

# Massachusetts School Building Authority

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## Building Controls and Automation

Being Prepared for Complex Building  
Systems

May 1, 2019



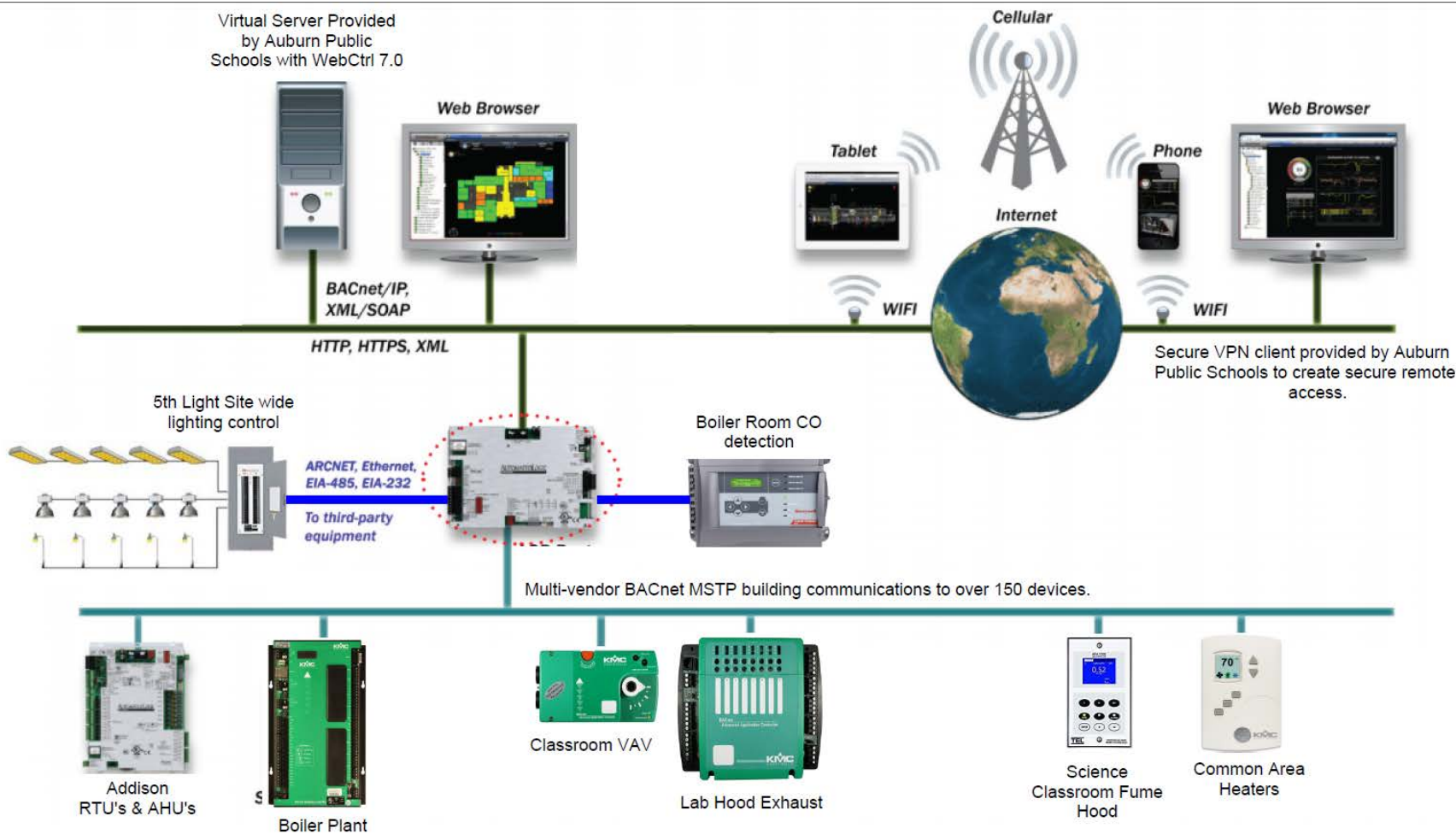


# Agenda

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- Building Automation System Architecture
- Representative Issues with Complicated Systems
- Controls Coordination Meeting
- Design Options
- Controls Technicians

# Building Automation System Architecture





# Building Automation System Architecture

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A Data Communication  
Protocol for Building  
Automation and Control  
Networks



# Building Automation System Architecture

## BACnet Facts

- **8 1/2 years in development**
- **Original standard published in 1995**
- **Updated standard published in 2001 that includes 5 addenda to BACnet-1995**
- **Approved as ISO Standard 16484-5 in January, 2003, and will also soon become a standard within the European Union**
- **Available products include workstations, controllers, gateways, routers and diagnostic tools**



# Building Automation System Architecture

## BACnet Applications

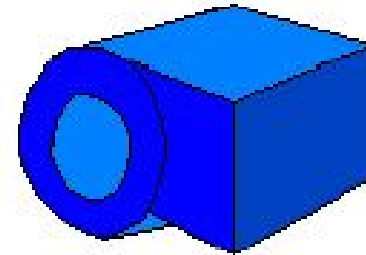
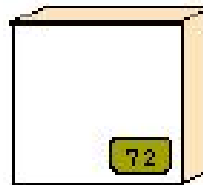
- **HVAC control**
- **Fire detection and alarm**
- **Lighting control**
- **Security**
- **"Smart" elevators**
- **Utility company interface**

# Building Automation System Architecture



## Objects

- **Objects represent physical inputs, outputs and software processes**







# Controls Technician


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- primary responsibility for “the maintenance of all controls, valves and related components of the HVAC systems and gas-fired equipment”



# Controls Technician

- To “install, test, maintain and repair Direct Digital Controls (DDC) and pneumatic controls, as well as low-voltage electric equipment.”
- To perform “tasks associated with DDC energy maintenance system, i.e. trending, overrides, calibrating, troubleshooting, replacement of parts, etc.”
- To use “digital multi-meter and calibration/testing tools associated with servicing DDC systems and their end devices.”
- To “troubleshoot and edit DDC programs and front-end graphics.”
- To utilize “a computerized maintenance management system to obtain work orders.”



# School Facilities – HVAC Operations Program Manager

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Thorough knowledge of the following is essential to success in this role:

- Electrical systems
- CMMS (Computerized Maintenance Management System) systems
- HVAC & BAS systems management
- Mechanical and plumbing
- Boilers Power plant systems
- Roofing systems
- Project management, subcontract management
- Maintenance programs standards
- Key performance indicators
- Vendor managed inventory
- Materials management
- Emergency response procedures & hazardous materials management
- Regulatory Compliance procedures
- Familiarity with all applicable local, state and federal codes, NFPA, NEC and OSHA regulations



# Representative Issues

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1. Single Vendor
2. Java Support
3. RTU Software for New England
4. RTU Loop Tuning
5. Lighting System Integration
6. Packaged or BAS-ready Equipment



# 1. Single Vendor

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- Existing single vendor provider for BAS
- Controls Vendor
- Bid as Alternate
- Educated owner / point person



## 2. Java Support

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- Java support issues at time of Project Completion
- Controls Vendor / HVAC
- Forecasting maturity of software
- Managing firmware / hardware
- Controls Technician



## 3. RTU Software for New England

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- RTU software inability to meets needs of New England Climate
- Equipment Manufacturer / Mechanical
- Vet vendor & equipment application
- Adapting Sequence to ensure proper operation year-round
- Controls Technician



## 4. RTU Loop Tuning

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- Loop tuning various sequences (equipment short cycling between modes)
- Equipment Manufacturer / Mechanical
- Ownership by equipment manufacturer if packaged or BAS vendor if data available from manufacturer
- Accountability upon single party upon project completion
- Controls Technician





## 5. Lighting System Integration

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- Loop tuning various sequences (equipment short cycling between modes)
- Electrical Lighting Control Subcontractor
- Independent sensors for lighting controls and HVAC
- Coordination between BAS vendor and lighting controls subcontractor
- Controls Technician



## 6. Packaged or BAS-ready Equipment

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- Individual responsibilities and support services available after project completion
- Controls Technician



# Controls Coordination Meeting

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- Best Practice to convene a controls integration meeting following submittal approvals, prior to software installation, to identify and correct problems



# Controls Integration Meeting

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- Required Documents
  - Equipment Submittals Approved
  - BMS Controls Submittal (prior to final approval)



# Controls Integration Meeting

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- Required Attendees
  - Mechanical Contractor
  - BMS Contractor
  - Equipment Representative for Start-Up and Control
  - Mechanical Engineer
  - Commissioning Consultant



# Controls Integration Meeting

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- Objective
  - Review Communication Interface
  - Review Sequences of Operation
  - Review Which System is Providing Control



# Design Options – Right Design

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- Optimal building operations stem from building design that meets needs of school.
  
- Owner's Project Requirements
  - *Functional Uses*
  - *Quality of Materials*
  - *Occupancy Requirements*
  - *Indoor Environmental Quality Requirements*
  - *Performance Criteria*
  - *Construction Considerations*
  - *Budget Considerations and Limitations*



# Design Options – Right People

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- Sophisticated systems offer lots of design options – vital to have people involved who understand the choices to make decisions.
  
- Operations and Maintenance personnel
  - *Extensive operations and maintenance experience in modern buildings*
  - *Thorough knowledge of building systems*
    - *Roofing*
    - *Electrical*
    - *Plumbing*
    - *HVAC*
    - *Building Automation/Building Controls*





# Design Options – Right People

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- Project Team
  - Owner's Project Manager
  - Designer
    - *Sub-consultants*
  - Contractor/Construction Manager
    - *Subcontractors*
      - *Sub-sub-contractors (verify qualifications)*
- Engage District staff early
  - *Maintenance and operations*
  - *Service contractors*
  - *Custodial*
  - *Administrators*
  - *Faculty*



# Design Options – Right Systems

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- Sophisticated building systems + Building Automation System = sophisticated school building.
- Balance the sophistication level with operators'/users' comfort levels
  - *Just because a system can perform/control a certain function doesn't mean it should*
- Understand the implications of the systems being proposed
  - *Initial cost*
  - *Operating cost*
  - *Life cycle*
  - *Training requirements*
  - *Serviceability & Maintenance requirements*



# Design Options - Training

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- Robust requirements in project specifications
- Professional videographer
- Timing
  - *Before building turn-over*
  - *At building turnover*
  - *Post occupancy*
- Train everyone
  - *Custodians*
  - *Operations/Maintenance personnel*
  - *Service contractors*
  - *Administrators*
  - *Faculty*



# Questions

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