INTEGRATED SYSTEMS: AN END USER PERSPECTIVE

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Agenda

• Setting the Vision
  – Top down planning, bottom up engineering
• Holistic view of facilities
• Case in point
  – Oil and Gas
  – Healthcare
  – Military
• Concluding thoughts
• Grand Unified Theory
The Vision – End User Perspective

• Help organization realize corporate goals:
  • Achieve GREEN initiatives
  • Reduce energy footprint
  • Improve efficiency
  • Reduce costs
  • Improve project deployment schedule
  • Work with our contractors and suppliers to comply with our requirements
• Develop standards based on industry best practices
• Meet procurement policy requirements
• Evaluate processes and procedures
• Validate efforts – Lessons Learned
Market Trends

- Industry preference for open systems
- Expectation for better energy efficiency
- Growing requirement for integration
- Demanding lower operating expenses
- Competitive bidding and procurement
- Do more for less
Smart Buildings, Smart Campus, Smart City Systems

- **Comfort/Productivity**
  - Heating
  - Cooling
  - Ventilation
  - Lighting
  - Air Quality
  - Sound Quality
  - Public Address
  - Irrigation

- **Fire/Life Safety**
  - Smoke
  - Fire/Flame
  - Toxic Gas
  - Emergency egress

- **Security**
  - Access
  - Intrusion
  - Gates
  - Parking
  - Badging

- **Communication**
  - Voice
  - Data
  - Video
  - Signage

- **Metering**
  - Power metering for electricity
  - Gas – boiler, heat
  - Water – domestic usage, chilled, hot, irrigation

- **Utilities**
  - Electricity
  - Gas
  - Water
  - Trash
  - Beer (colleges)
  - Wine (nor Cal)

- **Safety**
  - Streetlights
  - Traffic
  - Emergency Signage
  - Alarming
  - Sensor Grids

Increased convergence of system interactions, infrastructures, and communications

Process -> Environment -> Facility -> Personnel
Key End User Demand – Open Integrated Systems

• The ability to install devices from multiple sub-systems and from multiple vendors into a single cohesive system
• Reduce vendor locks
• Improve system to system integration
• Focus on BAS/BMS
Building Management Functionality (BMS)

Operations Interface
- Scheduling
- Overrides
- System Trends and Alarms

Maintenance Tools
- Equipment Status
- Scheduled Service
- Trends

Energy Dashboards
- Usage Patterns
- Costs Savings
- Predictive Optimization

Analytics and Reporting
- Fault Detection
- Diagnostics
- Optimization

Public Awareness
- Energy Kiosks
- Sustainability
- Green Awareness

Environmental Comfort
- Light dimming
- Temperature
- Air quality
- Glare control

Collect
Validate
Control
Analyze
Report
Visualize
Monitor
BMS Front End Options
Little Data Meets Big Data

Centralized system
- Centralized workstation based GUI
- Running on a PC
- Static application
- Hosted on owners computer

De-centralized, distributed system
- Client application
- Remote Terminals
- Thick or thin client access
- Browser based interfaces

Cloud Based
- Data mined remotely
- User interface via web access to remote server
- No local server
- No local software

Software-as-a-Service
- Pay as you go
- Use only what you need
- Module based applications
- Web browser based interface

Increase information, integration, access, network, security, costs
End User Requirements

- Reduce operating, maintenance, and training costs
- Leverage investments
- Multi-system connectivity
- Single user interface
- Meet open procurement policies
- Manage CAPEX vs. OPEX costs
- Design for performance and functionality
  - Not bells and whistles
Objectives and Direction

- Reduce engineering time and confusion
- Develop cross-compatible standards
- Address building level systems
- Address interoperability and connectivity
- Define specification guidance for all projects
- Establish basic integration requirements
- Define roles and responsibilities
- Ensure compliance to requirements
- Streamline system engineering
Smart Integrated Buildings – Best Practices

Based on the Smart Buildings Best Practices:
• Full Connectivity - Communications
• Good Integration – No System Silos
• Interoperable Control Network
• Common System Architecture - Wiring
• Based on Open Systems Standards
• Facility Operations User Displays, Dashboards
• Central Management, Data Collection, User Interface
• Analytics Tools, FDD (Fault Detection/Diagnostics)
• Enterprise IT Connectivity, Security, Reliability
Open Integrated Building Systems

• Open building systems are created using the products and systems from multiple vendors that in the end offer greater flexibility, easier management, higher levels of scalability, and lower life cycle costs.

• Fully Open Systems Will Deliver
  – Greater choices in vendors and suppliers
  – Lower energy costs
  – Lower install and life cycle costs
  – Easier add, moves, and changes
  – Greater system scalability
  – Better access to information
  – Greater control over the facility
  – Unlock vendor proprietary systems
The Key = Interoperability

- Systems and sub-systems are more effective and efficient if they can work together
- “Work Together” can have many differing connotations; we mean “interoperate”
- Owners gain value in choices, competition, and flexibility
- But don’t want to replace, they want to integrate – “Make My Stuff Work Together”
- Define a common data and communications model
- Repeatable, scalable, and based on industry standards
Master Planning

**Top Down Vision**
- Common infrastructure
- Common Communications
- Control and Usability
- Monitoring, Alarming, Analysis
- GUI Workstations
- BMS Solutions
- Training, Knowledge Based Staff

**Bottom Up Engineering**
- Open systems architecture
- Interoperability between vendors and components
- Leverage IP infrastructure
- Develop “on boarding” best practices
- Common protocols, wiring
- Common data models
- End User focused design
End User Master Planning

- Vision
- Objective
- Scope
- Enforcement
- Validation
- Adoption
- Plan
# Risk Assessment

## COMPOSITE RISK MANAGEMENT WORKSHEET

<table>
<thead>
<tr>
<th>1. TASK LOCATION</th>
<th>2. HAZARDS OR CLINICAL EFFECTED</th>
<th>3. INITIAL RISK LEVEL</th>
<th>4. CONTROLS</th>
<th>5. RESIDUAL RISK LEVEL</th>
<th>6. HOW TO IMPLEMENT</th>
<th>7. RESPONSIBLE PARTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Building Basement</td>
<td>Housekeeping, Laundry, Supply Management</td>
<td>Moderate</td>
<td>Housekeeping – Maintain temp control required Laundry – Maintain temperature control Sweep Clinic – Maintain temperature control</td>
<td>Low</td>
<td>FM&amp;E to put all associated equipment into manual mode Potential need to update equipment to reduce risk by adding handoff/auto Potential scope increase (Software or manual?)</td>
<td>Capital Management</td>
</tr>
<tr>
<td>Main Building Ground Floor</td>
<td>Mechanical Rooms, Computer Rooms, Health Records, Sleep Clinic, Office Space, Supply Management</td>
<td>Moderate to High</td>
<td>Mech. Room – Maintain pressurization Computer Rooms – Maintain cooling 24/7 Health Records – No controls required 24/7 Sleep Clinic – Maintain temp control 24/7 Office Space – Maintain temp control Supply Management – Maintain Temp control</td>
<td>High</td>
<td>FM&amp;E to put all associated equipment into manual mode Potential need to update equipment to reduce risk by adding handoff/auto Potential scope increase (Software or manual?)</td>
<td>Capital Management</td>
</tr>
<tr>
<td>Main Building Main Floor</td>
<td>Emergency Area, Lobby</td>
<td>High</td>
<td>Emergency Area - Maintain temp control Maintain pressurization 24/7 Lobby – Maintain pressurization</td>
<td>High</td>
<td>FM&amp;E to put all associated equipment into manual mode Potential need to update equipment to reduce risk by adding handoff/auto Potential scope increase (Software or manual?)</td>
<td>Capital Management</td>
</tr>
<tr>
<td>Main Building Unit 22</td>
<td>Psychiatry</td>
<td>Moderate</td>
<td>Maintain Temp control Maintain pressurization</td>
<td>Low</td>
<td>FM&amp;E to put all associated equipment into manual mode Potential need to update equipment to reduce risk by adding handoff/auto Potential scope increase (Software or manual?)</td>
<td>Capital Management</td>
</tr>
<tr>
<td>Main Building Unit 30/31/32</td>
<td>Burn Unit - Acute Pts Beds</td>
<td>High</td>
<td>Maintain Temp control 24/7 Maintain pressurization 24/7</td>
<td>High</td>
<td>FM&amp;E to put all associated equipment into manual mode Potential need to update equipment to reduce risk by adding handoff/auto Potential scope increase (Software or manual?)</td>
<td>Capital Management</td>
</tr>
</tbody>
</table>

4. PREPARED BY: Colin Parker

- **LAST NAME**: Parker
- **RANK**: High
- **POSITION**: Project Manager

5. DATE PREPARED: 2016/11/09

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Identify Project Risks Associated with process, people, equipment, schedules, policy, and more
## Identify Stakeholder Responsibility RASCI

<table>
<thead>
<tr>
<th>Task Description</th>
<th>Project Management</th>
<th>Consultants</th>
<th>Client Stakeholders</th>
<th>E.G. Stakeholders</th>
<th>Contractor</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset Management and Scope Development</td>
<td></td>
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<tr>
<td>1 Long Range Technical Planning</td>
<td>A</td>
<td>R</td>
<td>I</td>
<td>C</td>
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<tr>
<td>2 Outage Timing</td>
<td>A</td>
<td>R</td>
<td>C</td>
<td>S</td>
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<tr>
<td>3 Development of Master Work Scope Document</td>
<td>A</td>
<td>R</td>
<td>C</td>
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<tr>
<td>4 Scope Content Decisions</td>
<td>A</td>
<td>R</td>
<td>C</td>
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<tr>
<td>5 Scope of Work Document Release</td>
<td>A</td>
<td>R</td>
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<tr>
<td>Scope Definition and Planning</td>
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<tr>
<td>6 Identify Parts List</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>R</td>
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<td></td>
</tr>
<tr>
<td>7 Long Lead Orders for Components</td>
<td>A</td>
<td>I</td>
<td>I</td>
<td>R</td>
<td></td>
<td>RM&amp;E to be consulted with the schedule</td>
</tr>
<tr>
<td>8 Development of Project Execution Plans (Safety, QA/QC, Project Controls, etc.)</td>
<td>A</td>
<td>R</td>
<td>C</td>
<td>I</td>
<td>I</td>
<td>RM&amp;E. C.</td>
</tr>
<tr>
<td>9 Development of Detailed Execution/Cutover Schedule</td>
<td>A</td>
<td>R</td>
<td>C</td>
<td>S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 Overall Cost Model/Estimate</td>
<td>A</td>
<td>R</td>
<td>I</td>
<td>I</td>
<td></td>
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</tr>
<tr>
<td>11 Technical Advice/Strategy</td>
<td>A</td>
<td>R</td>
<td>C</td>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Provide recommended parts list</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>R</td>
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</tr>
</tbody>
</table>

**LEGEND**
- **Responsible (R)**
- **Accountable (A)**
- **Supporting (S)**
- **Consulted (C)**
- **Informed (I)**

- **RASCI**
- **Identify Stakeholder Responsibility**
ASHRAE SGPC-13 Guidespec Multi-Tier Model:
How do we model information connectivity between devices, sub-systems, systems?
Overview of the Multi-Tier Model

2 Tier Model
- Separation of the BAS from the BMS
- Pioneered by NASA, NYC Schools, US Army Corps
- One common user interface, many control components, suppliers, integrators

3 Tier Model
- Separation of Equipment from BAS and BMS
- ASHRAE BAS Guidespec, Schools, Hospitals
- Improves system design and competitive bidding

4 Tier Model
- Add Sensors/Actuators (not integrated into equipment)
- Sensors/actuators – connect to controllers or direct to BAS
- Electrician responsibilities (industrial process environment)
- Oil and Gas industry pioneers
Building Automation System Tier Architecture

- Sensors (4-20mA or 0-10VDC)
- Application Specific Controller
- Direct Fired MUA
- Wall Type AHU
- Unit Heater
- Exhaust Fan
- Pump
- Unit Heater

- Sensors (4-20mA or 0-10VDC)
- Application Specific Controller
- Direct Fired MUA
- Wall Type AHU

- Energy Metering System Interface
- Gas Detection System Interface
- Water System Interface
- Lighting System Interface

- Enterprise Level (BMS) Tier 1
- Building Level (BAS) Tier 2
- Equipment Level Tier 3
- Sensors and Actuators Tier 4

- Corporate Server or Cloud
- IT Enterprise LAN

- IT Enterprise LAN
- WAN Connectivity

- BAS Control Network Wiring
- Field Device Wiring

- Free Programmable Controller

- Sensors (4-20mA or 0-10VDC)
- Relays Actuators
- Various End Devices

- Internet/VPN

- Energy Metering System Interface

- Gas Detection System Interface

- Water System Interface

- Lighting System Interface

Develop a Holistic System Design
4-Tier System Architecture

Enterprise Internet/VPN

WAN

Tier-1

LNS Database

Graphical User Interface
Network Tools
Diagnostics
Web Interface

Remote Access
Email and TXT Alarms
Browser Based Monitoring and Control
Smart Phones, Tablet Access

Tier-2

Site IP/Ethernet Network

IP-852 Router or XML Server or Web Server

Tier-3

Equipment and Device/Control Network

Tier-4

Sensors/Actuators

Remote Access
Graphical User Interface
Network Tools
Diagnostics
Web Interface

Standard Network Variables
Exchanged Between Devices and to PC, Web, Remote Access

Standard 4-20mA, 0-10VDC, relay wiring

Remote Access
Enterprise Applications
Building Operations Center
Call/Dispatch Center
Reporting/Scheduling
Energy Analytics, Dashboards, Kiosks

Tier System Architecture

Devices

Tier

LAN

Tier-2

WAN

Tier-1

Tier-3

Tier-4
Identify Division of Responsibilities

**Design Engineer**
- System design
- Equipment specification
- General requirements for integration
- System architecture

**Traditional BMS Controls Contractor**
- Hired by Mechanical/Electrical Contractor
- Only sees his scope
- Limited or no integration

**System Integrator**
- Performs and or manages all work related to Building Automation Systems
- Better integration capabilities

**Master System Integrator**
- Manages the work at the network level and higher
- Acts as the owner rep to manage the System Integrators work
- Long term agreement
- Applies to larger Multi-Building systems, longer term projects
- Allows for easier management of multiple vendors
Standards Focus

- Define equipment interface requirements
- Follow Open System Standard
- Implement an open communications backbone using the ASHRAE multi-tier model
- Enforce device and equipment certifications and profiles
- Employ Facility Master System Integrator as oversight and integration experts
- Define interaction between tiers
Case Studies

• Oil and Gas (from PEMAC Conference Presentation)
  – Suncor Energy
  – Facility Standards for Controls

• Healthcare
  – Large Government Hospitals
  – Control System Upgrades for Aging Campus

• Department of Defense
  – Standards for Building Automation
  – Vendor Compliance and Best Practices
Suncor Energy’s Firebag Site
Suncor BMS Affected Systems

• HVAC
• Lighting
• Fire
• Security
• Gas Detection
• Energy Metering
• Water Metering
• Monitoring
• Management
Suncor Standards 2104 and 0487

All Based on Open Standards
Facility Master System Integration (FMSI) Responsibilities

• Building Automation System Panel Integration
• Design, Maintain, and Supply BMS Panels
• Building Management System
  • User interface
  • Common dashboard look and feel
  • Database management and maintenance
  • BMS software integration, programming, and tools
  • Operational training, documentation, support, service
• Integrate Tier 3 equipment into BMS
  • HVAC, Lighting, Fire, Gas, Energy, etc
  • Oversee equipment supplier compliance to standard
  • Coordinate sub-contractor responsibilities
  • Ensure vendor submittal compliance
Tier 1 – Strong IT and BMS Integration

TIER 1: PROJECT SCOPE

This work is performed by Suncor’s PMO contractor and is defined by the following activities:

BMS Server Configuration & Preparation (Governance: One-Time)

- Each new Suncor Site will require the following one-time setup procedures to prepare the site for on-going building additions as infrastructure is developed.
  - Coordination with Suncor IT group on BMS server hardware/software configuration.
  - Provide further vendor-specific software installations/setup and management.
  - Coordination with Suncor IT on remote access and administration procedures to facilitate future building additions work.

(Purpose: Cash Flow)

- Review Sequence of Operations with design consultant for existing and equipment lines not participating in design review, control system development & Equipment Submittal process.

- Ensure HVAC equipment to be integrated within Suncor’s BMS network compatibility requirements, including clearly defined network communication variable structure for enterprise-grade access.

- Review Fire Alarm, seq. connection, 995 and BPCS interface requirements and functions.

Construction & Start-up Stage (Governance: Cash Flow)

- Coordinate turn-over of required deliverables by the Tier 2 contractor, including:
  - Software & Database configuration files.
  - Sequence of Operations for equipment & Building level.
  - Network Architecture drawings as per Standard 2104 & 2105.

- Provide operation Graphics User Interface (GUI) including:
  - Development and construction of GUI screens for monitoring and operations requirements, including configuration of alarm messaging and routing.
  - Coordinate network connections to the building(s) with Suncor IT.
  - Populate network data on the GUI screens, commissioning graphics and controls required network data points definitions by Tier 2 contractors are visible on the network.

- Test Operations personnel as required and turn-over system.

- Update Plant BB Overall BMS Network Architecture Drawings as required per Standard 2104 & 2105.
Vendor Equipment Requirements

• All equipment and controllers must be LonMark Certified to the LON standards for interoperability
• Must follow standard profile definitions and document their interface
• Provide full product integration information
• Provide required training and documentation
• Adhere to the standards for wiring, termination, connectivity, environmental conditions, safety requirements and more
• Test and verify all network integration is in compliance
Suncor’s Prize

- Improve energy efficiency
- Lower initial capital costs
- Lower life cycle costs – equipment, infrastructure
- System design and implementation clarity
- Reduce cost of operations and maintenance
- Consistent value from our vendors
- Improve competitive bid process
- Improved system management and knowledge transferability
Case Studies

• Oil and Gas
  – Suncor Energy
  – Facility Standards for Controls

• Healthcare
  – Large Government Hospitals
  – Control System Upgrades for Aging Campus

• Department of Defense
  – Standards for Building Automation
  – Vendor Compliance and Best Practices
Aging Hospital Campus

- Built in the 1960s
- Aging infrastructure
- Obsolete components
- Lack of service and support
- Invest in new open architecture
- Focus on interoperability
- Multi-vendor competitive bid
- Use industry best practices
- Incorporate new construction
Key Objectives

• From the project BAS/BMS Control Requirements
  • This section describes the overall standard objectives including:
    » Interoperability and Integration
    » Upgrade to Current Technology
    » Follow Open Systems Model
    » Follow Project Management Procurement Processes (limit sole sourcing)
  • Defined several key objectives:
    1) to upgrade the campus to current technology through the use of this standard;
    2) to ensure reliable and effective integration of any new controls,
    3) to ensure a consistent naming and tagging nomenclature for improved operation and maintenance;
    4) to enhance competitive bidding of integration services and suppliers;
    5) to enhance project and vendor value; and
    6) to reduce operating costs.
Follow Latest Advancements in BAS Design

Greater system integration – going beyond just HVAC
Multi Tier Architecture Model
Networking requirements (IP, control)
BAS sub-system interfaces
Device level profiles and interfaces
Communication protocol options
Legacy system integration options
Details for specifiers

4-Tier System Architecture

Tier-1
BMS

Tier-2
BAS

Tier-3
Equipment

Tier-4
Devices

Any Networked Workstation
Alarm Processing, GUI, Dashboards

Enterprise
Data Center Rack
Server Backups

Site Database
Incl. Drawing
and Project Files
Backed Up to Server
(Archives Only)

4096:255:0000:0000:0000:0000:0000:0000

WAN – Fiber, INTERNET

LAN – Site IP Ethernet Network

Device Control Network
Twisted Pair Wire Network

Tier-1
BMS

Tier-2
BAS

Tier-3
Equipment

Tier-4
Devices

Workstation Interface Access to Web/Data/Alarm Server
Data Server, Alarm Server, Web Server, Router

Data Server, Alarm Server, Web Server, Router

Device Control Network

Twisted Pair Wire Network

Tier-1
BMS

Tier-2
BAS

Tier-3
Equipment

Tier-4
Devices

Workstation Interface Access to Web/Data/Alarm Server
Data Server, Alarm Server, Web Server, Router

Data Server, Alarm Server, Web Server, Router
Facility Assessment

- Onsite Assessment and Review
- Document and photograph existing panels and equipment site
- Develop equipment list by vendor/model
- Existing System Assessment
- Review existing and new programming method
- Review existing BMS interface
- Review existing wiring and network infrastructure
- Assess BMS user graphics requirements
- Review front end upgrade procedures
- Review existing documentation
Planning

• Review and develop project objectives
• Review initial design parameters
• Review initial design drawings
• Develop initial scope document based on above
• Evaluate BMS integration requirements
• Evaluate networking requirements for control and monitoring
• Evaluate front end requirements and server upgrades
Concept Design

• Develop Standards Overview Document
• Team review and revision
• Develop final standards documents for this project with intent to use on future projects
• Define contractor, vendor, installer, commissioning roles and responsibilities
• Develop open systems approach for AHS BAS and BMS projects following ASHRAE 3-Tier Model
• Develop front end BMS requirements
Schematic Design

- Panel design overview
- Panel drawings
- Site system architecture drawings (location of servers, panels, IP connectivity)
- Wiring drawings and requirements document
- Documentation
- Review project RFQ packages
- Develop and document BMS user graphics requirements and contractor qualifications
- Review IT/OT network security requirements for control infrastructure
- Develop requirements for network cyber security
- Review BMS server selection and design
- Define bid package requirements for BAS panels
Construction Work Package

- Review product submittals
- Review installation procedures
- Advise on installation and commissioning
- Open sourced product review
- Review product ability to meet requirements
- IT/OT coordination (networking)
- Define and review panel vendor design and commissioning sheets
- Attend project meetings during all phases (remote call in as needed)
- Document project progress, invoicing, administration
- Advise on BMS front end server upgrade
Operations & Maintenance

Lessons Learned

• O&M
  – Assess system training requirements
  – Develop and produce operator training requirements
  – Review and advise on vendor training schedule
  – Facilitate training coordination and requirements

• Lessons Learned
  – Team review of pilots and phased upgrades
  – Ensure meeting of goals
  – Identify and validate changes in design
  – Update specifications and standards
Case Studies

• Oil and Gas
  – Suncor Energy
  – Facility Standards for Controls

• Healthcare
  – Large Government Hospitals
  – Control System Upgrades for Aging Campus

• Department of Defense – US Army Corps of Engineers
  – Standards for Building Automation
  – Vendor Compliance and Best Practices
Specifications for Open Systems

USACE-ERDC-CERL
UMCS-MCX Subject Matter Expert
Overview

- “2-spec” approach
- Requirements for Open Systems
- Philosophy of Open Systems
Layer Architecture (Tiers)

IP Network External to ICS PIT

Level 5
External Connection
And PIT Management

Connection Components
(Firewalls, DMZ, Proxies, Servers etc)

Platform IT Accreditation Boundary

Level 4
UMCS Front End and UMCS IP Network

4N – IP Network (ICS Platform IT VLAN(s) or dedicated network)

Operations Center

Level 3
Field Point of Connection (FPOCs)

Switch, “Proxy Device”, or Firewall

Level 2
Field Control System (IP)

2B – Switches

2A – IP Based Controllers

2D – Field Control System Computers

Level 1
Field Control System (non-IP)

1N – Non-IP Network

1A – Non-IP Controllers

Level 0
Sensors & Actuators

Platform IT Management

To more Field Control Systems

Connections Components
(Firewalls, DMZ, Proxies, Servers etc)

External to ICS PIT

1A – Non-IP Controllers

1A – Non-IP Controllers

1A – Non-IP Controllers

1A – Non-IP Controllers

4B – Workstations

4A – Servers

1A – Non-IP Controllers

1A – Non-IP Controllers

1A – Non-IP Controllers

1A – Non-IP Controllers
“2-Spec” Architecture

UMCS Front End

UMCS Front-end
UMCS Client
UMCS Client
UMCS Client?

O&M PC
O&M PC
Other PC
Other PC

UMCS (IP) network

Security
WWW

FPOC

AHU 1&2 Vendor A DDC
VAVs Vendor A DDC

AHU Vendor B DDC
Boiler Vendor B DDC
AHU Vendor A DDC
Boiler Vendor B DDC
Chiller Vendor C DDC

Bldg 1 BCS
Bldg 2 BCS
Bldg 3 BCS

FPOC=Field Point of Connection (UMCS to Facility/Building Control Network)
What’s The Problem?

Multi-vendor DDC is inevitable due to the Government’s competitive procurement rules.

- Multi-vendor DDC results in multiple software tools, laptops, & interface hardware
- Proprietary supervisory architecture
- Varied & incompatible building systems
- Non-interoperable systems
- Overall… a great deal of complexity and significant challenges for O&M staff, construction inspectors, and end users

12 of Fort Bragg’s many O&M laptops
What is Open?

- An Open DDC system is characterized by the ability for any qualified entity to readily modify, operate, upgrade, and perform retrofits on the system. An Open system:
  - Permits multiple devices from multiple vendors to readily exchange information
  - Provides the capability to easily replace any device with another device procured from multiple sources
  - May have components available from only one manufacturer, but they represent a small percentage of the overall device
  - May have fees associated with the use of certain components, as long as the fees are established and consistent

- The opposite of Open is Closed, or Proprietary as defined by Government procurement rules (can only buy from 1 vendor)
Open System Goal

(one-line version)

“One (integrated, multi-vendor) system with no future dependence on any one contractor or controls vendor.”
Open System Goals

1. **One system.** Multiple buildings with controls installed by multiple vendors are integrated into one system.

2. **One common front-end** that provides users with the capability to interface with all buildings (monitoring, supervisory control, etc.).

3. **One common tool** for network management and device configuration. One common tool for device programming would be great!

4. **No future need for** the original (installing) contractor or any particular device manufacturer to perform work on system.
Philosophy of Open Specs

- “Cooperation” between contractors via spec requirements and submittals
  - Contractors DON’T need to work together
  - Contractors DO have to follow the specs

- Use standards when possible but restrict/extend standards via specific requirements when necessary
Philosophy of Open Specs

- An Open system that isn’t supported isn’t Open
  - Buy-in by system owner
  - Buy-in by maintenance organization
  - Buy-in by contract enforcement
  - Support of qualified installers and maintainers
Conclusion

- End users require better integration
- Single seat front end
- Common infrastructure
- IP based system to system connectivity
- Reduce system complexity
- Identify roles and responsibilities clearly
- Interoperability at all levels
The Grand Unified Theory

- All building systems will work together and share information across an open control networking infrastructure allowing any device, subsystem, system, and building to produce and consume data without the need for closed or proprietary components and where all systems and applications reside in an open, integrated, secure, interoperable environment.
Questions?

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