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

Security
- Access
- Intrusion
- Gates
- Parking
- Badging

Communication
- Voice
- Data
- Video
- Signage

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

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

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

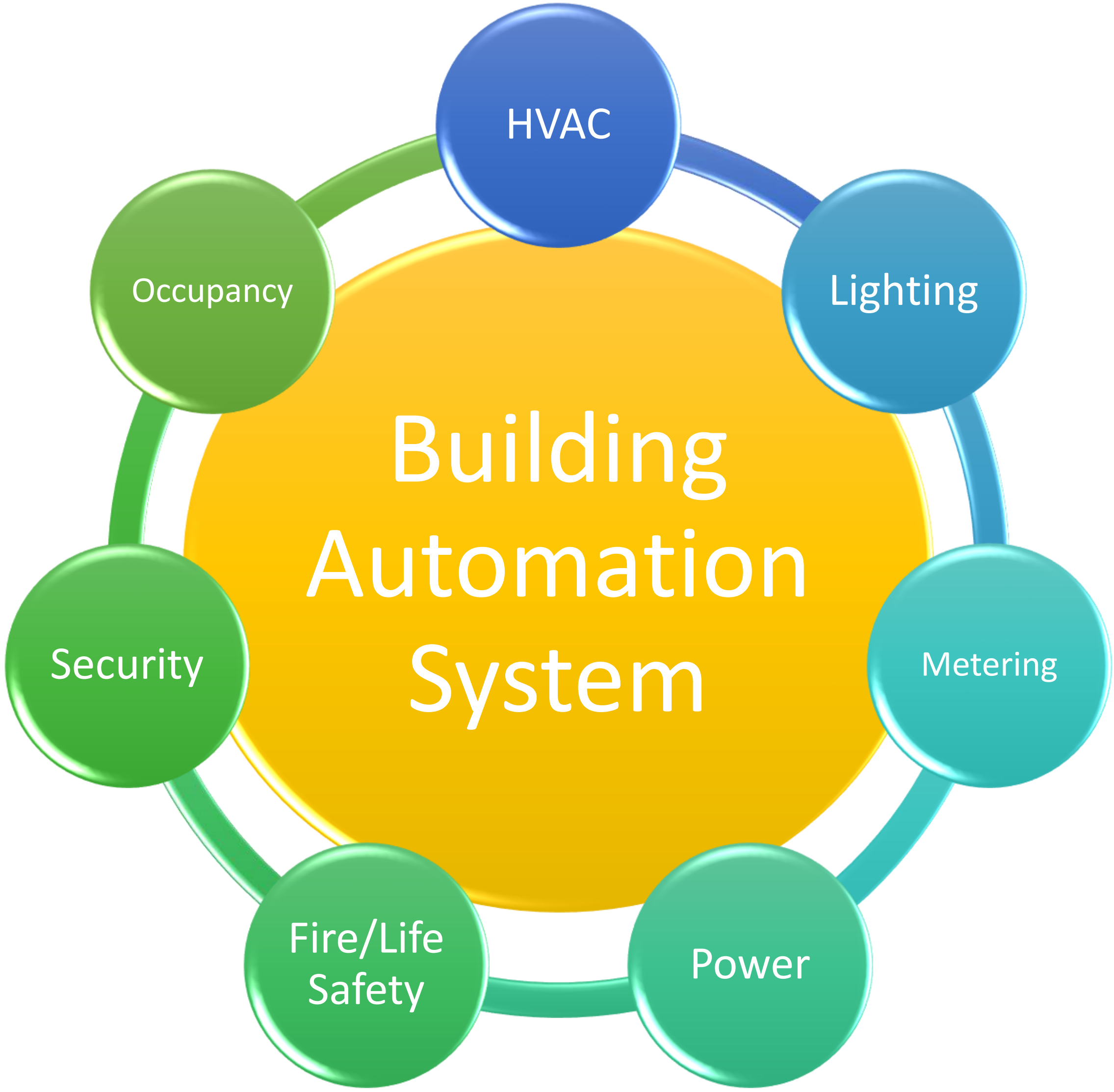
Safety
- Streetlights
- Traffic
- Emergency Signage
- Alarming
- Sensor Grids

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

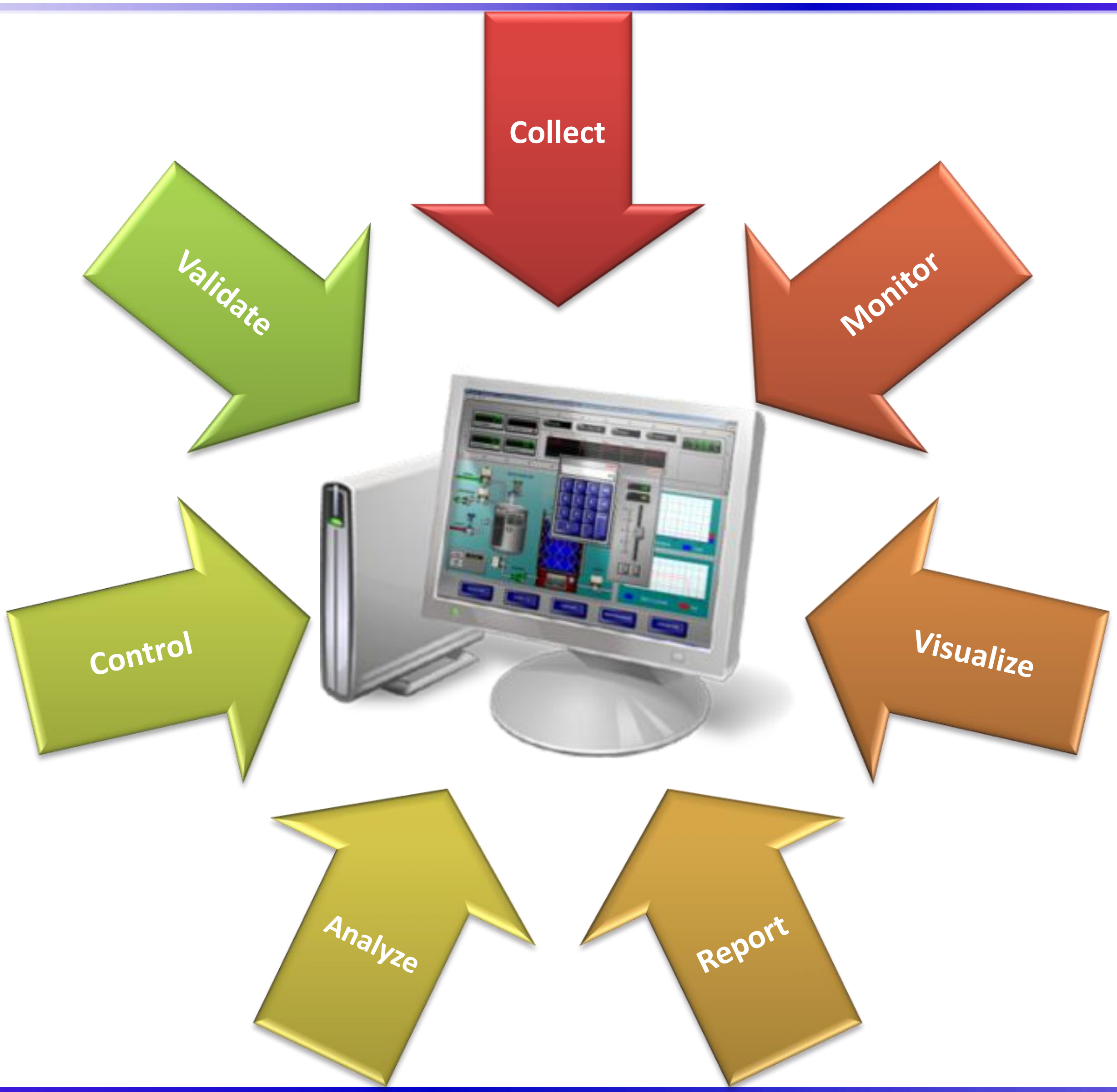
Analytics and Reporting
- Fault Detection
- Diagnostics
- Optimization

Maintenance Tools
- Equipment Status
- Scheduled Service
- Trends

Public Awareness
- Energy Kiosks
- Sustainability
- Green Awareness

Energy Dashboards
- Usage Patterns
- Costs Savings
- Predictive Optimization

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



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

Factory Equipment Mounted

Building Panel Mounted

Stand Alone Central Workstation

Networked Workstation

Network Connected Device

Increase information, integration, access, network, security, costs

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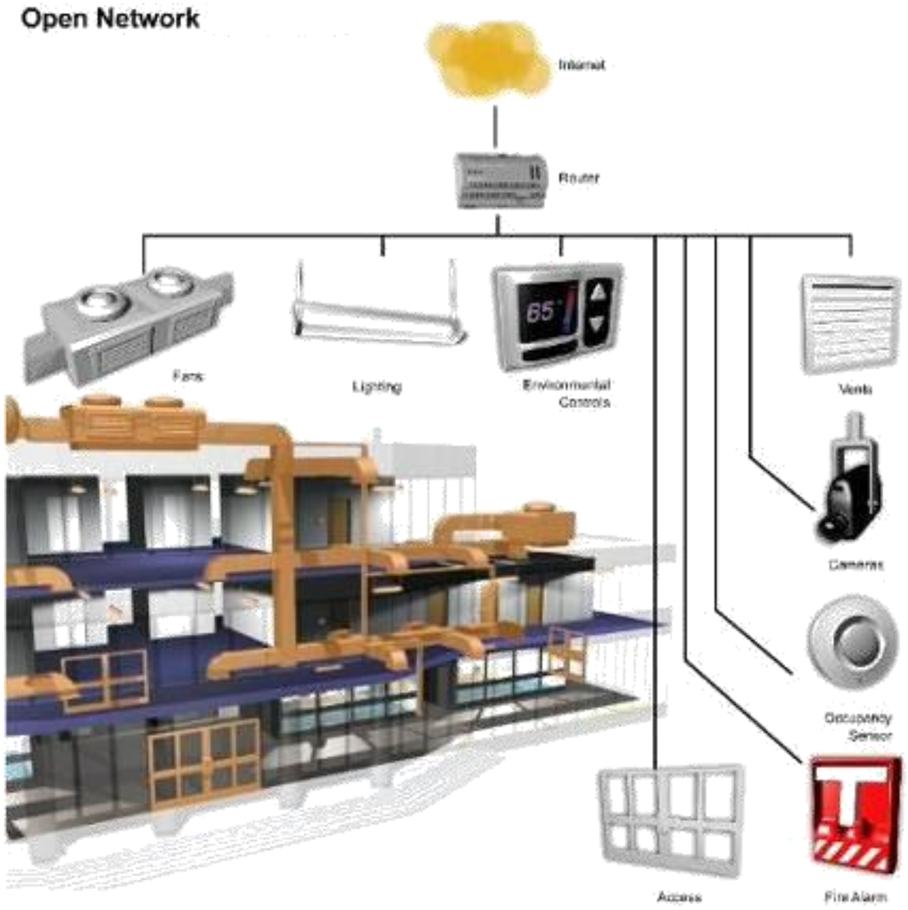
End User Requirements

- 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

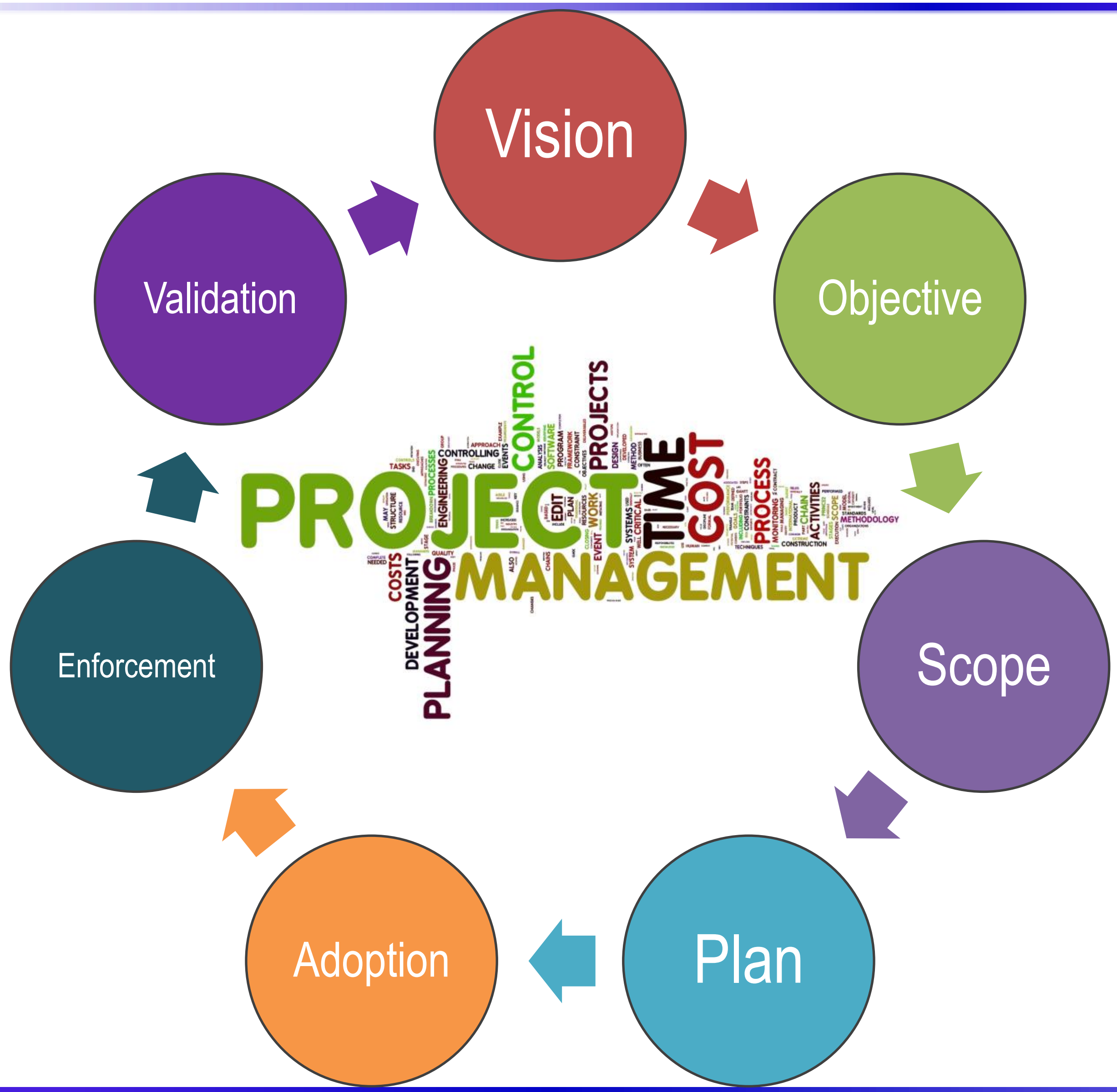
Top Down Vision

- 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



Risk Assessment

Identify Project Risks Associated with process, people, equipment, schedules, policy, and more

COMPOSITE RISK MANAGEMENT WORKSHEET							
1. MSN/TASK: **FMC – BMS Network Upgrade Project** **BMS/BAS systems in need of upgrade and replaced with BACnet hardware. In preparation, one system will be done as a pilot project; Main Building NC26 is planned. The risk matrix is being done to identify all areas affected in particular clinical areas that will be impacted by the shutdown during the system upgrade.**				2a. Planned Completion Date	2b.New Anticipated Completion Date	3. DATE PREPARED *(2016/11/09)*	
4. PREPARED BY: **Colin Parker**							
a. LAST NAME: Parker			b. RANK: **High**	c. POSITION: Project Manager			
5. SUBTASK LOCATION	6. HAZARDS AREAS/CLINICAL EFFECTED	7. INITIAL RISK LEVEL	8. CONTROLS	9. RESIDUAL RISK LEVEL	10. HOW TO IMPLEMENT	11. RESPONSIBLE PARTY	12. WAS CONTROL EFFECTIVE?
Main Building **Basement Floor**	Housekeeping Laundry Supply Management	Moderate	Housekeeping – Maintain temp control required Laundry – Maintain temperature control Sleep Clinic – Maintain temperature control	Low	FM&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?)	FM&E Capital Management	Yes
Main Building **Ground Floor**	Mechanical Rooms Computer Rooms Health Records Sleep Clinic Office Space Supply Management	Moderate to High	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	High	FM&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?)	FM&E Capital Management	No - with multiple areas effected to put all equip. in manual mode is not practical
Main Building **Main Floor**	Emergency Area Lobby	High	Emergency Area - Maintain Temp control Maintain pressurization **24/7** Lobby – Maintain pressurization	High	FM&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?)	FM&E Capital Management	No - due to the criticality of this area a detailed project plan is required
Main Building **Unit 22**	Psychiatry	Moderate	Maintain Temp control Maintain pressurization	Low	FM&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?)	FM&E Capital Management	Yes
Main Building **Unit 30/31/32**	Burn Unit - Acute Pt Beds	High	Maintain Temp control **24/7** Maintain pressurization **24/7**	High	FM&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?)	FM&E Capital Management	No - due to the criticality of this area a detailed project plan is required

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Identify Stakeholder Responsibility

RASCI

LEGEND	
Responsible	R
Accountable	A
Supporting	S
Consulted	C
Informed	I

RASCI CHART - Roles and Responsabilities

LEGEND	
Responsible	R
Accountable	A
Supporting	S
Consulted	C
Informed	I

Refer to "Definitions" tab for a full description of each role

	Task Description	AHS - Project Management	Consultants	Clinicl Stakholders	FM & E Stakholders	Contractor	Comments
Asset Management and Scope Development							
1	Long Range Technical Planning	A	R	I	C		
2	Outage Timing	A	R	C	S		
3	Development of Master Work Scope Document	A	R		C		
4	Scope Content Decisions	A	R		C		
5	Scope of Work Document Release	A	R		I		
Scope Definition and Planning							
6	Identify Parts List	A	C		C	R	
7	Long Lead Orders for Components	A	I		I	R	FM&E to be consulted with the schedule
8	Development of Project Execution Plans (Safety, QA/QC, Project Controls, etc.)	A	R	C	I	I	FM&E - C
9	Development of Detailed Execution/Cutover Schedule	A	R	C	S	I	
10	Overall Cost Model / Estimate	A	R		I	I	
11	Technical Advisor Strategy	A	R		C	C	
12	Provide recommended parts list	A	C		C	R	

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ASHRAE SGPC-13 Guidespec Multi-Tier Model:

How do we model information connectivity between devices, sub-systems, systems?


GUIDELINE

ASHRAE

ASHRAE Guideline 13-2015
(Supersedes ASHRAE Guideline 13-2014)
Includes ASHRAE addenda listed in Annex G

Specifying Building Automation Systems

See Annex G for ASHRAE approval dates.

This guideline is under continuous maintenance by a Standing Guideline Project Committee (SGPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the guideline. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE website (www.ashrae.org) or in paper form from the Senior Manager of Standards. The latest edition of an ASHRAE Standard may be purchased from the ASHRAE website (www.ashrae.org) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 678-539-2129. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in US and Canada). For reprint permission, go to www.ashrae.org/permissions.

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Includes Web-based access to Example Specification for Building Automation Systems (Requires Microsoft® Word®)

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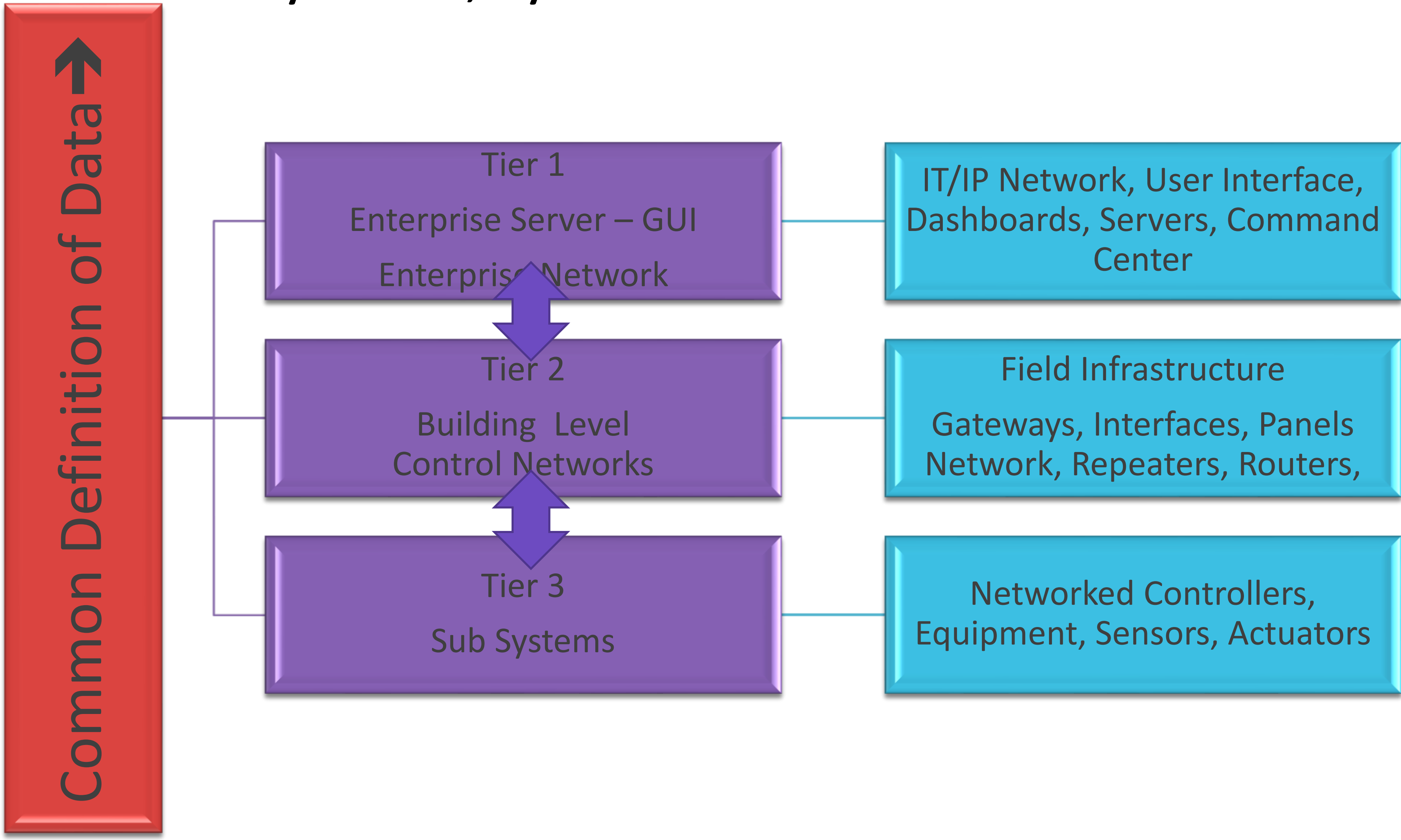


Overview of the Multi-Tier Model

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

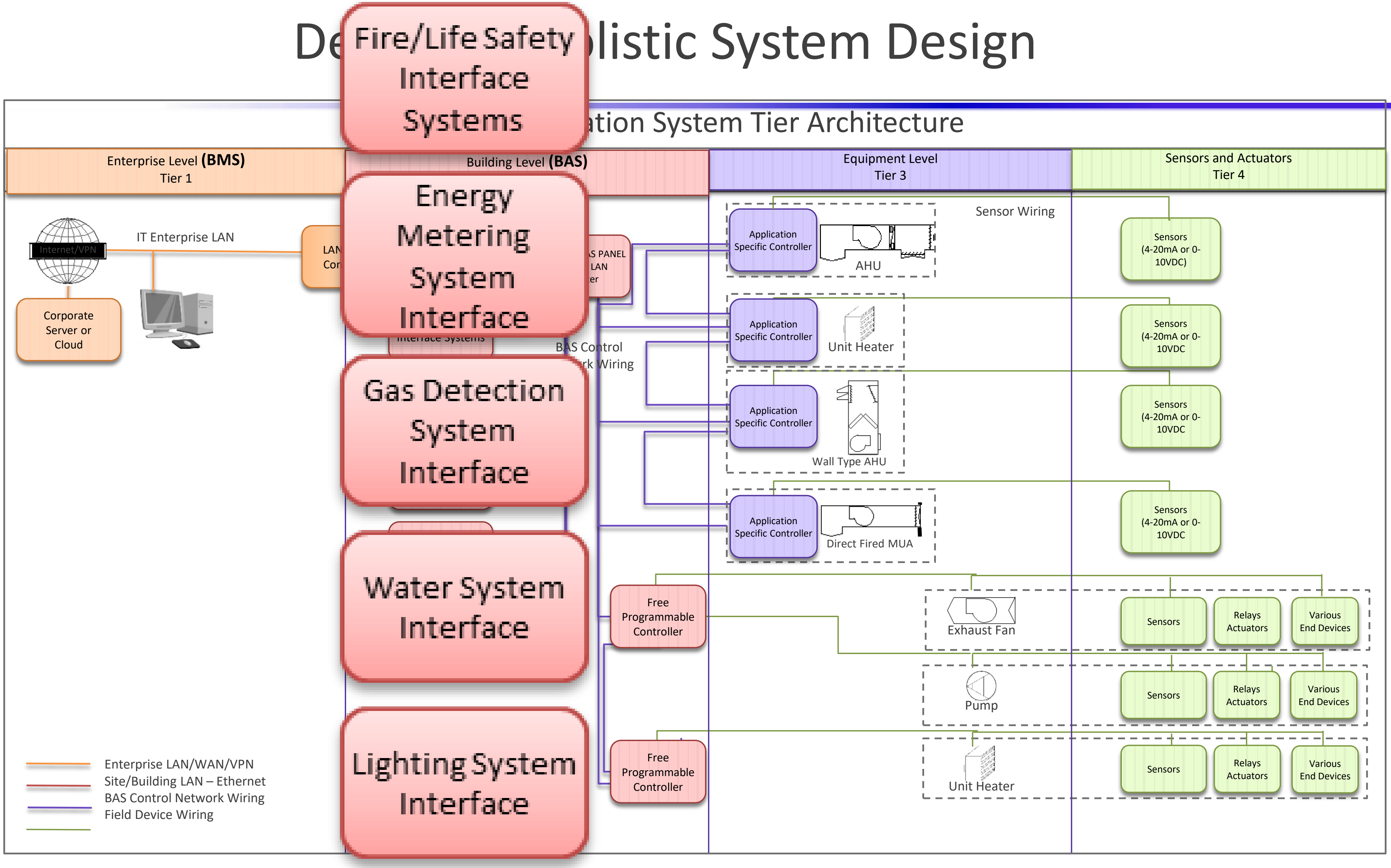
3 Tier Model

- 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

De listic System Design



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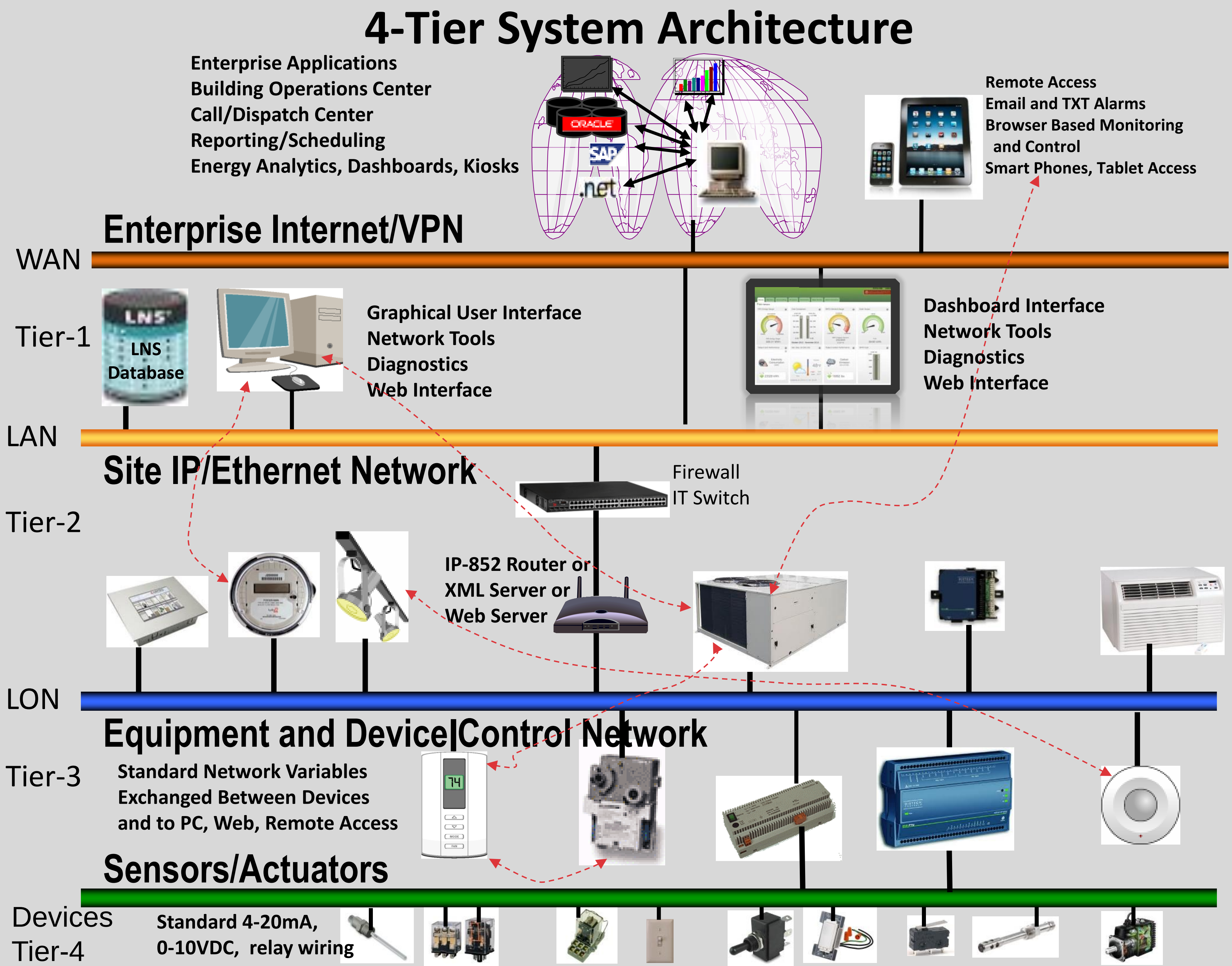


4-Tier System Architecture
Enterprise Applications
Building Operations Center
Call/Dispatch Center
Reporting/Scheduling
Energy Analytics, Dashboards, Kiosks
ORACLE
SAP
.net
Remote Access
Email and TXT Alarms
Browser Based Monitoring
and Control
Smart Phones, Tablet Access
Enterprise Internet/VPN
WAN
Tier-1
LNS
LNS Database
Graphical User Interface
Network Tools
Diagnostics
Web Interface
Dashboard Interface
Network Tools
Diagnostics
Web Interface
LAN
Site IP/Ethernet Network
Firewall
IT Switch
Tier-2
IP-852 Router or
XML Server or
Web Server
LON
Equipment and Device|Control Network
Tier-3
Standard Network Variables
Exchanged Between Devices
and to PC, Web, Remote Access
74
Sensors/Actuators
Devices
Tier-4
Standard 4-20mA,
0-10VDC, relay wiring

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

SUNCOR ENERGY

CORPORATE TECHNICAL STANDARD 2104

ENGINEERING DESIGN FOR HEATING, VENTILATION AND AIR CONDITIONING SYSTEMS

Suncor Corporate Technical Standards define Suncor's minimum requirements that MUST be met to manage operational risks, mitigate environmental impacts and deliver safe, reliable operations. A Technical Deviation Notice (TDN) must be approved in advance before deviating from Suncor Corporate Technical Standards. Use of Suncor Corporate Technical Standards does not absolve the engineer/designer from performing their due diligence in completing their engineering design. Details of work to meet the requirements of a Technical Standard shall be supplemented with Specifications, Data Sheets and Purchase Orders for a specific project or situation. Order of document precedence shall be Legal & Regulatory requirement followed by Suncor Policy followed by Corporate Technical Standard followed by Specification, Procedure and Work Practice.

SUNCOR ENERGY INC.

Rev	Date (YYYY/MM/DD)	Revision Notes	Originator	Checker	Approver
2	11/11/23	Issued for Implementation	CParker	R.McFarlane	A. Devender
1	06/18/07	Issued For Implementation	CParker	MN	PC
0	02/06 /07	Issued for Review (Originator) – Colin Parker, Reviewed by Lynn Marsh, Zach LaPlante, Nab Banerjee, James Wang	CParker		

SUNCOR ENERGY

CORPORATE TECHNICAL STANDARD 0487

ENGINEERING DESIGN FOR BUILDING MANAGEMENT SYSTEM (BMS) - BUILDING AUTOMATION SYSTEM (BAS)

Suncor Corporate Technical Standards define Suncor's minimum requirements that MUST be met to manage operational risks, mitigate environmental impacts and deliver safe, reliable operations. A Technical Deviation Notice (TDN) must be approved in advance before deviating from Suncor Corporate Technical Standards. Use of Suncor Corporate Technical Standards does not absolve the engineer/designer from performing their due diligence in completing their engineering design. Details of work to meet the requirements of a Technical Standard shall be supplemented with Specifications, Data Sheets and Purchase Orders for a specific project or situation. Order of document precedence shall be Legal & Regulatory requirement followed by Suncor Policy followed by Corporate Technical Standard followed by Specification, Procedure and Work Practice.

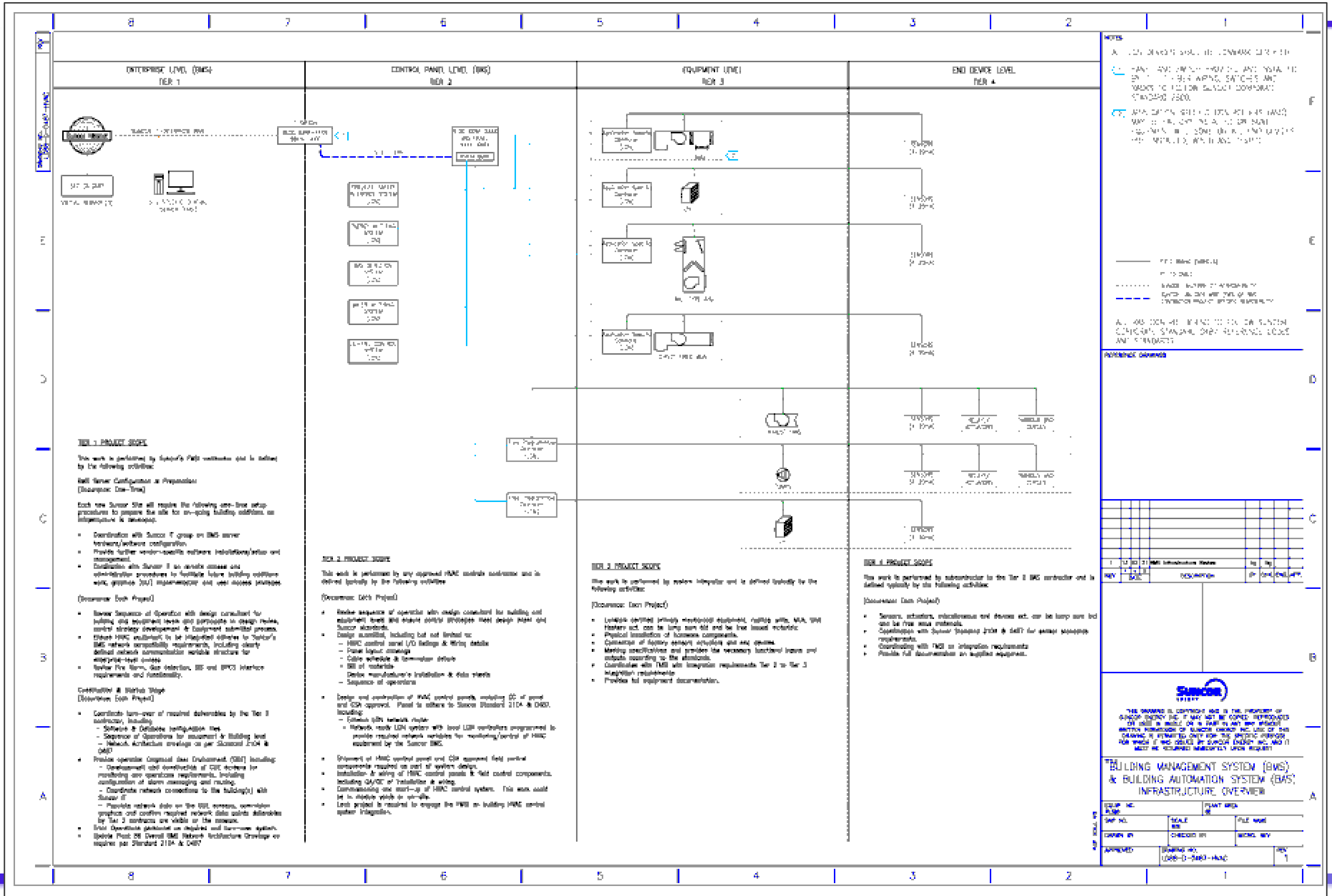
SUNCOR ENERGY INC.

All Based on Open Standards

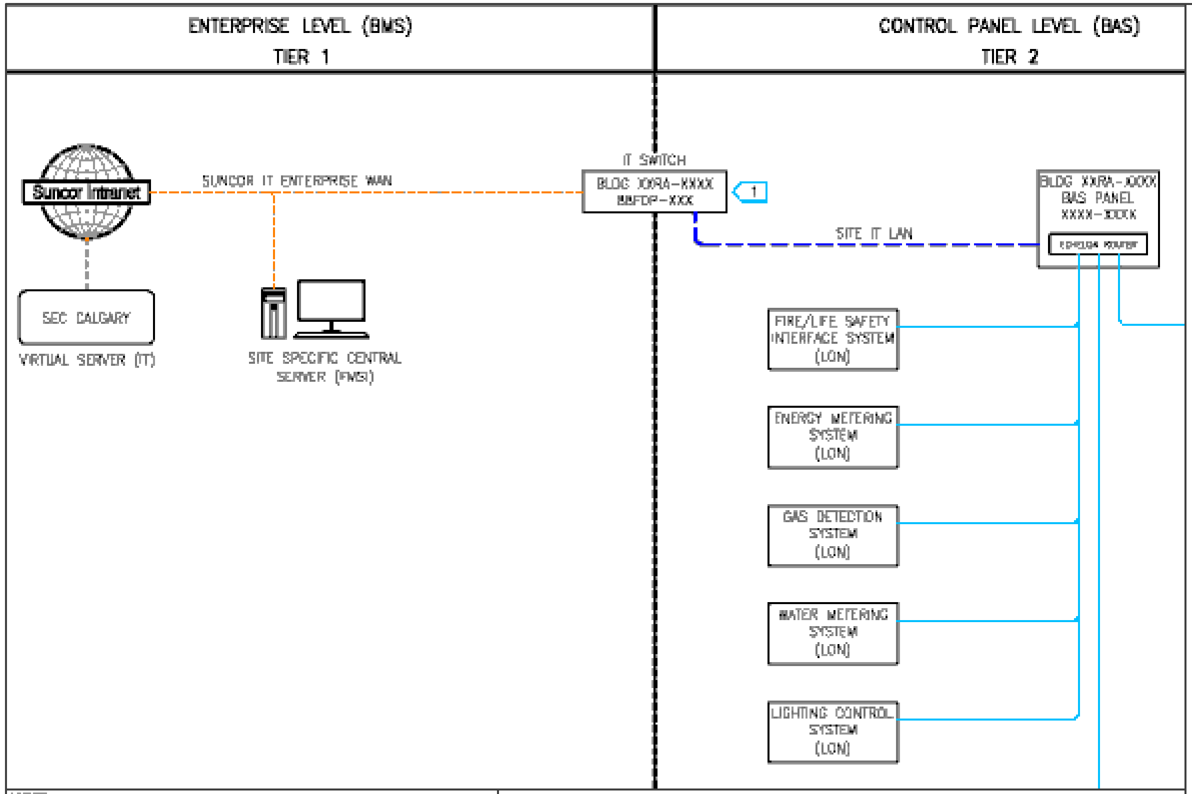
Facility Master System Integration (FMSI) Responsibilities

- 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

4 Tier Overview - Standard 0487



Tier 1 – Strong IT and BMS Integration



NOTES

ALL LON DEVICES SHALL BE LONMARK CERTIFIED.

1 PANEL AND SWITCH PROVIDED AND INSTALLED BY IT. IT FIBER WIRING, SWITCHES AND RACKS TO FOLLOW SUNCOR CORPORATE STANDARD 2600.

2 APPLICATION SPECIFIC CONTROLLERS (ASC) MAY BE FACTORY INSTALLED ON SOME EQUIPMENT WILL SOME OR ALL END DEVICES PRE-INSTALLED, WIRED AND TESTED.

<u>TIER 1 PROJECT SCOPE</u>

This work is performed by Suncor's FMSI contractor and is defined by the following activities:

BMS Server Configuration & Preparation:
(Occurance: 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.
- Cordination with Suncor IT on remote access and administration procedures to facilitate future building additions work, graphics (GUI) implementation and user access privileges.

(Occurance: Each Project)

- Review Sequence of Operation with design consultant for building and equipment levels and participate in design review, control strategy developement & Equipment submittal process.
- Ensure HVAC equipment to be integrated adheres to Suncor's BMS network compatibility requirements, including clearly defined network communication variable structure for enterprise-level access.
- Review Fire Alarm, Gas detection, SIS and BPCS interface requirements and functionality.

Construction & Startup Stage
(Occurance: Each Project)

- Coordinate turn-over of required deliverables by the Tier 2 contractor, including:
  - Software & Database configuration files.
  - Sequence of Operations for equipment & Building level
  - Network Achitecture drawings as per Standard 2104 & 0487.
- Provide operation Graphical User Environment (GUE) including:
  - Developement and construction of GUE 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 GUE screens, commision graphics and confirm required network data points delierables by Tier 2 contracto are visible on the network.
- Train Operations personnel as required and turn-over system.
- Update Plant 88 Overall BMS Network Architecture Drawings as required per Standard 2104 & 0487

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;

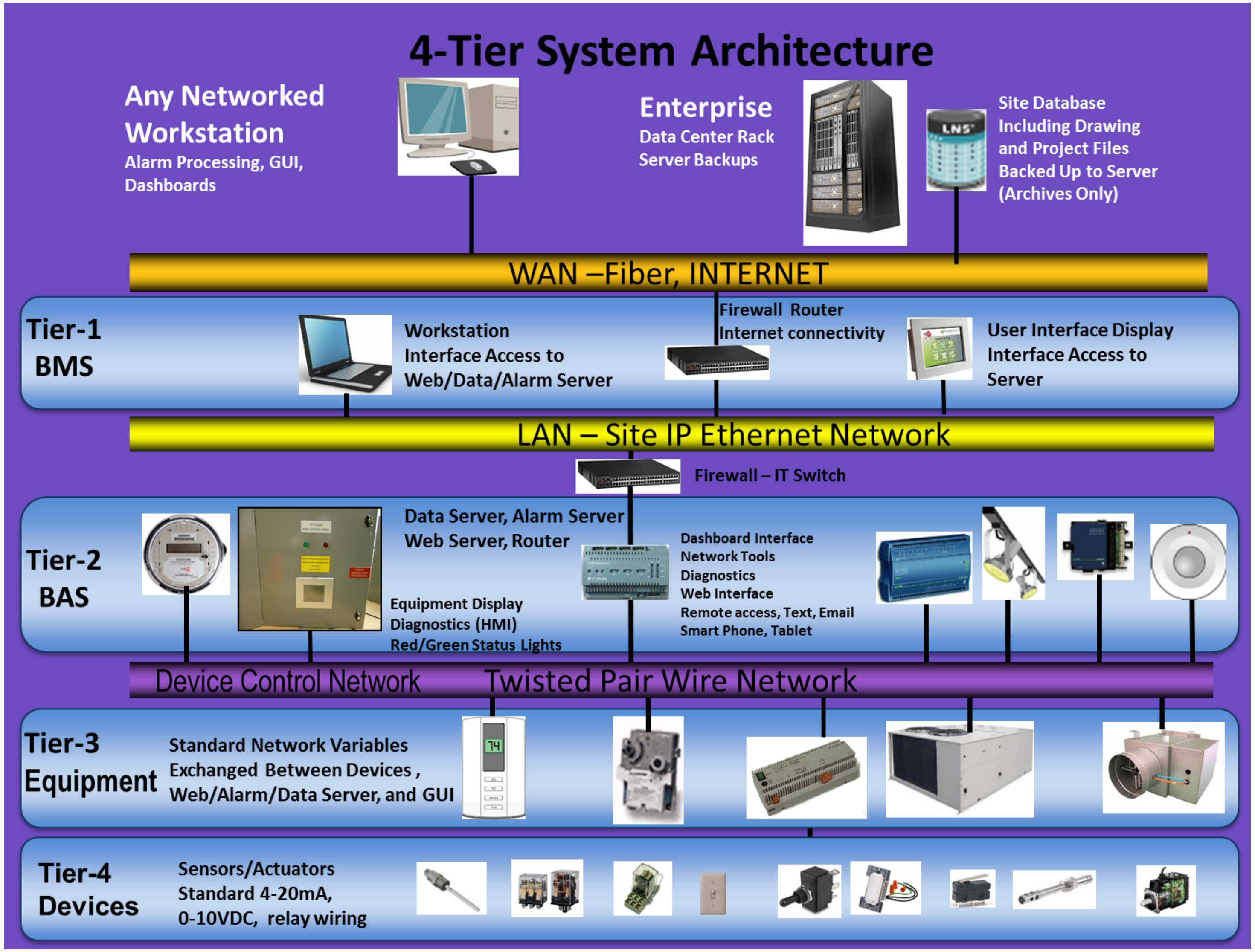
    4) to enhance competitive bidding of integration services and suppliers;

    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



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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

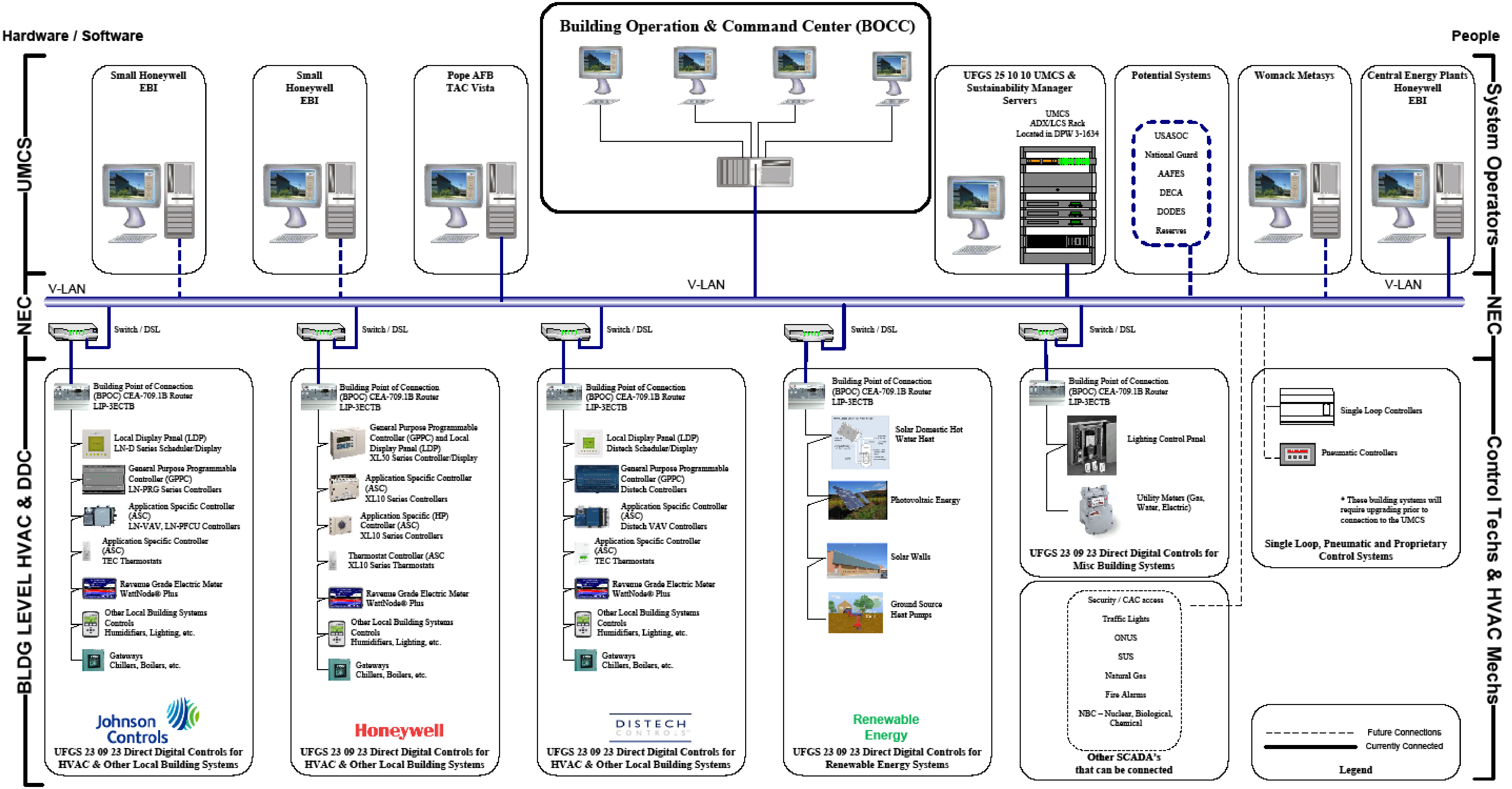
- Oil and Gas
  - Suncor Energy
  - Facility Standards for Controls
- Healthcare
  - Large Government Hospitals
  - Control System Upgrades for Aging Campus
- Department of Defense – US Army Corps of Engineers
  - Standards for Building Automation
  - Vendor Compliance and Best Practices

Specifications for Open Systems

USACE-ERDC-CERL
UMCS-MCX Subject Matter Expert

US Army Corps of Engineers
BUILDING STRONG®

FORT BRAGG
Utility Monitoring & Control System (UMCS)

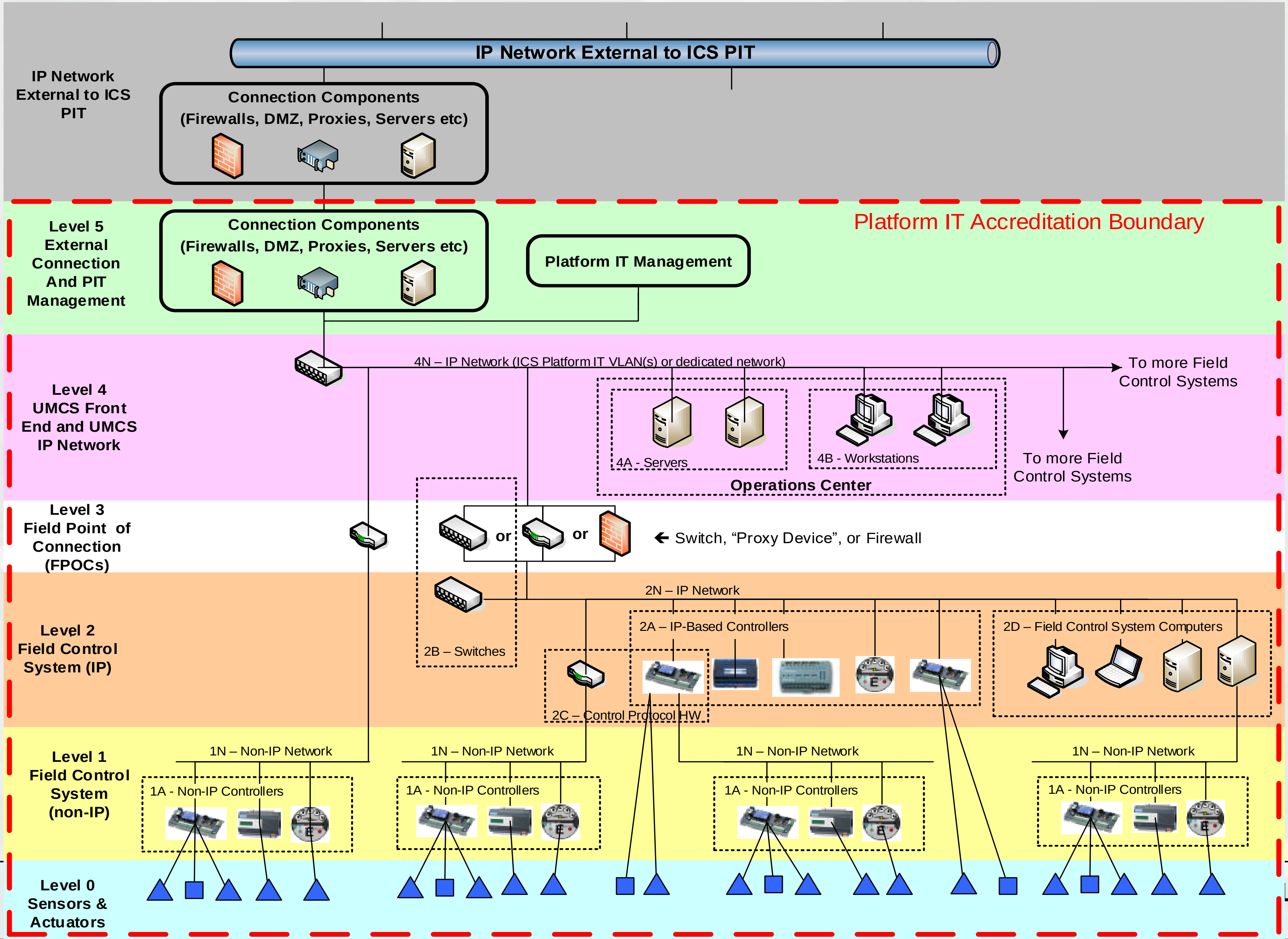


U.S. ARMY

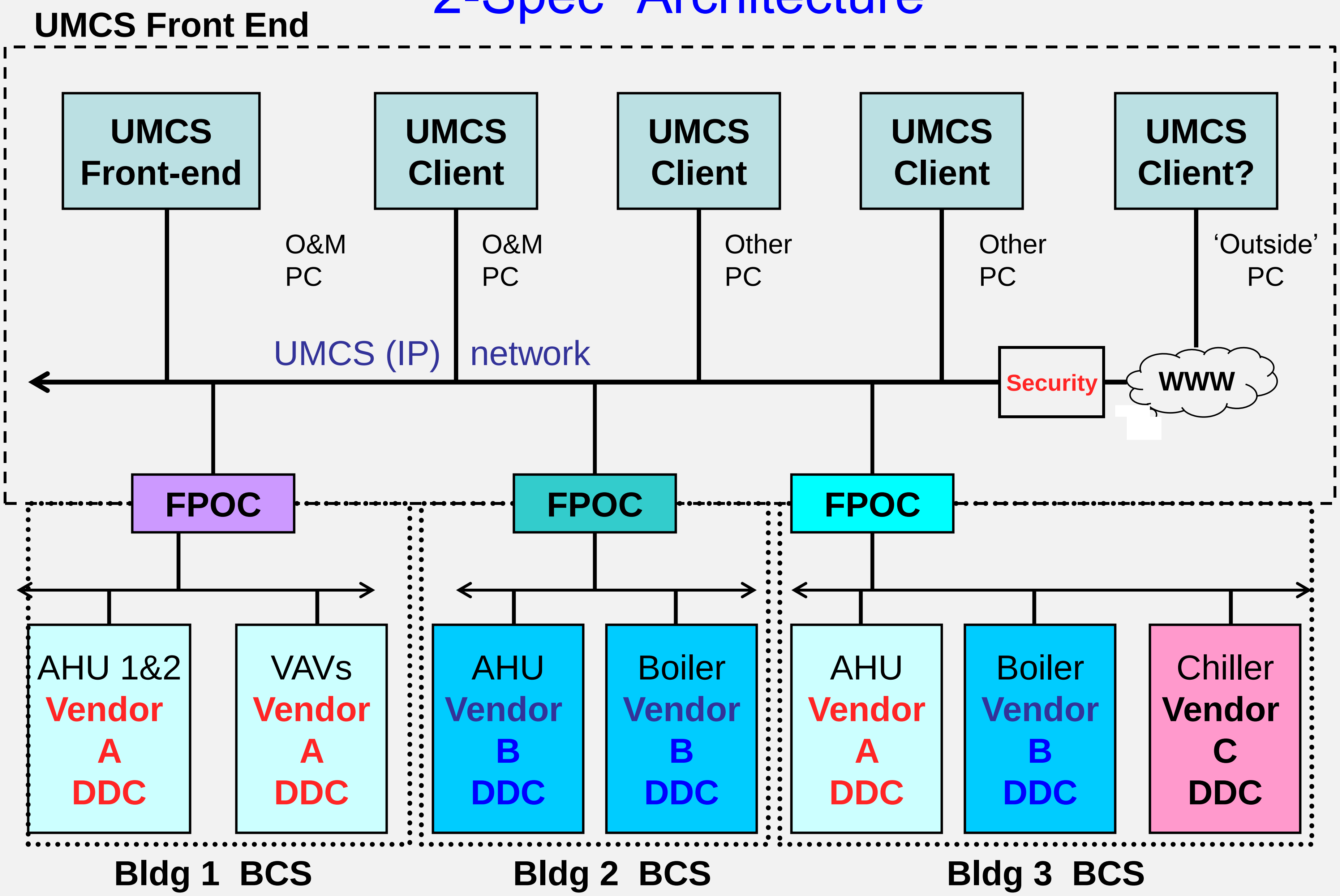
Overview

- “2-spec” approach
- Requirements for Open Systems
- Philosophy of Open Systems

Layer Architecture (Tiers)



“2-Spec” Architecture



FPOC=Field Point of Connection (UMCS to Facility/Building Control Network)

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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)

(one-line version)

"One (integrated, multi-vendor) system with no future dependence on any one contractor or controls vendor."

U.S.ARMY

US Army Corps of Engineers
BUILDING STRONG®

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

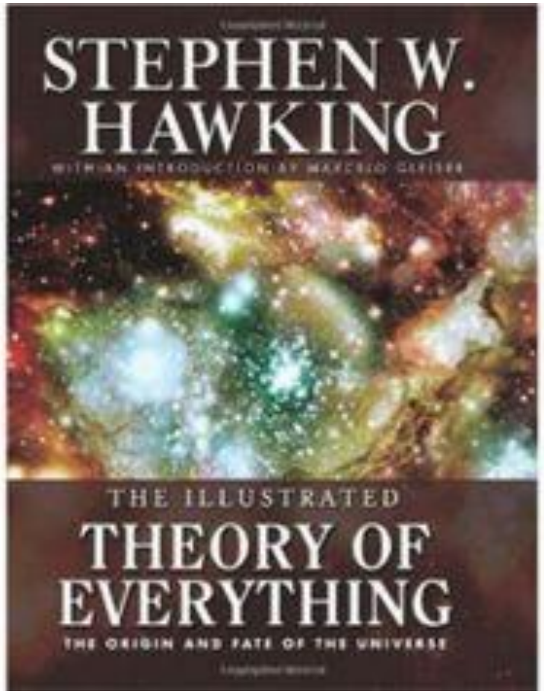
Philosophy of Open Specs

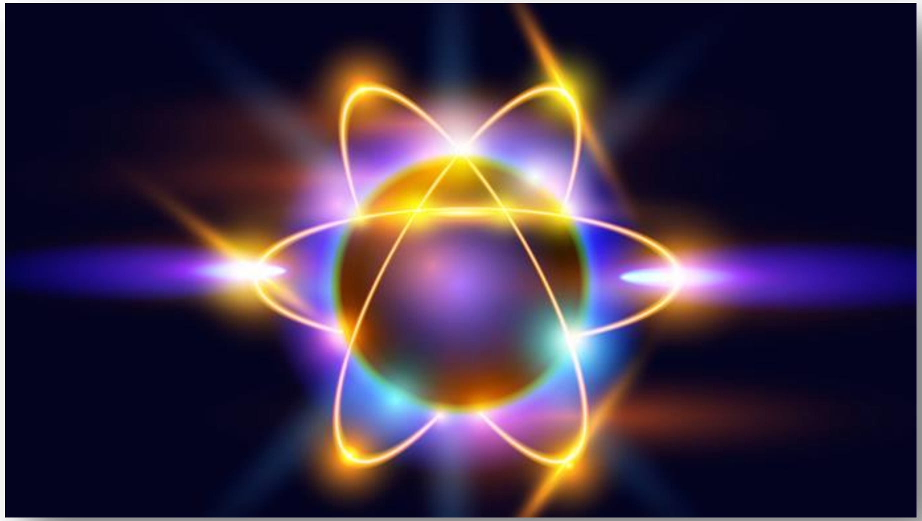
- An Open system that isn't supported isn't Open
  - Buy-in by system owner
  - Buy-in by maintenance organization
  - Buy-in by contract enforcement
  - Support of qualified installers and maintainers

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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