plant floors have Islands of Automation
  • Data is contained in each island
  • No way to share data between systems
  • No access to data from a corporate level

• Rockwell Automation’s Connected Enterprise provides the solutions for accessing data that has been trapped in these Islands of Automation and can contextualize it to provide the right intelligence to the right people.
To achieve The Connected Enterprise, convergence of IT and OT is the key. This provides a way to capitalize on operational, business and transactional data.

The benefits of the Connected Enterprise:
- Faster time to market
- Improved asset utilization
- Lower total cost of ownership
- More effective enterprise risk management
5 STAGE TO THE CONNECTED ENTERPRISE

• Rockwell Automation defines the five stages to The Connected Enterprise as:

1. ASSESSMENT
   - Evaluate all aspects of your existing IT/OT infrastructure
   - Examine legacy processes/workflows that haven’t been designed to take advantage of IT/OT convergence

2. SECURE AND UPGRADE
   - Securely update IT/OT network and control to modern, information-enabled technologies
   - Deploy an IT/OT backbone that will deliver secure, adaptable connectivity from operations to enterprise business systems

3. WORKING DATA CAPITAL
   - Define and organize available data in order to improve decision making
   - Determine how to utilize data for improving business processes

4. ANALYTICS: OPERATIONAL BENEFITS
   - Leverage predictive capabilities to improve planning and asset management, order execution and quality

5. OPTIMIZE AND COLLABORATE
   - Create an environment that drives continuous improvement while improving collaboration within a site and across the enterprise, including suppliers and customers
   - Securely increase visibility and access to assets, processes and subject matter experts for improved operations

A PRACTICAL PLACE TO START:
ASSESS, SECURE, UPGRADE INFRASTRUCTURE
Early Attempts to Connect Manufacturing to the Enterprise

- Many problems both with manufacturing system outages as well as disruptions to office/enterprise networks.
- Security: Risk of unauthorized changes
- Malware: virus, worm disruptions
- Management: Patching or network updates not appropriate for control devices
- Traffic: Control network messages flooding enterprise causing disruption
• Keep local traffic local in the respective zones.

• Demilitarized Zone (DMZ): Shared computing resources between enterprise and manufacturing preventing direct access to manufacturing zone assets (remote access is the exception)

• ISA-99 - Industrial Automation and Control Systems Security focuses on the DMZ
Industrial Network was frequently an ‘after thought’ to the overall control system design.

The networks implemented were limited to one flat network with no segmentation.

Design documentation did not exist.

Record-Set or “As-Built” documentation was frequently limited to an Excel spreadsheet of IP addresses, equipment location, and access credentials.
Logical Network layouts became customary components of CAD drawing sets.

The Logical Layout was the basis for the physical infrastructure design.

Physical Infrastructure and installation was typically “provided by others” as dictated by the customer.

The physical components (cabling, pathways, terminations, grounding, bonding, etc.) were done ‘on-the-fly’ by the electrical contractor in many cases.
Most end users have little knowledge on what makes up a comprehensive network design package.

Customers heavily rely on their integration partners to be technology experts, and the IACS network is no exception.

As automation integrators, we are now being requested to deliver the overall solution including:

- Logical Network Design
- Physical Infrastructure Design
- Network Installation Management
- Network Deployment

**Now and in the Future: DESIGN the Network**

**Network Design RFQ**

Integrator shall engineer their best design to give us a robust Network Topology that will meet the needs of production, both present and future.

**Your quotation will include Design Services for:**

A. Overview level Network Topology in DWG format.
B. Overview level Network schematics in DWG format.
C. Anticipated Network BOM in MS Excel format.
D. Please separate engineering, parts/materials and installation

**Proposal Considerations:**

- Please suggest your best recommendation for the type of redundancy we should install.
- Please give order of magnitude pricing (as options) that indicates the pricing to provide for varying levels of redundancy and robustness

**Optional Quotation (Where you offer this service):**

A. To install your proposed network design at our manufacturing site.
B. To configure the Network
C. To certify the Network and pronounce it fit to accept existing and future I/O, workstations, servers, etc.
Cisco and Rockwell Automation recommend that network developers design smaller Cell/Area IACS networks using multicast delivery and to route unicast delivery between Cell/Area zones for controller-to-controller information exchange and interlocking.

A proper design should include a thorough survey and documentation of all existing control system messaging.

A new network design will need to take into consideration Layer-3 routing between VLANs as needed to preserve existing dependencies.
**DESIGN / DEPLOYMENT AND TEAMING**

- Must have a sound logic design that complements the physical design
- Team with Certified Network Installers
- Provide oversight during installation to make sure TIA standards are followed for physical infrastructure
PHYSICAL INFRASTRUCTURE – THE BAD
Physical Infrastructure – The Good
VIRTUALIZATION - A KEY COMPONENT TO THE CONNECTED ENTERPRISE
VIRTUALIZATION: WHY SHOULD YOU VIRTUALIZE?

Percentage of x86-Architecture Workloads Running in VMs

Virtualization allows one computer to do the job of multiple computers, by sharing the resources of a single hardware across multiple environments.
Hardware virtualized servers remove the dependency of the hardware from the operating system, and allow multiple separate operating systems to share common hardware.

Interfacing between operating systems and the physical server hardware is handled through the Hypervisor, in this case, VMware ESXi.
Benefits of Virtualization

- Traditional servers running a single operating system never fully utilize the available resources (both CPU and RAM).
- Costs are reduced by requiring less hardware and reducing overall energy requirements.
- Remove reliance of a system backup on specific hardware.
- Allows for easy hardware upgrades without the need for re-installation of the operating system and application files.
- Decrease the downtime incurred during a hardware failure
  - Virtual system image is stored as a file. New hardware only requires installation of the hypervisor and copying system images.
Thin Clients - Operationally Simple Visualization
REMOTE DESKTOP SERVICES

FT View SE Client
ACP ThinManager
Windows Server 2012 R2 / Remote Desktop Services

ACP Firmware Enabled Thin Clients

RDP

RDP

RDP

APP OS
Benefits of Remote Desktop Services

- Microsoft Remote Desktop Services provides the ability to host multiple, simultaneous PlantPAx client sessions on a single server.
- ACP ThinManager manages the Thin Client hardware and provides redundancy capability between multiple RDS servers.
- Thin Client hardware requires minimal configuration.
- Ability to Shadow Thin Client Sessions.
VIRTUALIZATION AND THIN CLIENT SAVINGS

The following is based on a Dairy Processing System:

• A traditional installation for this system would require seven servers, and five thick clients with FT View SE installed on each client.
• Using Virtualization, server count was reduced to three servers, at a cost savings of 60%
• Remote Desktop Services with Thin Clients saved over 33%
• Reducing the number of servers and utilizing Thin Clients realized a power savings of approximately 55%
CONNECTED ENABLEMENT:
A PROJECT EXAMPLE
A Legacy Migration Isn’t What It Used to Be

• Case Study:
  Global Pharmaceutical Company Legacy DCS Migration

  • Existing system was an island of automation with no direct ties to the corporate network
  • No ability to integrate with future plant-level MES system
  • All existing reports and historian data had to be printed out
  • No visibility of the process outside of the DCS network. This prevented the ability to provide remote support during any downtime event
**PlantPAx Distributed Control System Enables the Connected Enterprise**

Rockwell Automation’s PlantPAx Modern DCS vs. a ‘Traditional’ DCS

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Traditional DCS</th>
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<tbody>
<tr>
<td>Local Support</td>
<td>Single Local Solutions Provider</td>
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<tr>
<td></td>
<td>Local Eco-System consisting of dozens of local Integrators and Solution Partners</td>
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<tr>
<td>Scalability</td>
<td>Hardware + Additional License required for additional I/O</td>
</tr>
<tr>
<td></td>
<td>No additional licensing required</td>
</tr>
<tr>
<td>Topology</td>
<td>Dedicated Servers. Software and Hardware Upgrades Expensive</td>
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<tr>
<td></td>
<td>Virtualization Fully Supported – Decoupling Hardware from Software</td>
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**The Control System Design**

- **Document Existing System Functionality**
  - Create Functional Requirement Specifications and Detailed Design Specifications, as the groundwork for generating a full Validation Protocol set
  - Define Control Modules, Equipment Modules, Phases, and Units.
  - Process Optimization discussions with plant production and engineering resources

- **Staged Cut-over Installation**
  - Use of Allen-Bradley IFM modules allowed for flexible mounting locations next to existing DCS termination boards, allowing for a unit-by-unit cutover once a unit became available, thus minimizing the downtime occurred by the unit.
SOFTWARE AND HARDWARE FRAMEWORK

• Nine virtualized images
  – FactoryTalk® View Servers (Primary and Secondary)
  – ACP ThinManager Remote Desktop Services (RDS) Servers (Primary and Secondary)
  – FactoryTalk® Batch Servers (Primary and Warm Backup)
  – FactoryTalk® Historian
  – FactoryTalk® VantagePoint
  – Microsoft SQL Server
  – Seven FactoryTalk® View SE Thin Clients

• Two Engineering Workstations

• Cisco Stackwise Switches between Data Center and I/O Room

• Device-level Ethernet Ring
  – Utilized for all I/O Chassis

• Phase I IDMZ implementation separating office network and manufacturing network via firewall.

• VPN Connection into system for Remote Support, controlled by enterprise IT department
IMPLEMENTATION OF STANDARDS

• Rockwell’s Library of Process Objects provided a standardized set of device control faceplates and PLC code
  • Reduces development and validation time
  • Validation was done once on each faceplate used, with remaining devices validated through I/O checkout.

• FactoryTalk Batch Implementation
  • Utilizing standardized batch start screens
  • Archiving of Batch data to System-wide SQL server

• Reporting
  • SQL Server Reporting Services (SSRS) was utilized to provide web-based access to reports, with data taken from SQL tables and FactoryTalk Historian SE Data Historian
DATA VISUALIZATION AND CONTEXTUALIZATION

• FactoryTalk Historian SE and VantagePoint
  • Time-series data logged from the PlantPAx system as well as stand-alone skids
  • Data is available on the enterprise network through the VantagePoint server
  • Gives engineers and management the ability to troubleshoot issues or deviations quicker than the legacy DCS

• FactoryTalk Alarms & Events and FactoryTalk Diagnostics
  • Logs all alarms and Operator Actions to the system-wide SQL server
  • Event report through SSRS provides a batch by batch summary of all alarms and operator actions that occurred during a batch
MORE TECHNOLOGY ENABLEMENT AND OPTIMIZATION

• User Authentication
  • Biometric readers used to authenticate users into PlantPAx system
  • Domain Authentication provided by enterprise Active Directory

• Network Upgrades and resiliency
  • Cisco switches were used in a Stackwise configuration with redundant fiber to provide redundancy between the Data Center and the I/O room.
  • Device Level Ring for all I/O racks back to the ControlLogix processors
  • ControlLogix Processors are redundant using the Allen-Bradly RM2 redundancy module
• Results
  • **PlantPAx DCS provides a framework for exposing data to the corporate level**
    • Easier to troubleshoot than the legacy DCS
    • Real-time process data available through FT Historian SE and VantagePoint
    • Spare parts are readily available
    • Use of Thin Client technology reduces the time required to replace a defective HMI station from hours to minutes
    • Virtualization decouples the Operating System from the physical hardware, thus making disaster recovery easier

• Recommendations
  • While laying your framework for the Connected Enterprise, have early and often conversations with plant IT groups. Make them part of the design process.
WHERE HAS THIS JOURNEY TAKEN US?
The Connected Enterprise must start with a decision to fundamentally change the way your organization approaches industrial automation projects.

A major focus on infrastructure improvements enables the Connected Enterprise.

Modern DCS Deployments and utilizing common IT technologies such as virtualization and thin clients is the new norm.

The Journey must be planned strategically, but exercise patience in upgrading to a fully connected state.

In the end, the results will provide a solid foundation for...

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**Operational Intelligence**
Access, analyze, and act on your production data in real-time

**Productivity**
Connect systems and redefine productivity in the information age

**Risk Management**
Address issues to safeguard your assets and protect your brand
Thank You!

Questions?

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Your Allies in Intelligent Automation Since 1994