

Controls Integration and a Path to More Efficient Buildings

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Presentation Overview

- ❑ What is Controls Integration?
- ❑ The Need for Advanced Integration
- ❑ What Makes Advanced Integration Work
- ❑ Case Studies
- ❑ Wrap Up

What is Controls Integration?

- ❑ Sharing of Information from Multiple Sub Systems
- ❑ Consolidation of Information into a Common Front End
- ❑ Direct Digital Controls (DDC) Provided a Major Advance for the Control of HVAC Systems
- ❑ Next Stage of Development is Wide Area Integration of DDC Systems

Different Generations of DDC System

- 'First' Generation – 1980s
 - Programmable devices, remote alarming
 - Slower & smaller networks, serial & modems
 - DOS based

- 'Second' Generation – Early 1990s
 - Graphical front end and windows based
 - Faster networks, trending, MSTP & ARCNET

- 'New' Generation – Mid to Late 1990s
 - 'Open' protocols such as BACnet & LONworks
 - Web based, Ethernet

Older Proprietary Systems Lack Functionality

❑ Older DDC Systems Lack Many Features

- Trending difficult
- Mixed with pneumatics & limited control
- Insufficient control points
- Many are still DOS based
- Diagnostic features other than basic alarms are unavailable
- Few options for remote access



Proprietary Systems Prevail

- ❑ Owners of Multiple Buildings have Multiple Different DDC Systems
 - Difficult procurement process
 - Numerous licenses needed
 - Building operators require knowledge of different systems

- ❑ Older DDC Systems Can be Expensive to Upgrade
 - Prioritization of budgets for controls upgrades
 - One system, one vendor, one price
 - Ten year cycle

Components of a Successful Wide Area Integration

- ❑ Use of Open Protocols
 - Control systems with open protocols easier to integrate
- ❑ Reliable and Functional IT Network
 - Select the right IT solution, select correct router ports.
- ❑ Robust Hardware
 - Hardware is the interface between the native controls system and the common front end; correct selection is critical.
- ❑ Experienced Integrator
 - Integrator must have experience of native control systems, IT systems and integration technology.

Open Protocols – Quick Review

- ❑ Building Automation and Control Networking (BACnet)
 - BACnet over IP
 - BACnet over Ethernet
 - BACnet over MSTP
- ❑ LonWorks (LON)
 - Lonworks
- ❑ Modbus
 - Modbus RTU
 - Modbus ASCII
 - Modbus TCP

Commonly Used Integration Systems

- ❑ Java Application Control Engine (JACE)
 - Produced by Tridium, multiple connection types, multiple drivers, Niagara AX language open source & write custom drivers.

- ❑ Richards Zeta
 - Multiple devices depending on application or protocol, mediator is main integration device, translation file needed.

- ❑ Field Server
 - Multiple drivers, used a lot in non-HVAC systems

- ❑ Long Established Controls Manufacturers
 - For example ALC Webctrl

IT Network Types

- ❑ Exclusive IT LAN
 - Highly secure, total control, dedicated bandwidth, fast, expensive.
- ❑ Virtual Local Area Network (VLAN)
 - Secure, use existing infrastructure, dedicated bandwidth, less expensive than exclusive
- ❑ Shared Public or Private LAN
 - Answer to IT Dept., use existing network and share bandwidth, less expensive than exclusive or virtual
- ❑ Dial Up
 - Most control systems support modems, very slow, connect to one system at a time, cheap

An Ideal Scenario

- ❑ Readily Accessible Information on Building System Performance
- ❑ Remote Control of Building Systems
- ❑ Competitive Environment to Deliver Highest Quality Control Systems
- ❑ Consistent and Recognizable Graphics & Point Naming Convention
- ❑ HVAC System Sequences that Result in Optimal System Performance on an Ongoing Basis

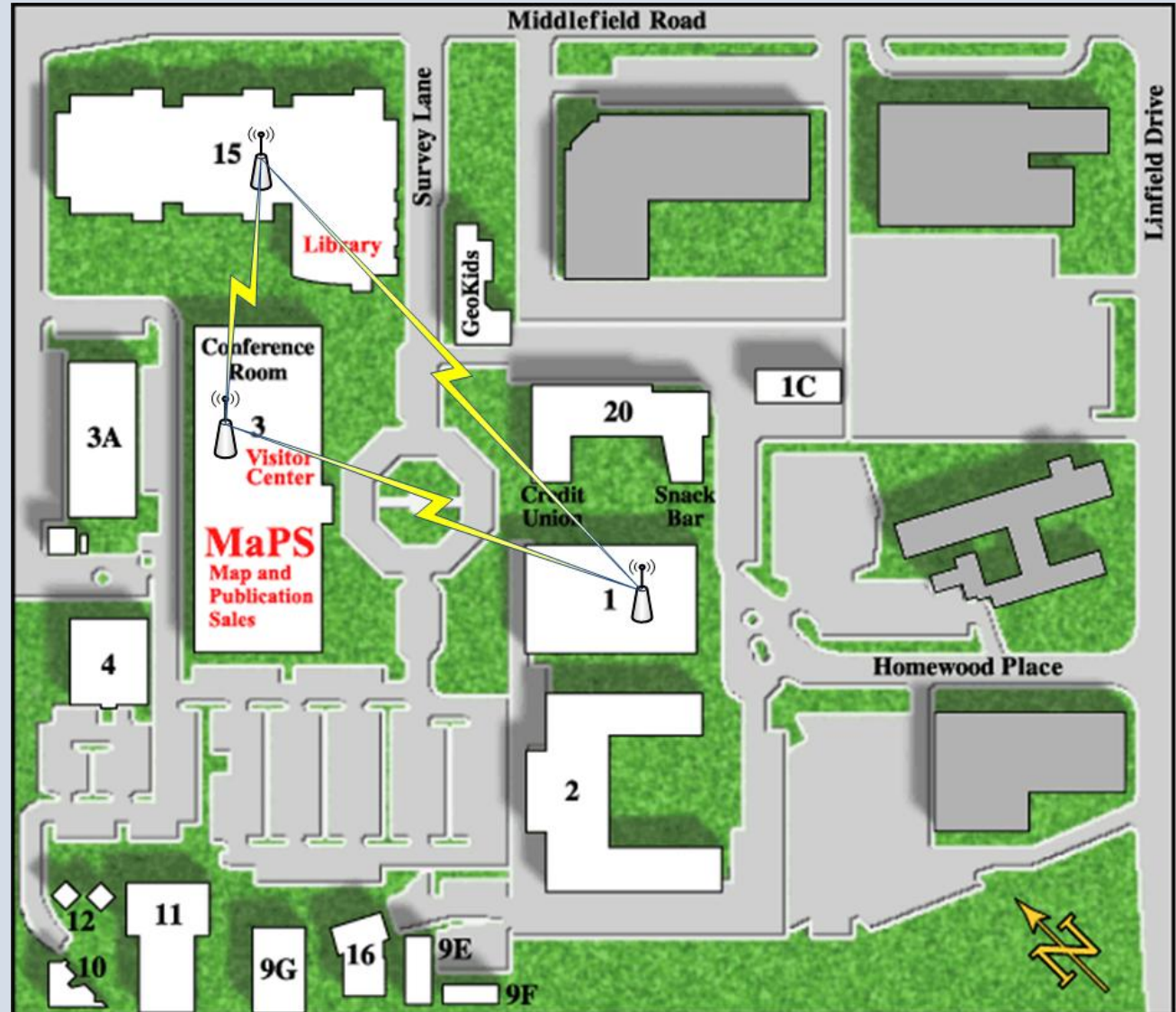
Two Case Studies

- ❑ Menlo Park Campus, GSA
 - Campus of several buildings
 - Integration of four 'First'/ 'Second' generation control systems into common Tridium AX front end.

- ❑ GEMnet (Government Energy & Maintenance Network) Expansion
 - Expansion of an existing wide area network covering around 100 buildings in four States.
 - Existing wide area network integrates ten (10) buildings using ALC Webctrl.
 - Integration of the control systems at eighteen (18) facilities into Tridium AX front end.

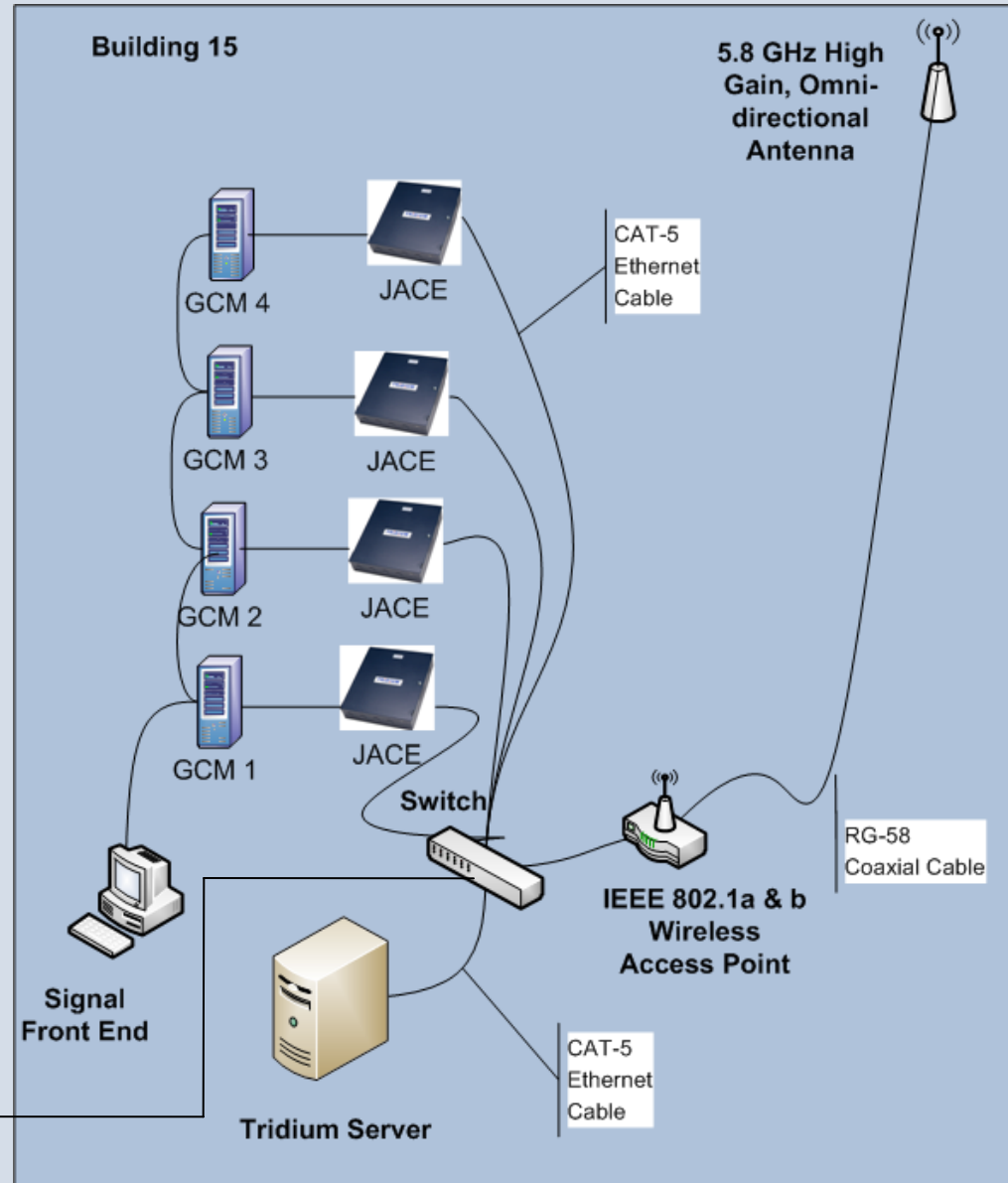
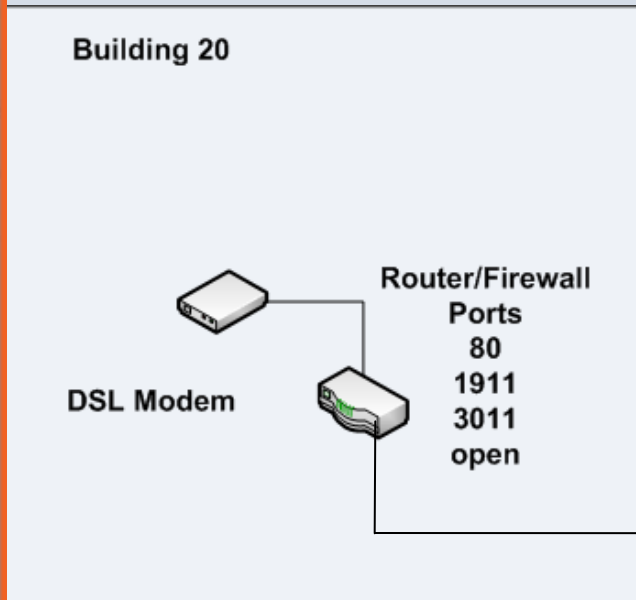
Menlo Park Campus Site Plan

A mesh, wireless network was established between buildings 1, 3 and 15. Building 15 is the location of the Tridium server at this site.



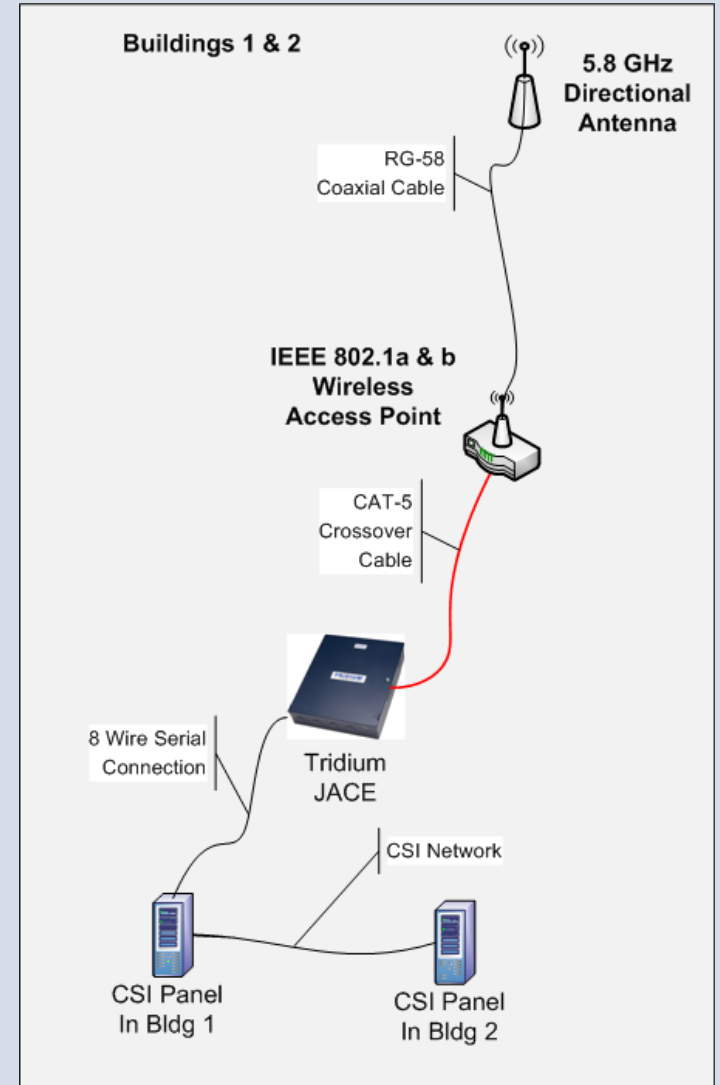
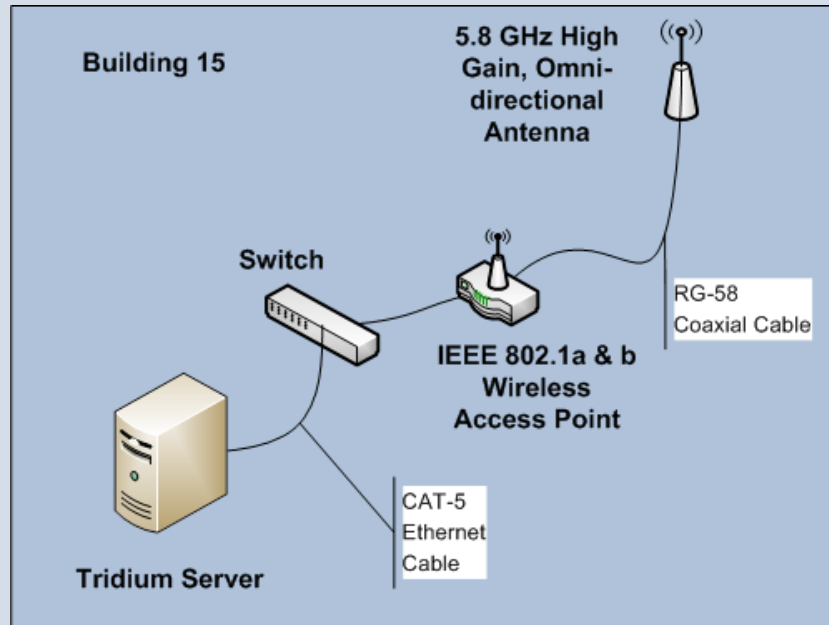


Menlo Park – Buildings 15 and 20



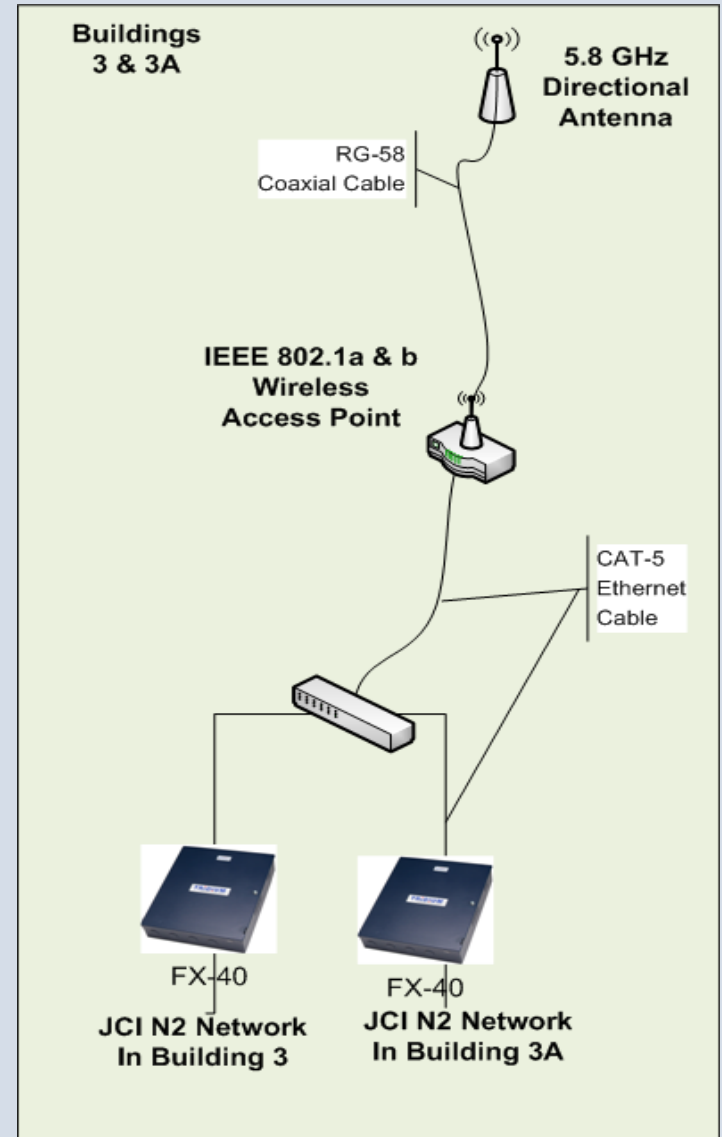
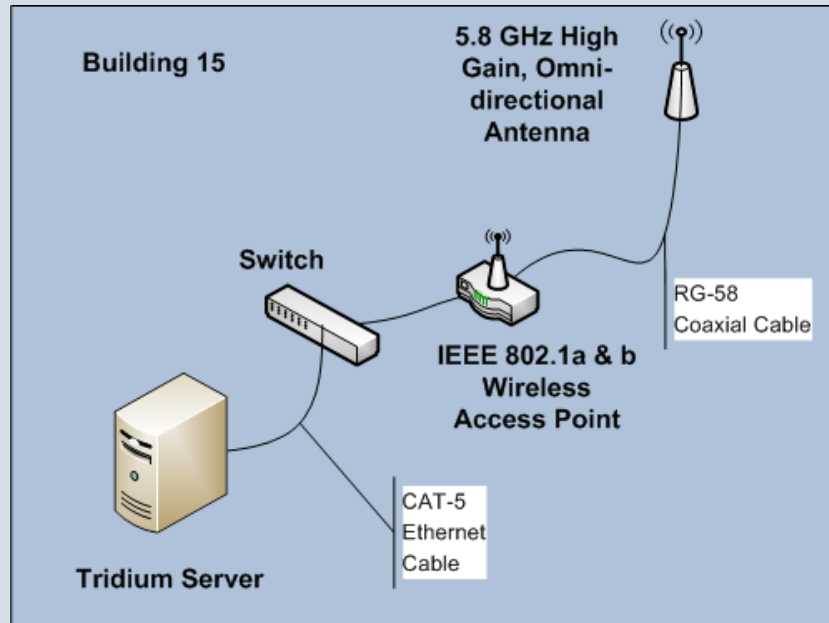


Menlo Park – Buildings 1 and 2





Menlo Park – Buildings 3 and 3A

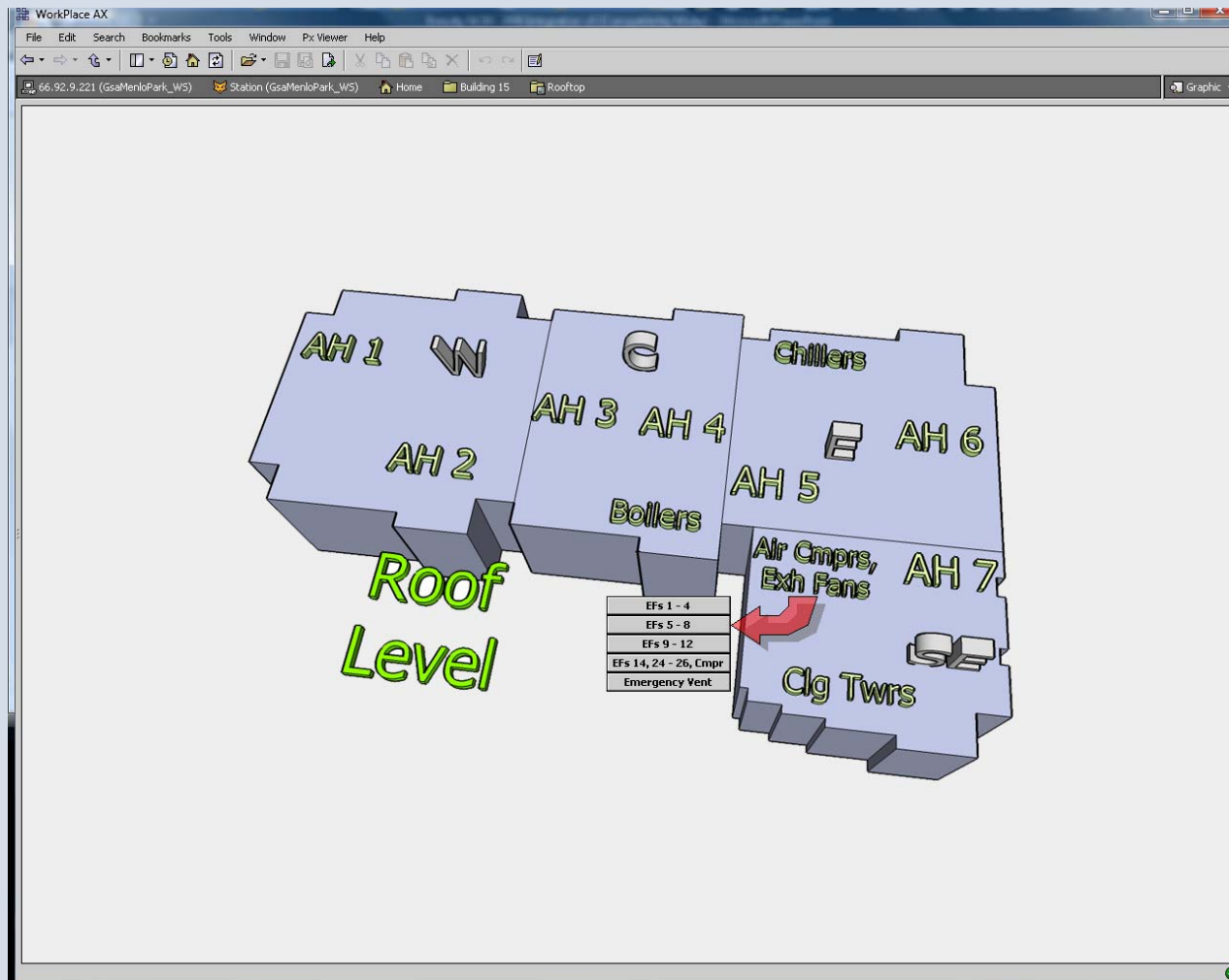




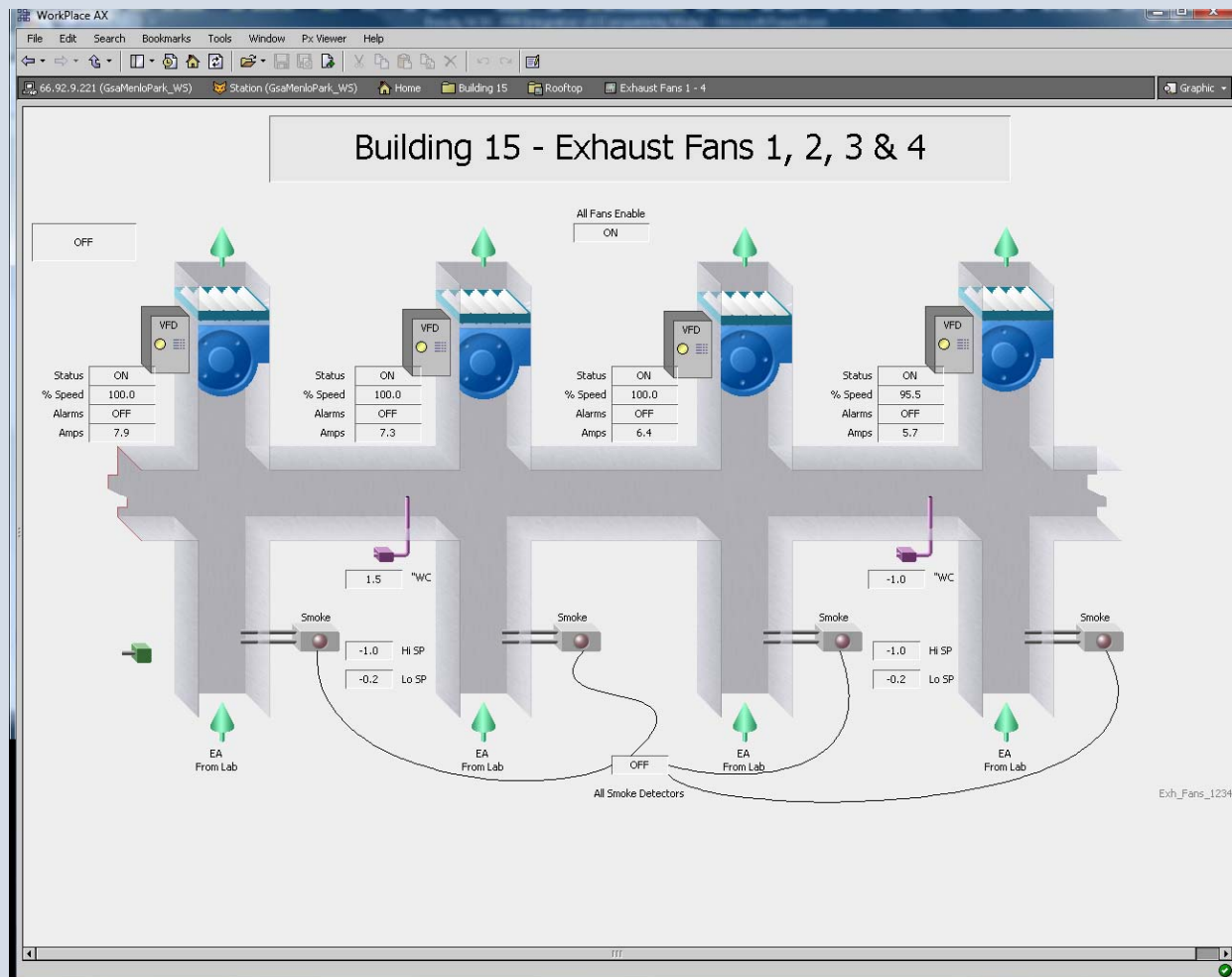
Improved System for Building Operators

- ❑ All Five Buildings Now Monitored from One Front End
- ❑ Setpoints, Schedules, Alarms, Trending from One Front End
- ❑ Common Set of Graphics
- ❑ New Building Operators Require Less Training

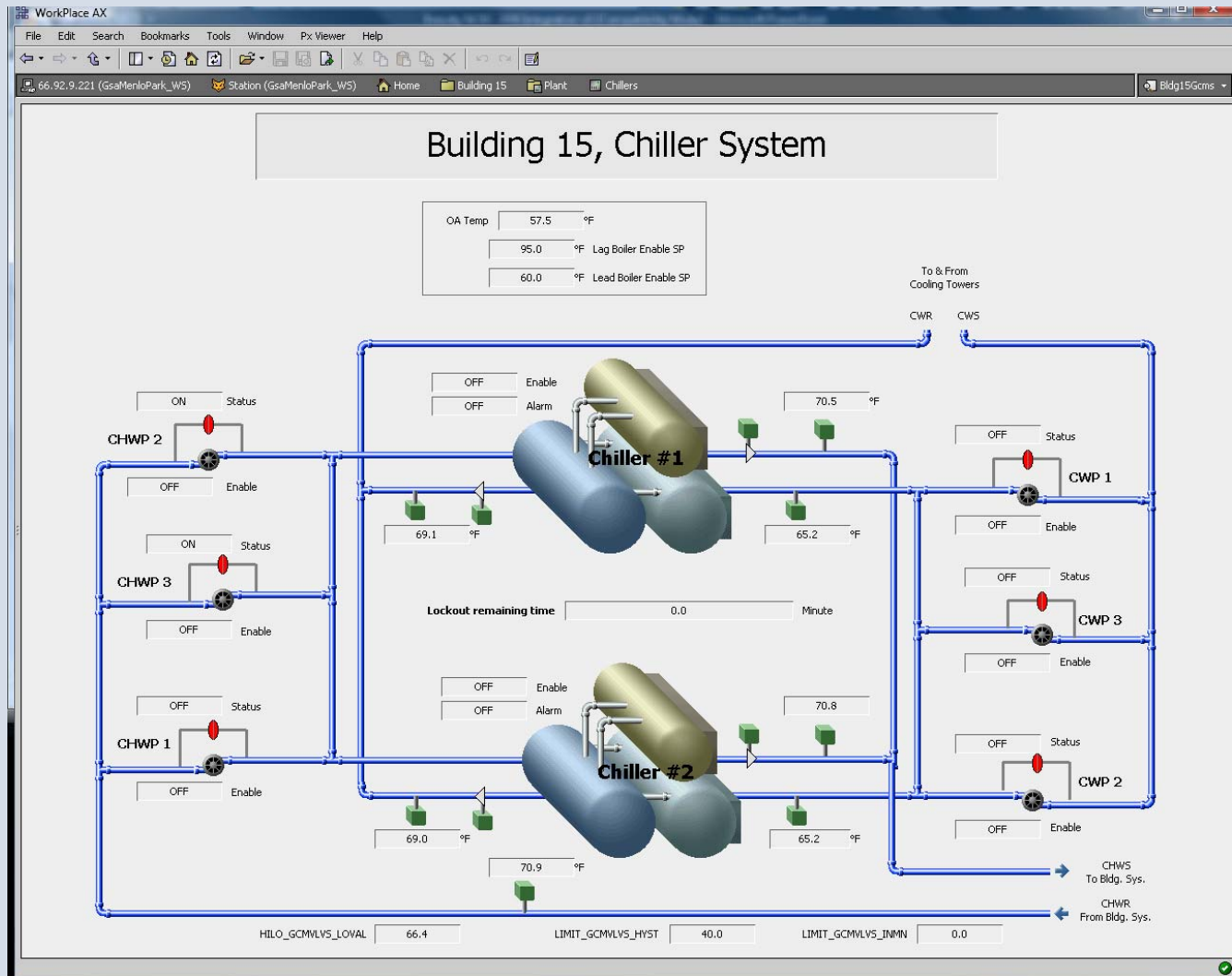
Menlo Park Sample Tridium Graphics I



Menlo Park Sample Tridium Graphics II



Menlo Park Sample Tridium Graphics III





Lessons Learned – Menlo Park Campus

- ❑ Existing Network 8000 Network Issues
 - Additional JACE panels were needed in Building 15.
- ❑ Commission System
 - Thorough point to point checks needed
- ❑ Building Operator Training
 - Coordination with building engineers and client critical through integration process
- ❑ Wireless Network Required a Lot of Troubleshooting

GEMnet Integration Phase II





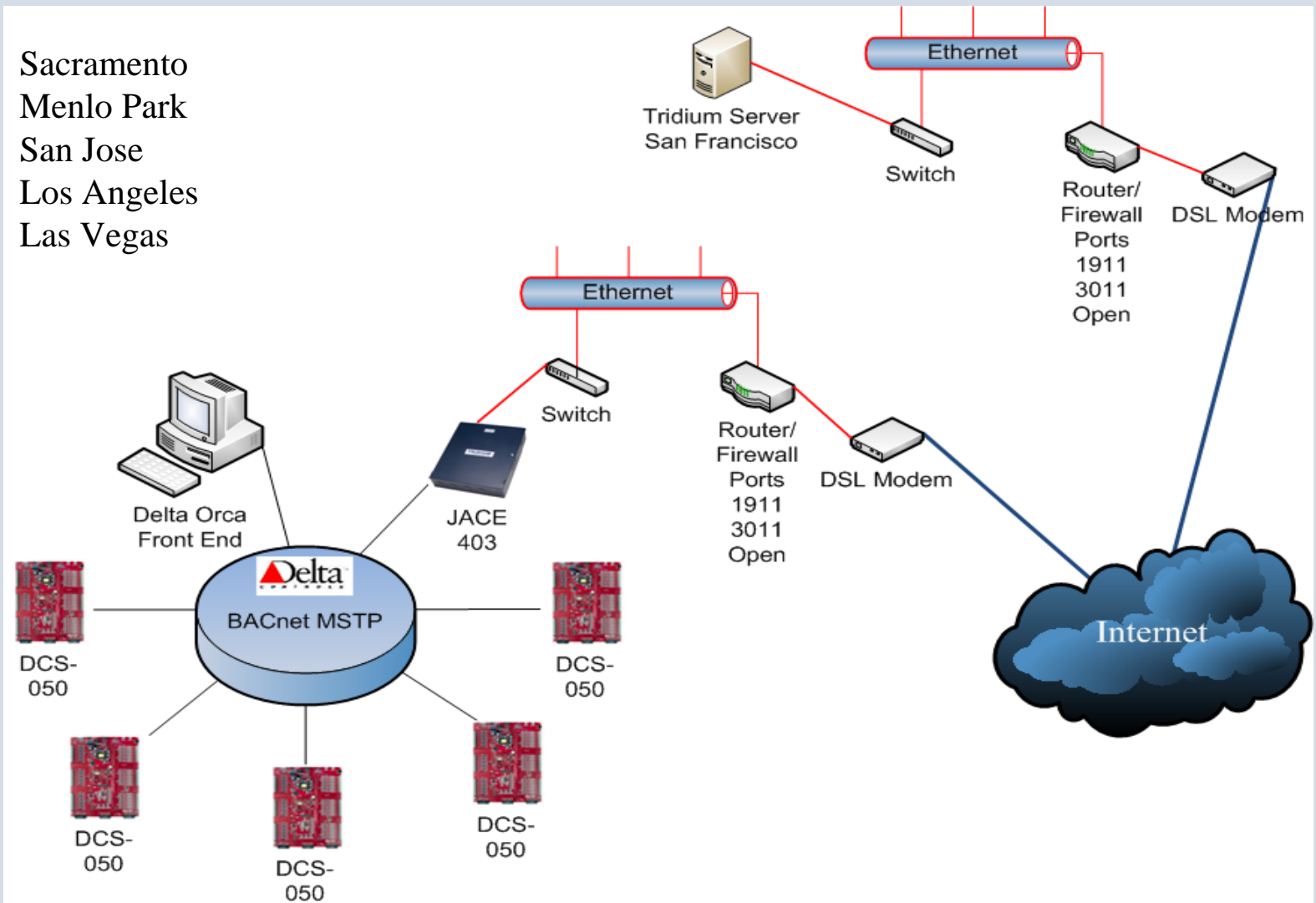
GEMnet Integration Phase 2 Overview

City	Buildings per Site	Proprietary Systems	Hardware Installed	Final Protocols Used
Sacramento	4	Johnson	Mediator, JACE	BACnet/IP, Niagara
San Francisco	1	Niagara	None	SQL
Fresno	1	Invensys	Mediator	BACnet/IP
Van Nuys	1	Delta	Mediator	BACnet/IP
Los Angeles	3	Delta, CSI	JACE	BACnet MS/TP, ModBus/RTU, Niagara
Santa Ana	1	ALC	None	BACnet/IP
San Diego	1	LonWorks	None	SQL
Calexico	1	LonWorks	None	ModBus/RTU
Menlo Park	5	CSI, Barber-Colman, Johnson	JACE, Server for operator use	Niagara
San Jose	2	Delta	JACE	BACnet MS/TP, Niagara
Reno	1	Johnson	Mediator	BACnet/IP
Las Vegas	1	Delta	JACE	BACnet MS/TP, Niagara



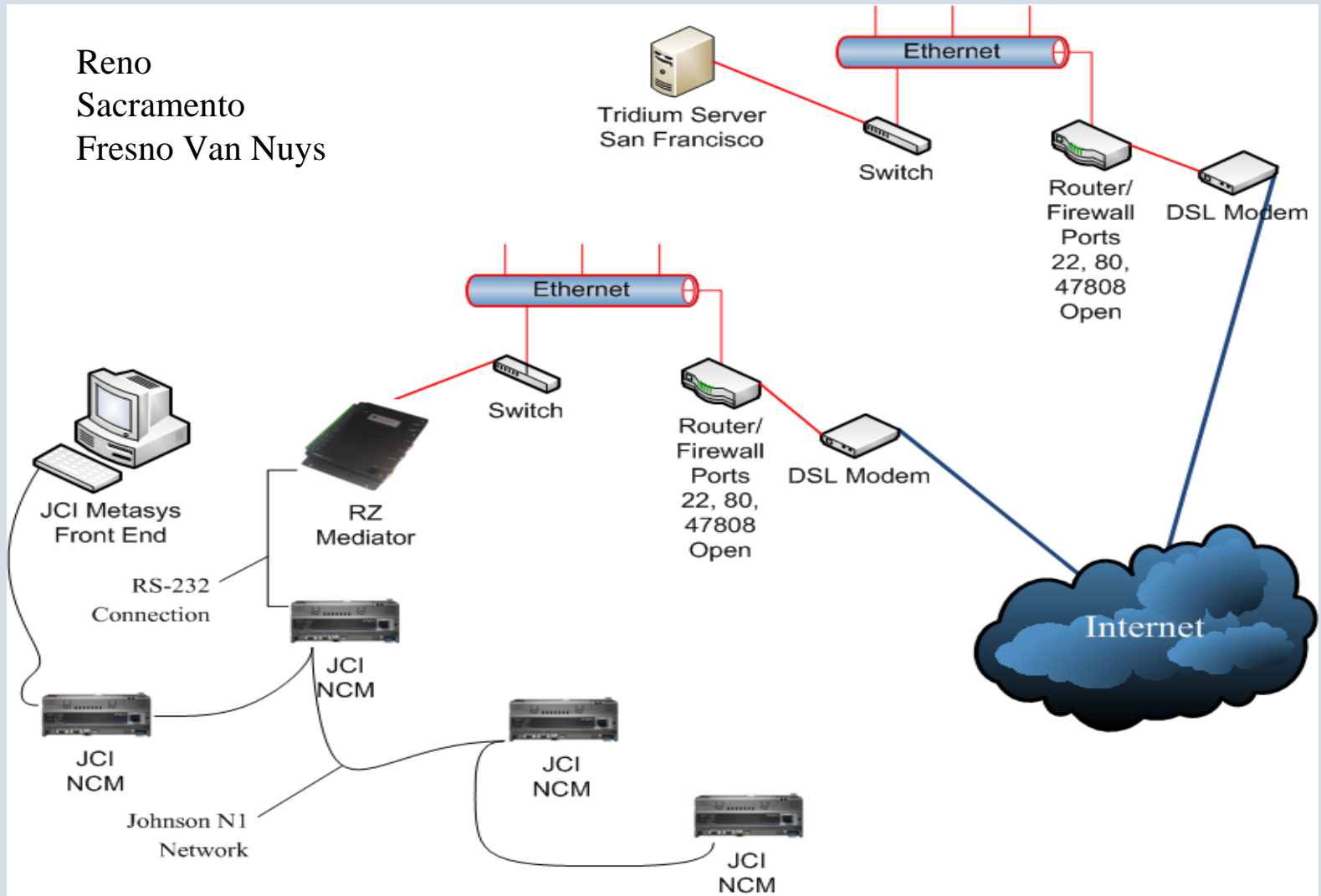
Typical Layout for a JACE

Sacramento
Menlo Park
San Jose
Los Angeles
Las Vegas





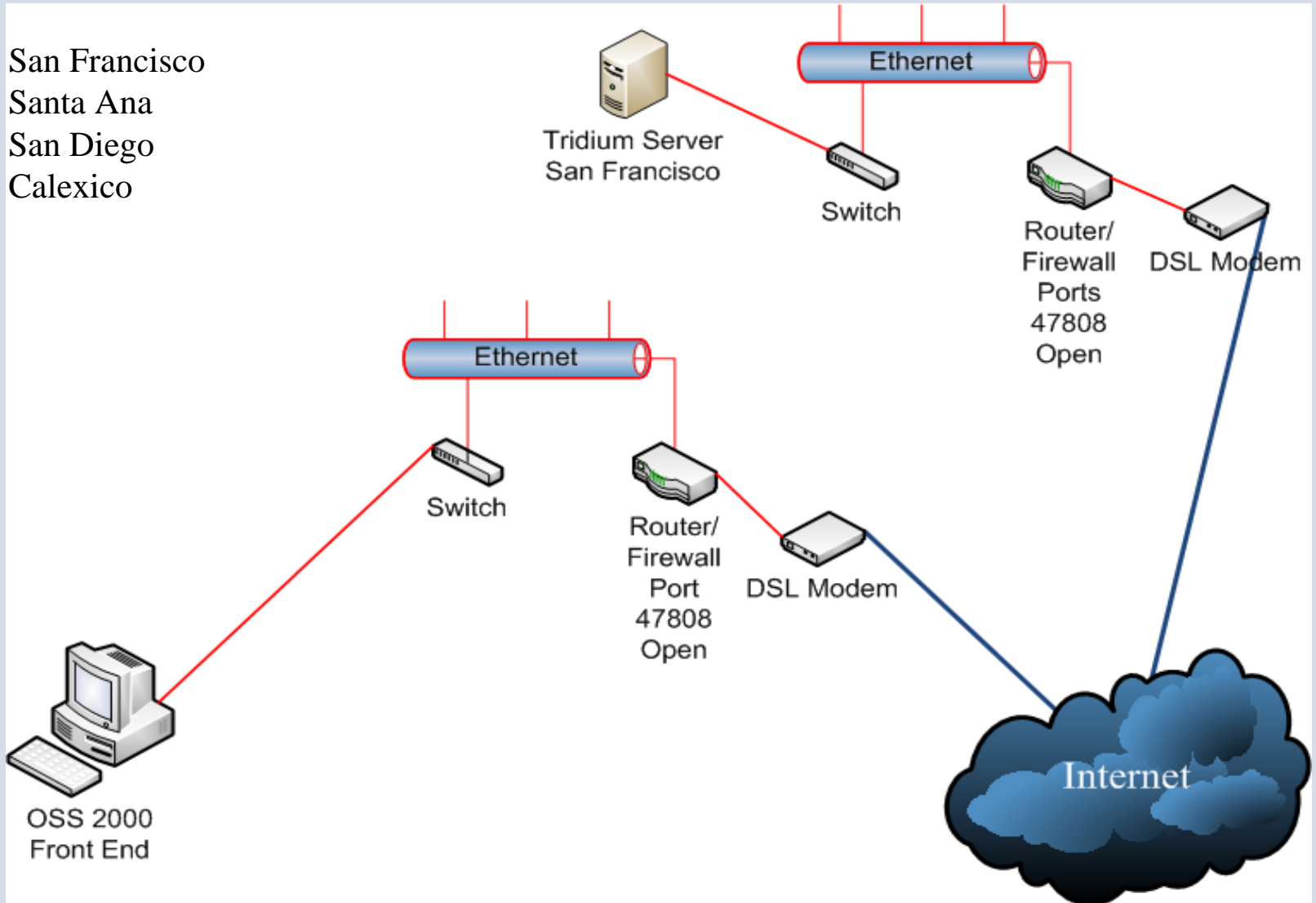
Typical Richards-Zeta Mediator Connection





Typical Modbus, BACnet or SQL Connection

San Francisco
Santa Ana
San Diego
Calexico





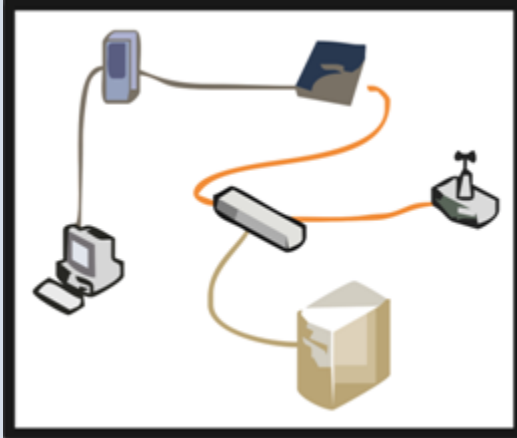
Lessons Learned – GEMnet Phase II

- ❑ Verify Network is Fully Functional Within Each Building
 - FAA building in LA did not have good ethernet connection between BAS & router.
- ❑ Firewall Configurations
 - Had to work with GSA network administrator to understand firewall configurations and open ports
- ❑ Individual Site Hardware Requirements
 - What works in theory does not always work in practice; native BACnet site needed JACE
- ❑ Verify Existing Open Protocols
 - One site was Modbus RTU; master/slave not defined

Power of the Fully Integrated System

- ❑ Central Point for Initiating Demand Reduction
- ❑ Collect Trend Data for Multiple Facilities on One Server
- ❑ Fault Diagnostics & Monitoring Based Commissioning Easier to Implement
- ❑ System Performance at Multiple Facilities Can be Monitored from Any Location
- ❑ New Facilities Can be Remotely Commissioned

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