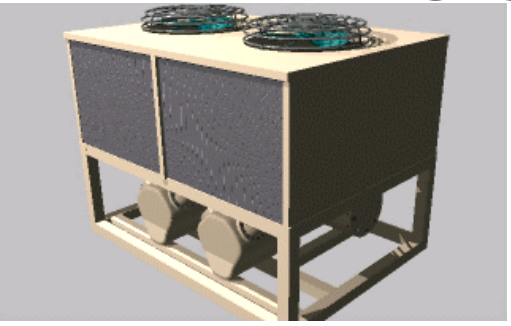
ENERGY/FACILITIES CONNECTIONS

Energy-Facilities Connections Conference
Leavenworth, Washington

It's All About HVAC Systems and Saving Big Bucks Using DDC Systems!



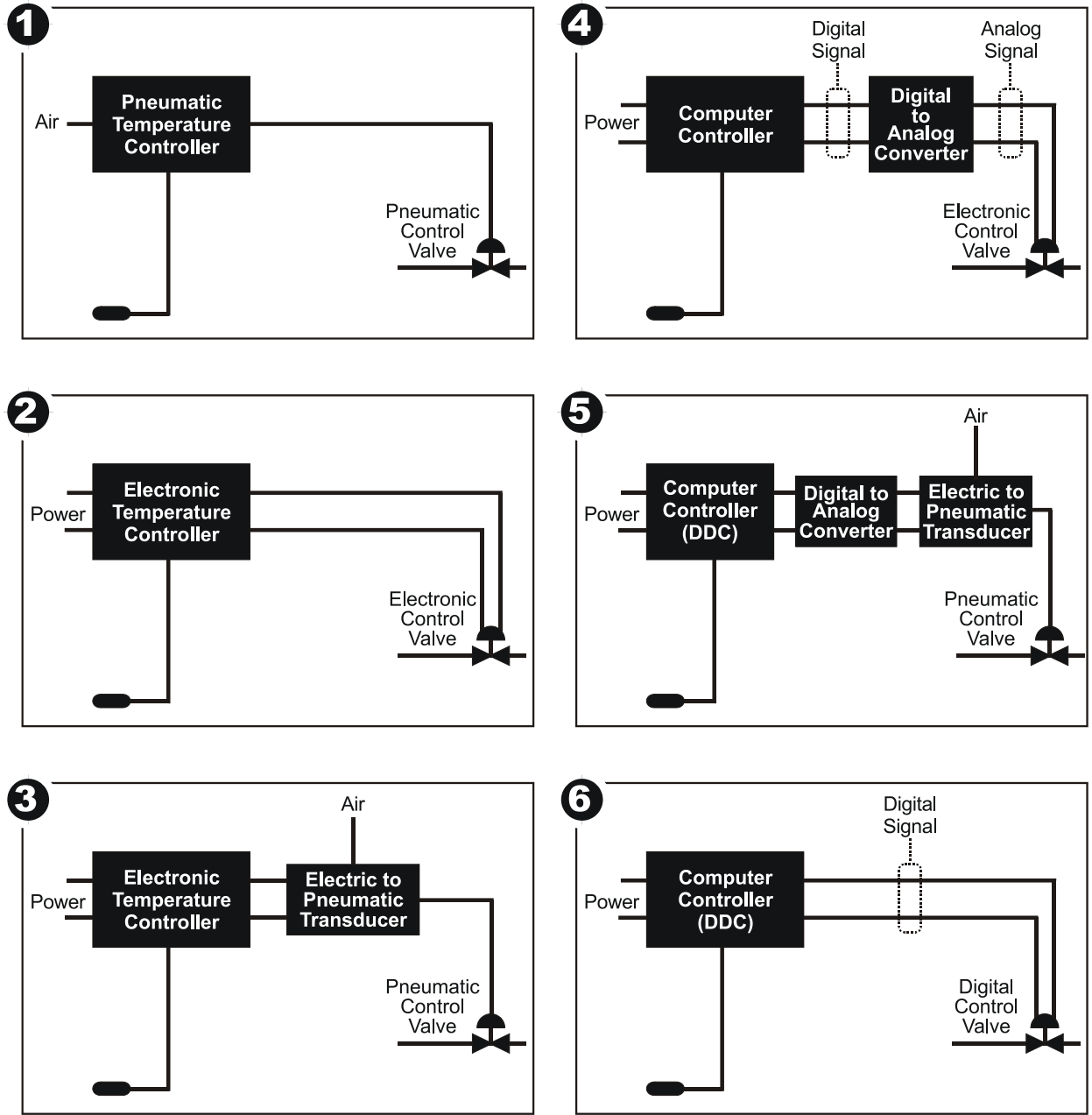
May 12th, 2010
Session 2, 10-11:20 am
by Greg Jourdan

WENATCHEE VALLEY COLLEGE

Agenda-It's All About HVAC Systems and Saving Big Bucks!

- **Current DDC Control Trends**
  - **Past, Present, Future**
- **DDC software and Network Communication Protocols BacNET, LON, and NiagaraAX**
- **Identify vendor options to simplify DDC networks while simplifying plant operations.**
- **Challenges and Future of DDC controls**
- **Identify the top 6 energy saving opportunities of any DDC control system.**

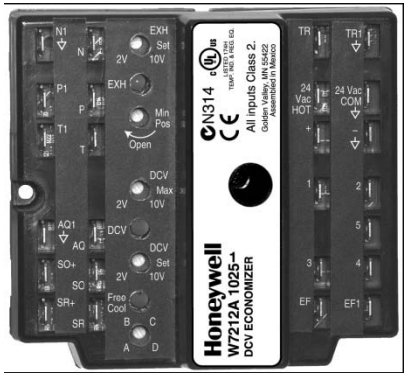
Past Evolution of Controls & DDC



The Past Traditional Controllers Included:

Electric Controls

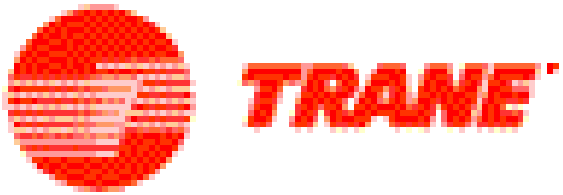
Pneumatic Controls



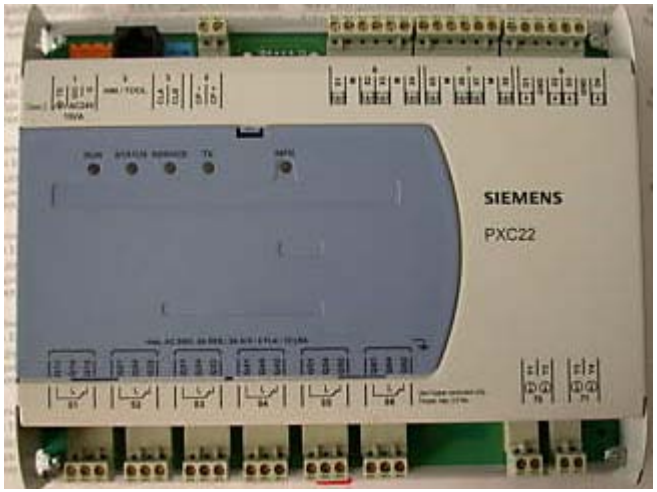
Electronic Controls

DDC Control Systems were PC Based with DDC Field Panels and Hard Wired Local Controls

Present DDC Control Companies are Merging Corporations

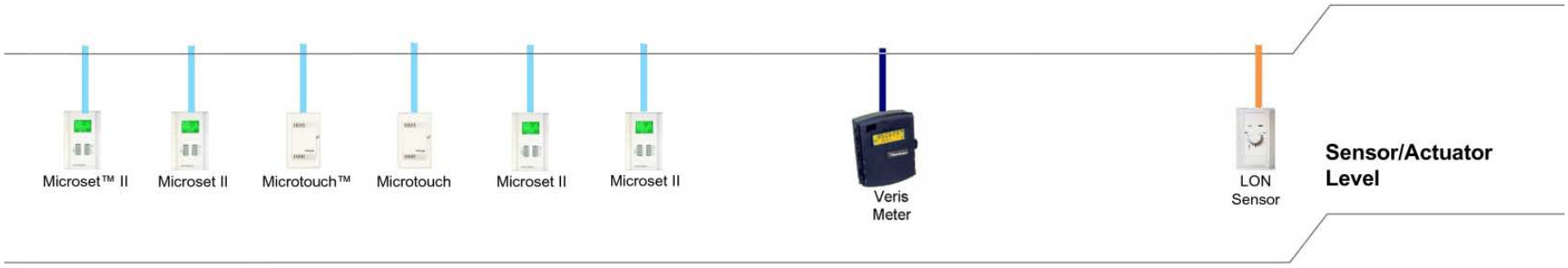


Present Options in DDC Controls Vary with Manufacturer's Equipment

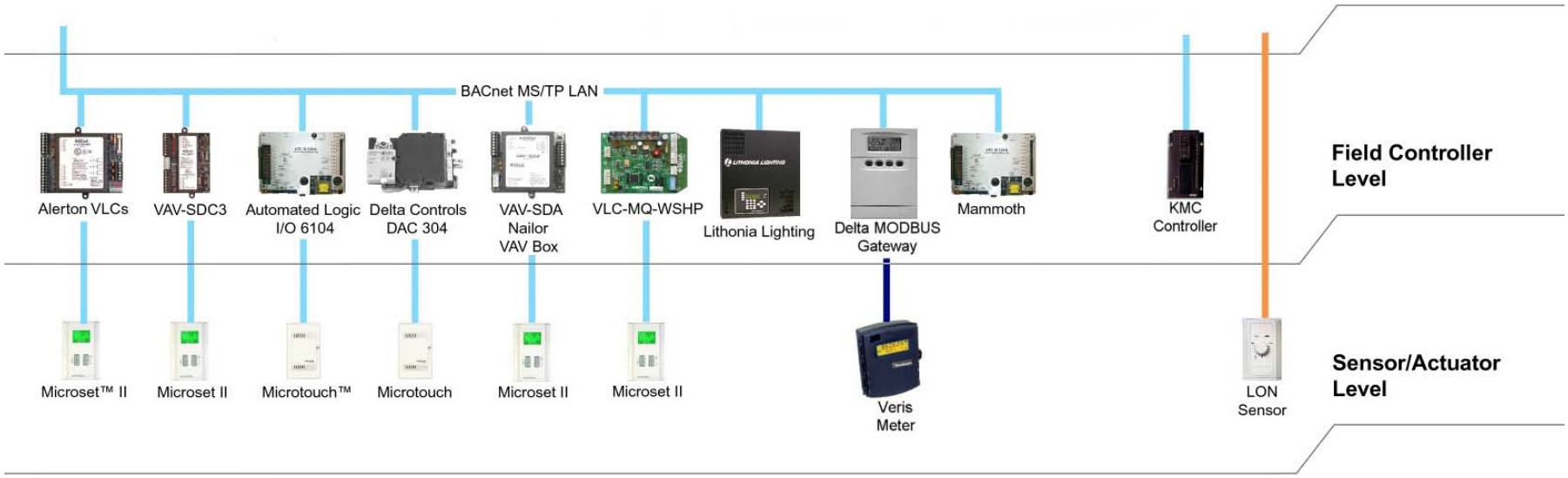


Present DDC Building Controls Utilize a Four Level Architecture

Sensor Level



Present DDC Building Controls Utilize a Four Level Architecture Field Controller Level



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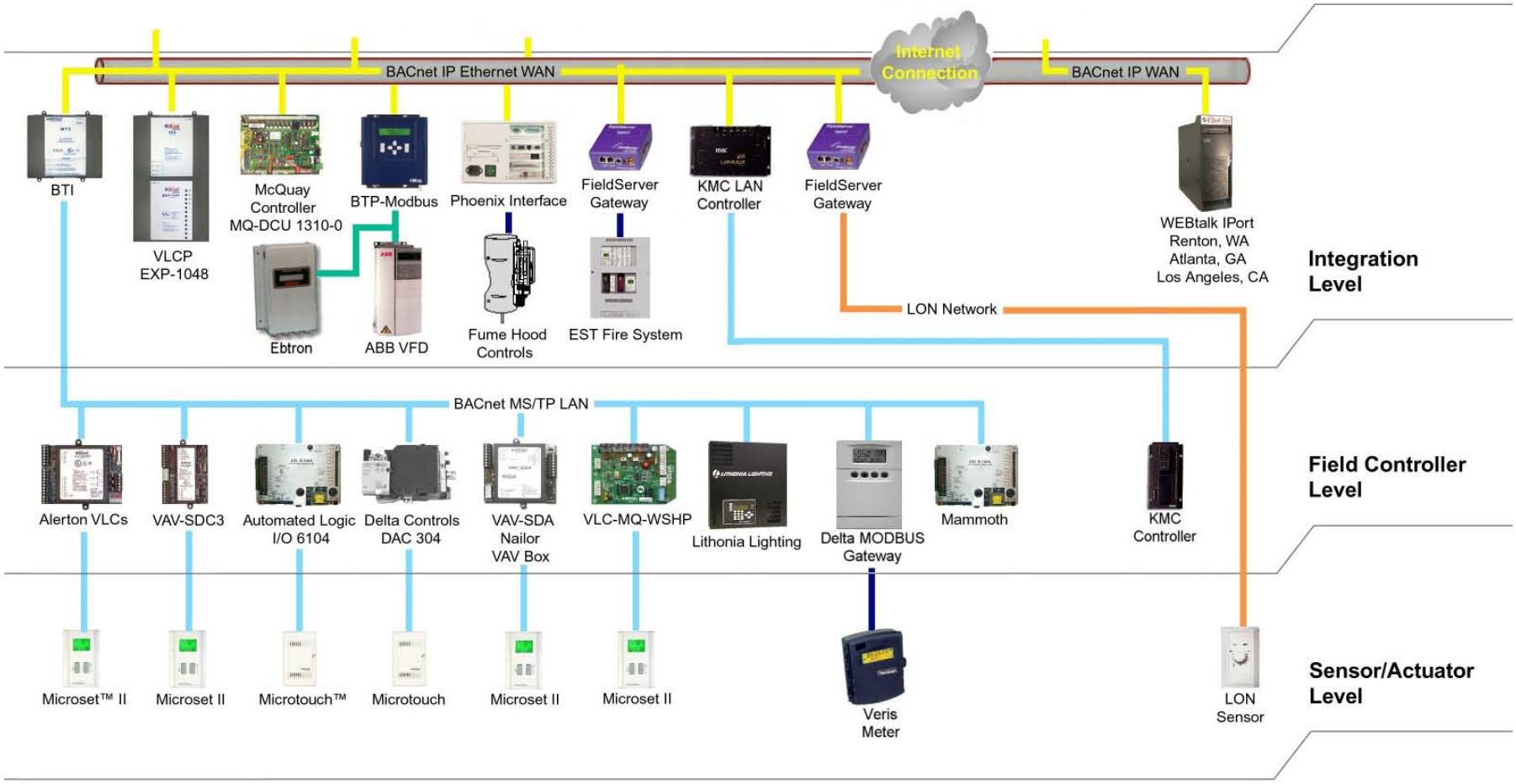
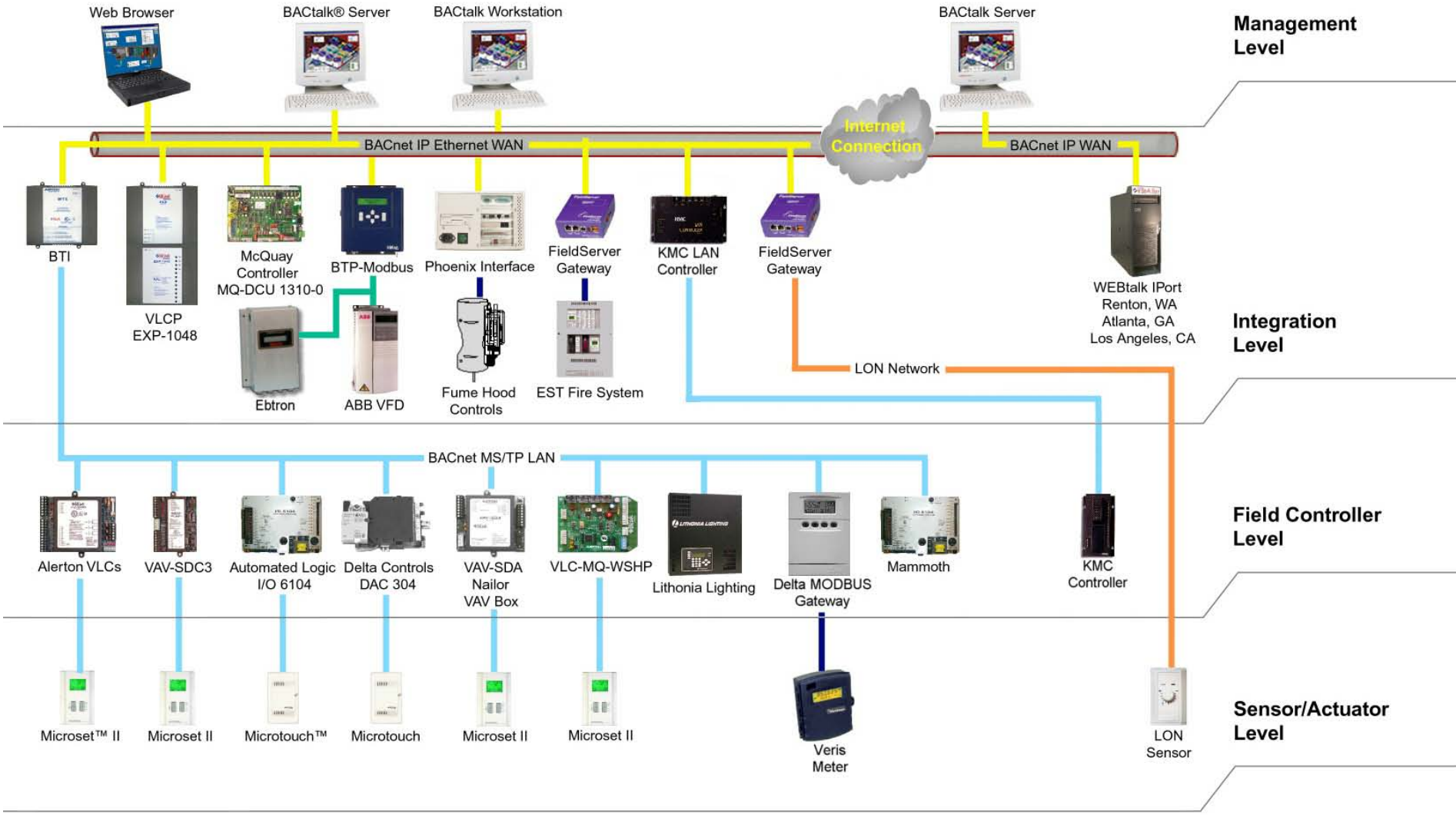
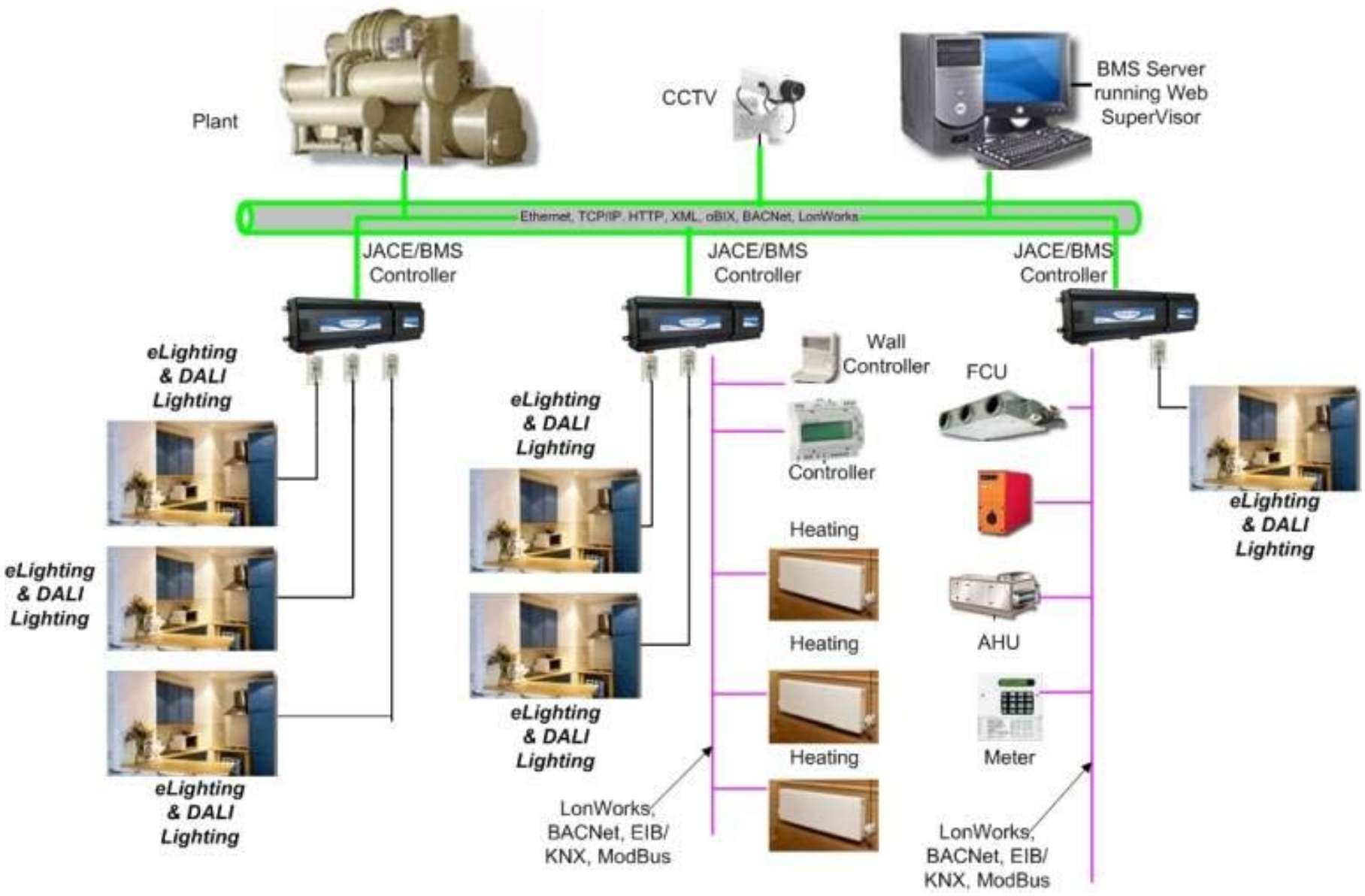
Integration Level



Present DDC Building Controls Utilize a Four Level Architecture Management Level



Integration is the Key with DDC Controls

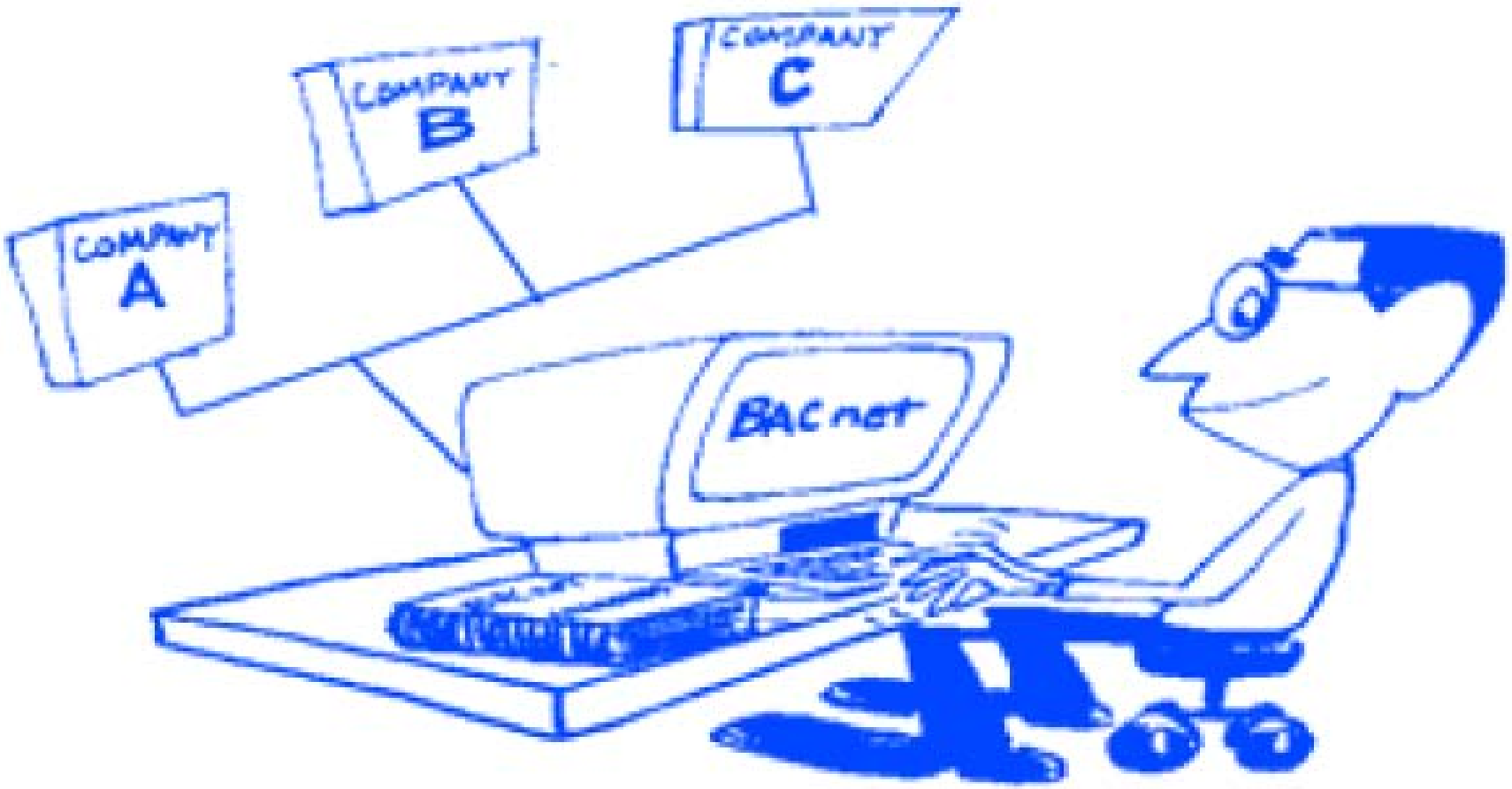


DDC Software and Hardware is Integrated into Building Systems to Allow Multiple Vendor Integration

Boilers, Chillers, Fire Alarm, Security, Lighting, AHU's, RTU's

Why Use Open Protocol?

Open Protocol Integrates DDC Manufacturer's



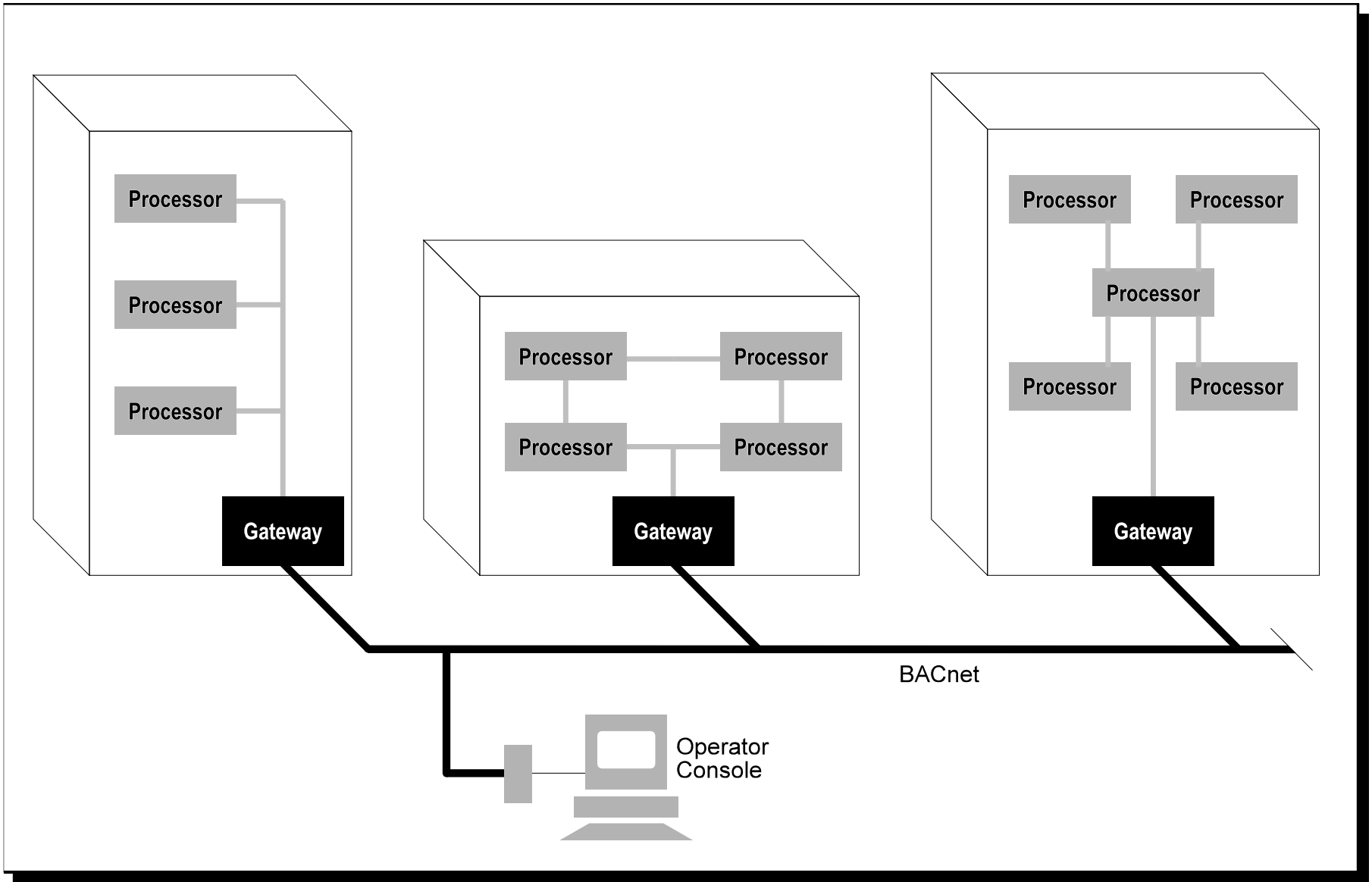
Open Protocol and Levels of Interoperability Issues

- Co-Existence
  - Systems don’t interfere nor they cooperate
- Solution Specific
  - Requires Joint development & Engineering
- Plug & Play
  - Effortless integration of various manufacturing
- Components
  - Interchangeability
  - Products are functionally identical

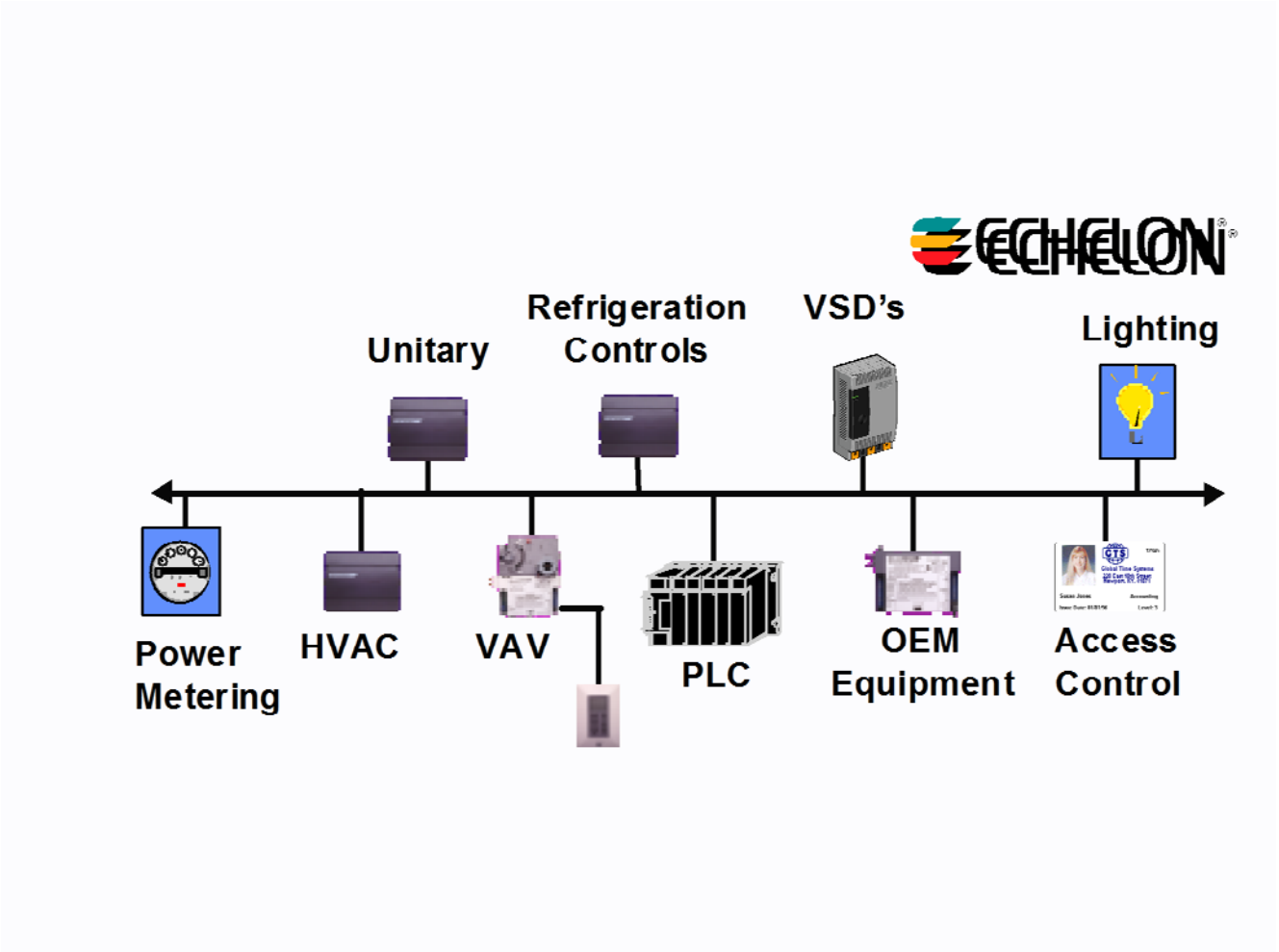
Integration is possible using the BACnet Software Standard Protocol

- BACnet, Developed by ASHRAE
- True, Non-proprietary, Open Protocol (Industry Standardized)
- Multiple Vendor Controllers

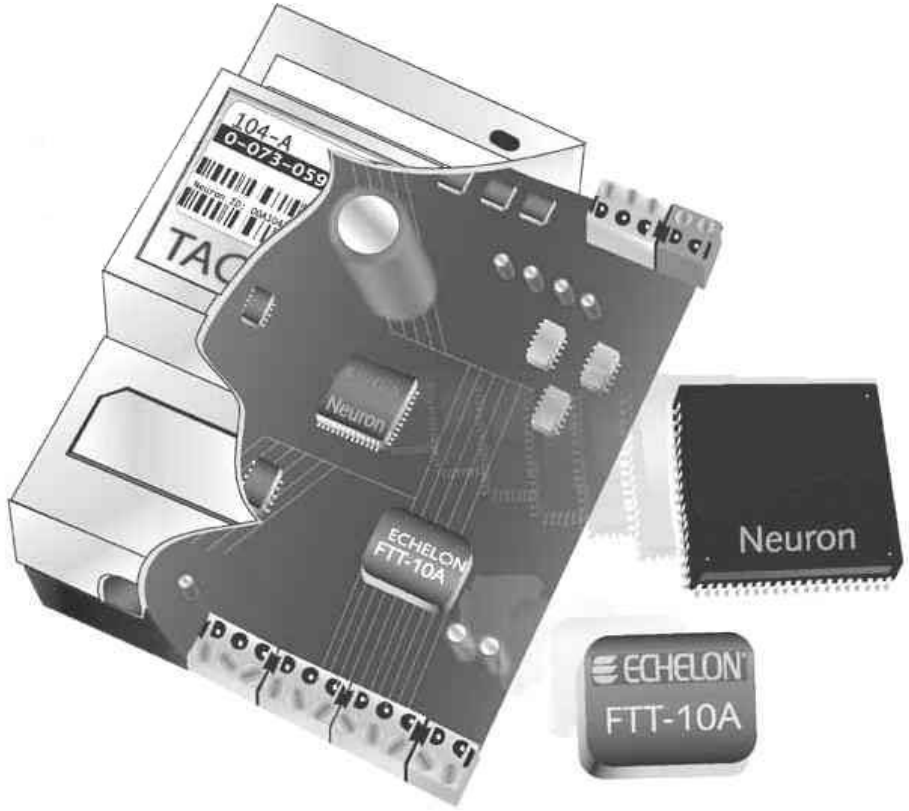
BACnet Connects DDC Controls



LonWorks Platform Integration (Open Protocol)



LonTalk and the Neuron Chip is a Product of the Echelon Corporation



BACnet is the Preferred and Fastest Growing Network Standard

		Units (1000s)			Revenue (mill $)	
	BACnet	ECHELON	Pro-prietary	BACnet	ECHELON	Pro-prietary
1998	145	44	588	110	43	604
2001	183	58	717	231	61	684
2008	747	90	947	648	78	821

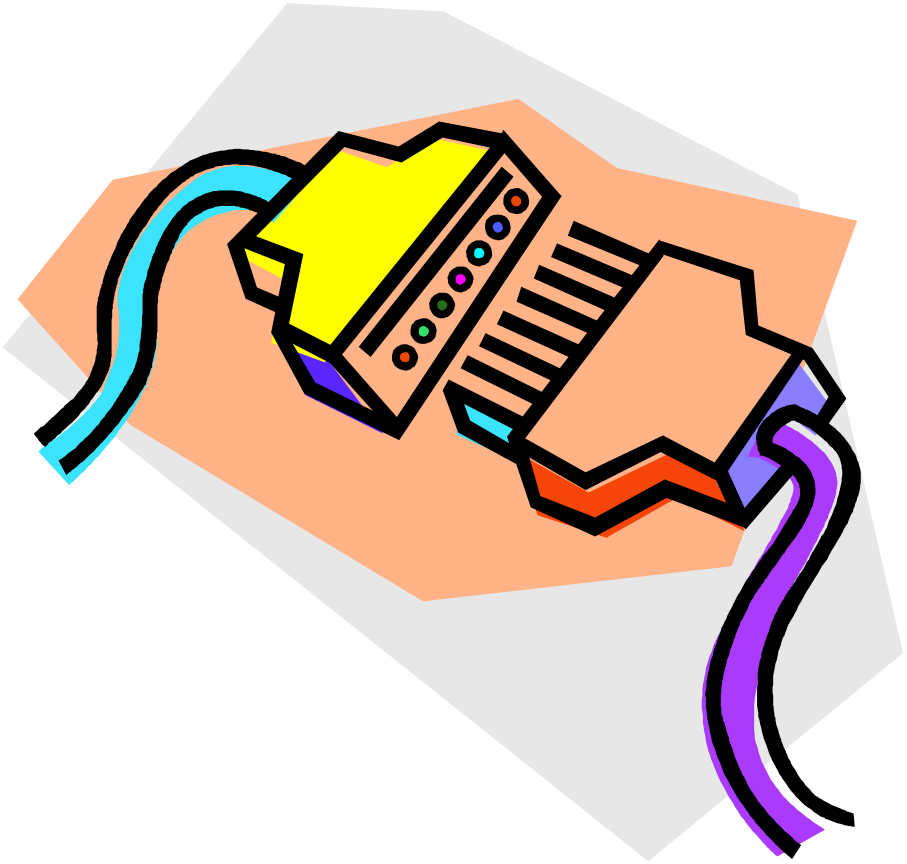
* Units sold and revenue for BACnet, LonWorks, and proprietary systems in the building automation industry, 1998-2008
(Source: Frost & Sullivan, *North American Building Protocol Analysis, 2001 #A143-19)*

The Challenge of DDC Controls

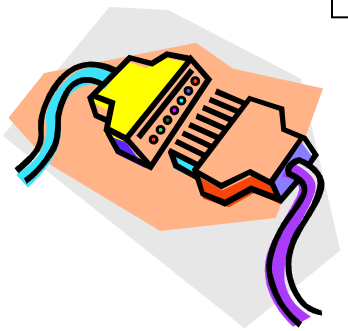
- **Current DDC Controls use embedded systems.**
  - Highly fragmented, Limited Interoperability.
  - Increasing complexity of systems and smart devices.
- **Multiple standards compete in an expanding market.**
  - No single technology dominates the marketplace.
  - Numerous protocols must be addressed.
- **The Internet, The Enterprise is The Future.**
  - Emerging technologies and specialties have filled the gaps: service bureaus, asset managers, wireless, cellular, etc.
  - True “Convergence” is now Realistic with Internet Integration

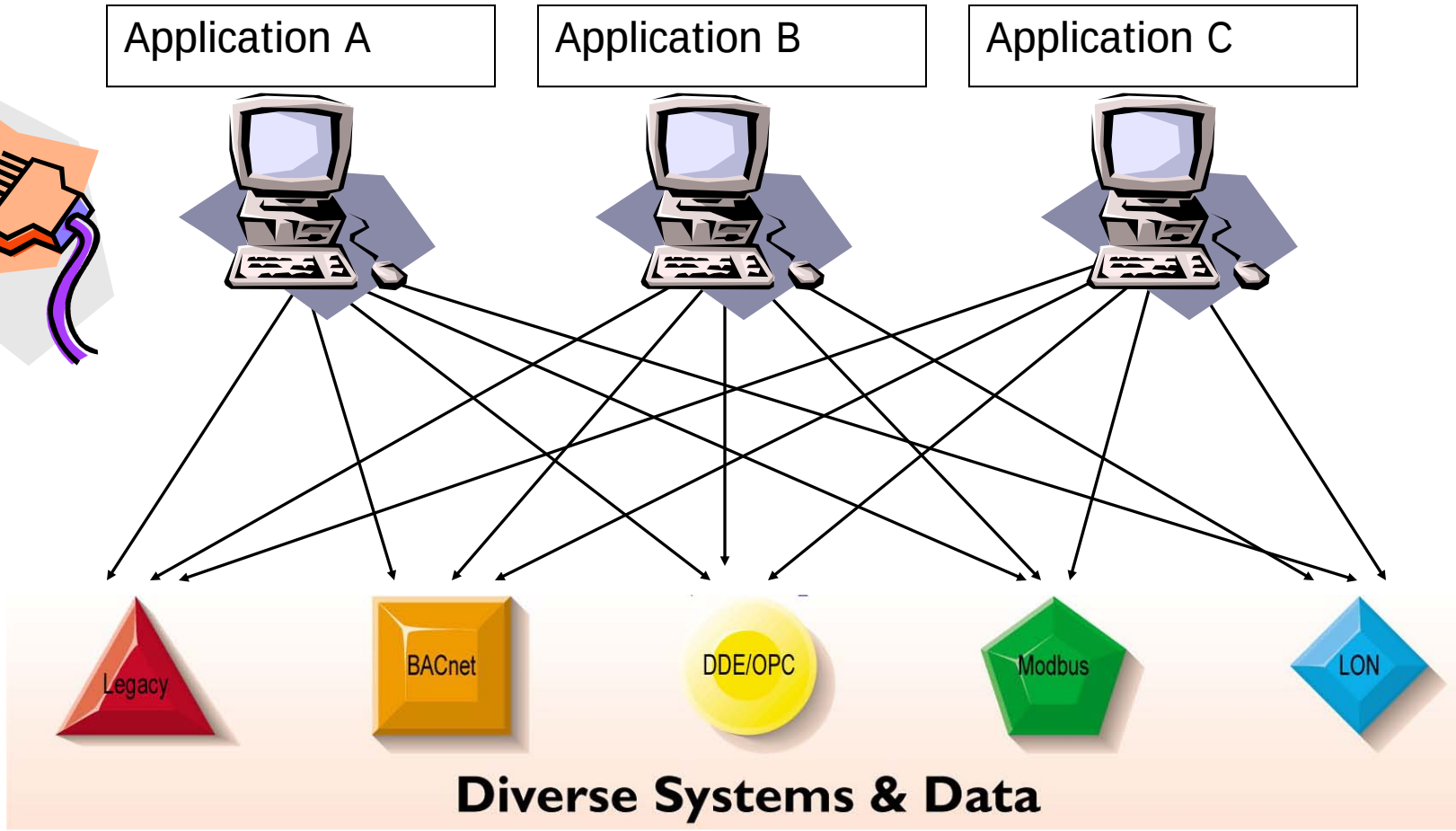
ECHELON® THE LONWORKS® COMPANY BACnet™ Modbus OPC FOUNDATION

Connectivity is the Main Challenge with DDC Controls



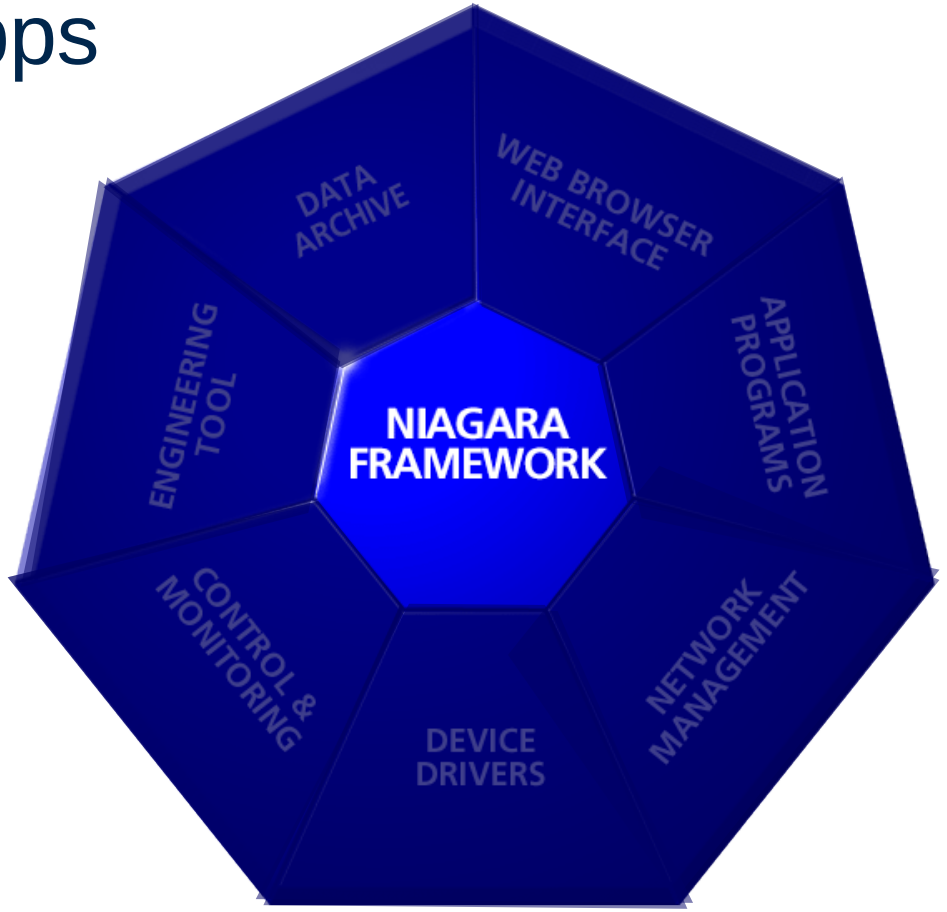
DDC Networks Have Lot of Connections And Don't Always Communicate between the Various Vendors





A Solution to Connectivity Problems is to standardize the Internet Enterprise with NiagaraAX

- A Comprehensive software platform
- Internet-enabled products and device-to-enterprise apps



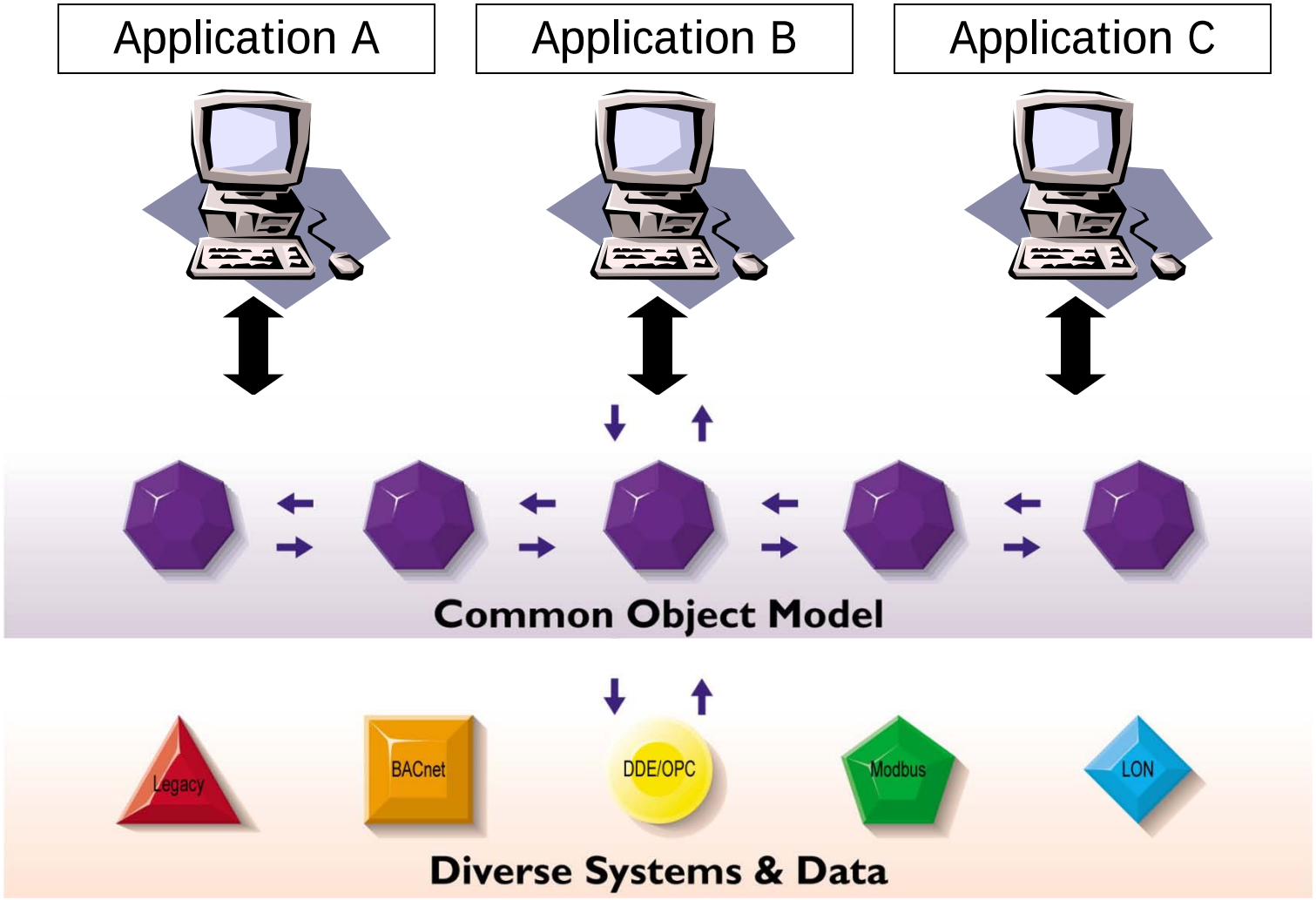
The Niagara Framework

- A Comprehensive software platform
  - for building Internet-enabled products and device-to-enterprise apps
  - Internet standards built-in
  - Real time – connects real time data from field devices to enterprise applications, provides local control execution
  - Connects disparate devices to each other for coordinated peer-to-peer control in the field independent of any central server

What is the Niagara AX Framework

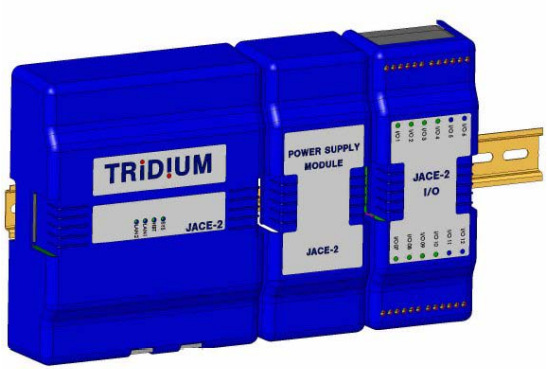
- Niagara Framework software is a graphical user interface with two main advantages of all other GUIs previously mentioned.
- First, the I/A Series Niagara Framework has the ability to be accessed through a standard Internet browser. Therefore, the end user can view building parameters and even make changes from anywhere in the world by using an Internet browser, with no other software required.
- Second, the I/A Series Niagara Framework is designed to integrate data from many types of control systems, LON, BACnet, and Modbus.

Niagara Normalizes All Systems BACNet or LON Network

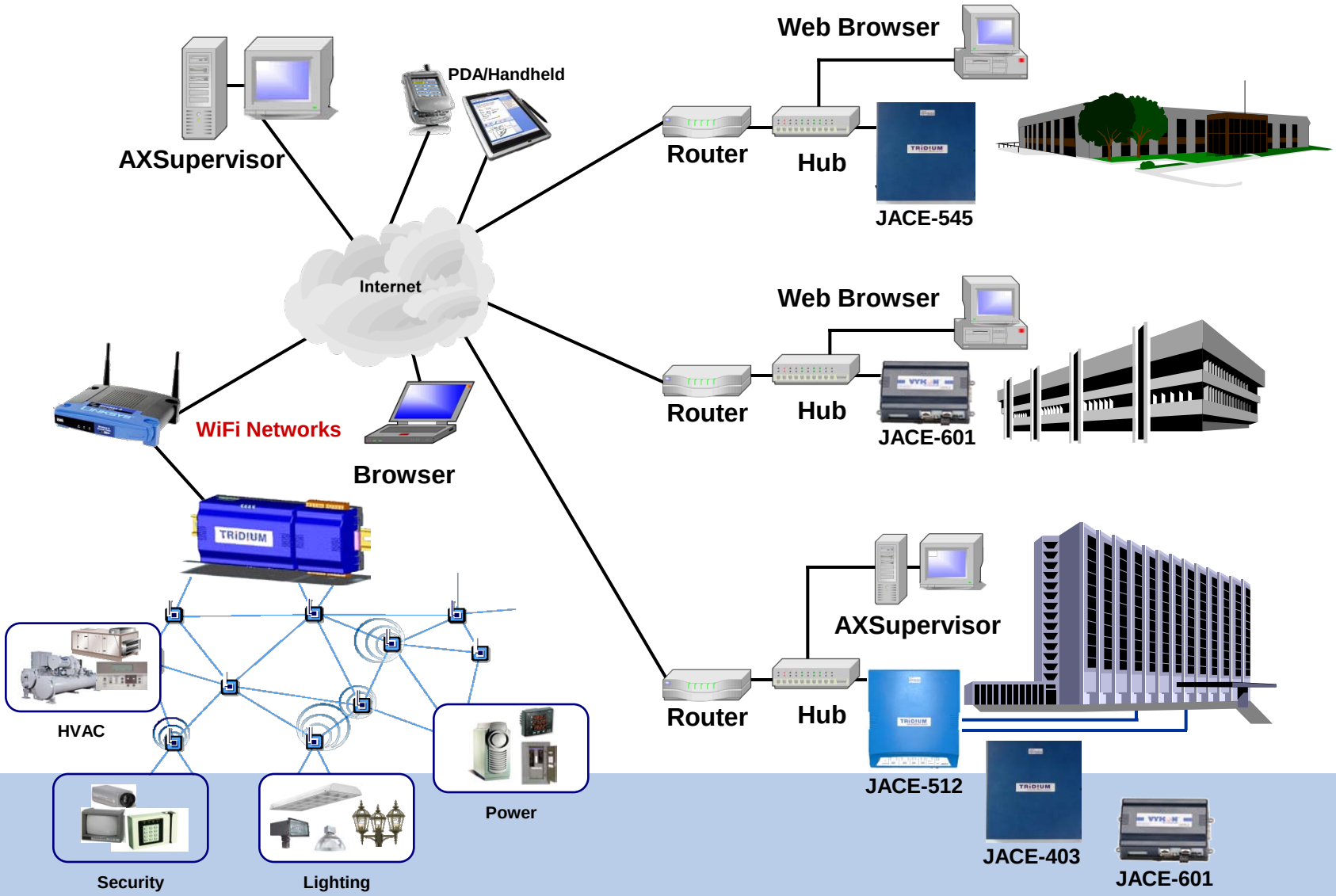


NiagaraAX Looks and Feels Like any other DDC System

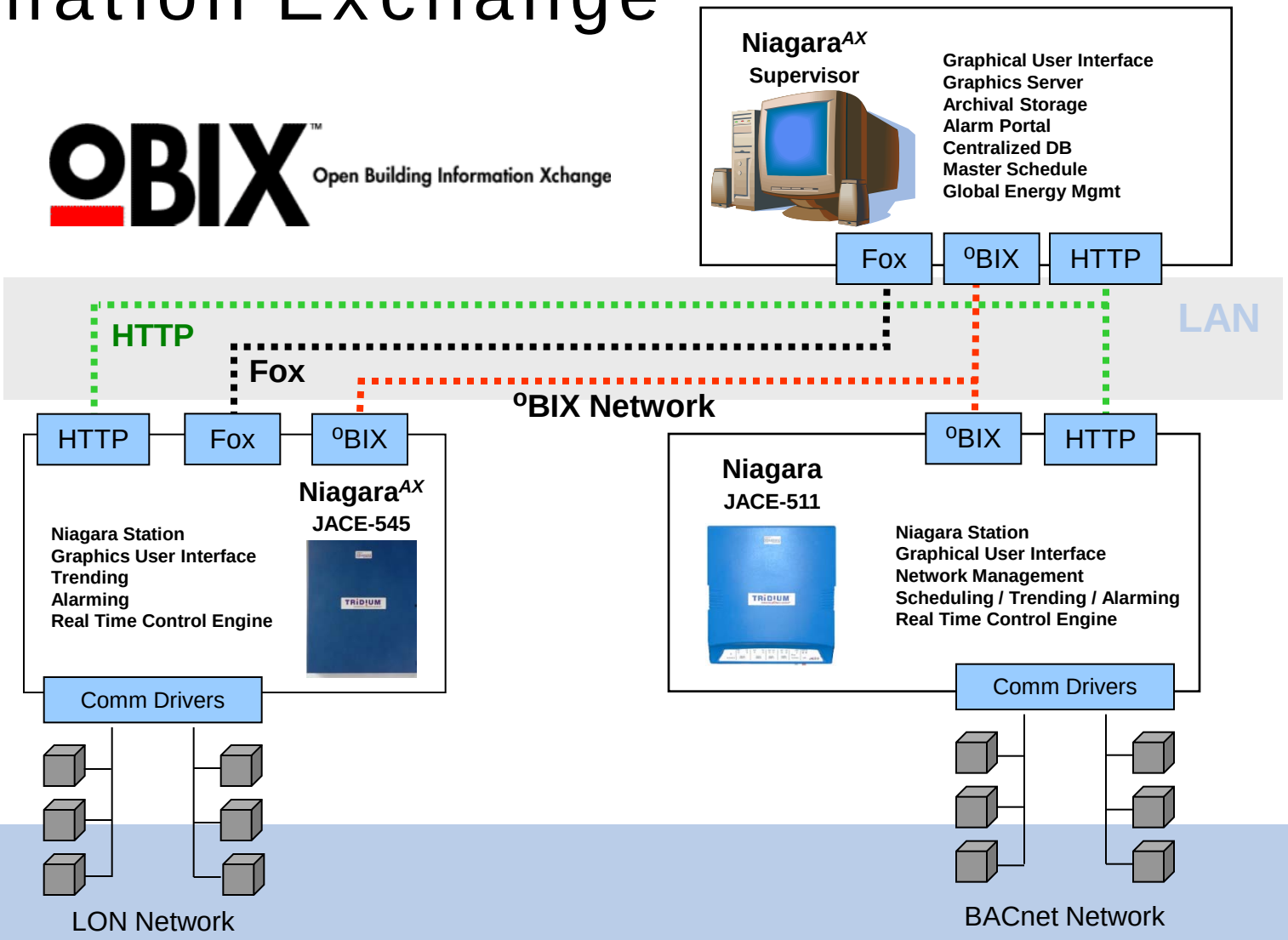
NiagaraAX Controllers are Available from Most Manufacturer's



A NiagaraAX Internet-DDC Architecture



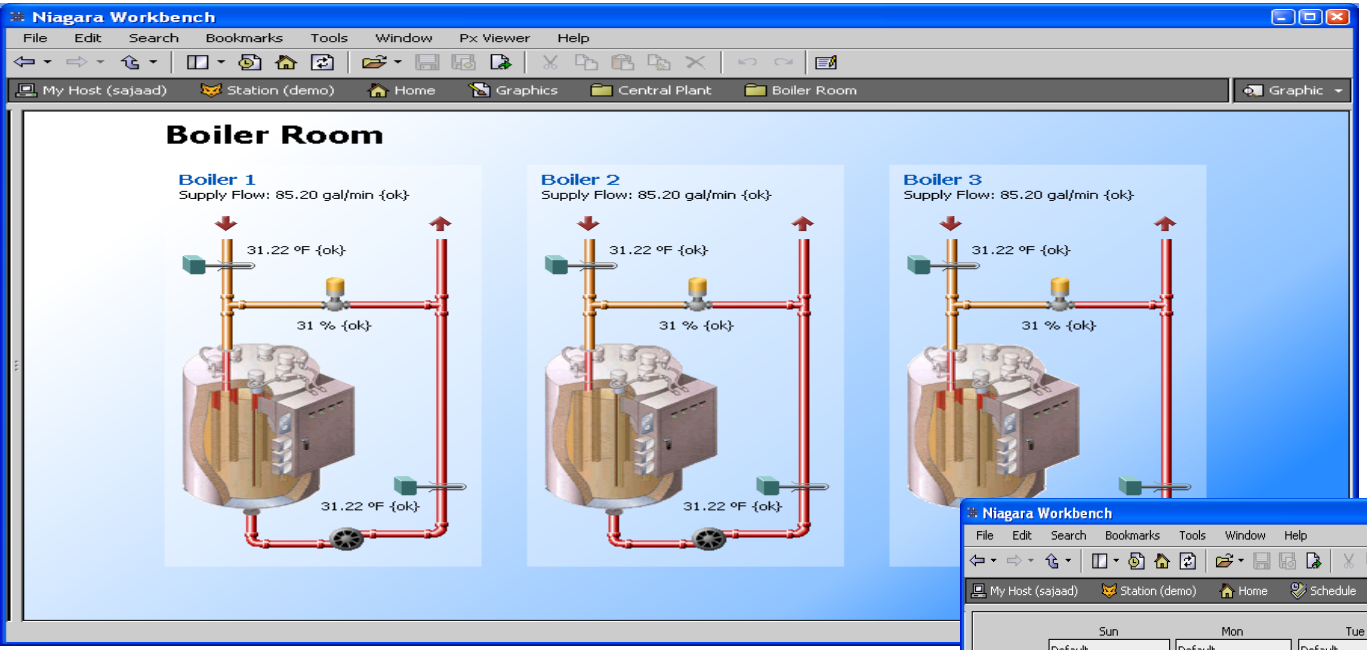
NiagaraAX OBIX-Open Building Information Exchange

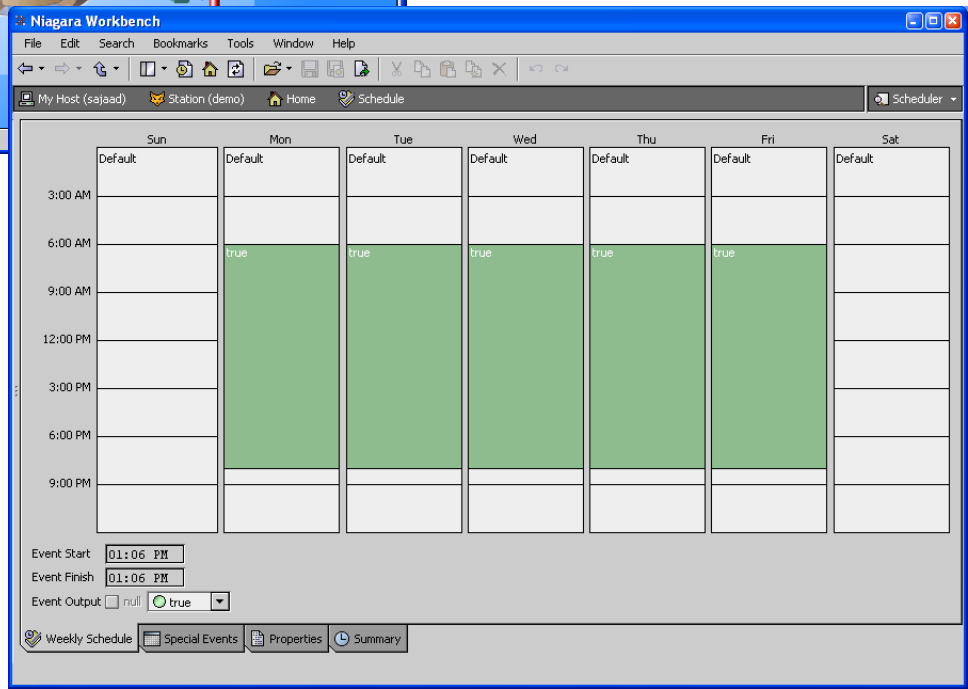


Niagara^{AX} – Key Features

- Alarm Framework
- Alarm APIs
  - Alarm model
  - Grouping via classes
  - Routing via the recipients
  - Storage via history data
- Pre-built recipients to Niagara stations, email, IM, printers
- Desktop and web enabled alarm consoles

Niagara^{AX} – Key Features is Easy to Program and Build Graphics





Start Using Energy Dash Boards

- They give real time data
- Provide actual savings or losses each month
- Are relatively simple to use
- Can show the total energy plant
- Steam, Electric, Water, etc.

Start Using Energy Dash Boards

Main | BAS | Fire Systems | Access | CCTV | Budget | Support

Utility Costs

Public Service
Electricity - $0.0854/kWh
Natural gas - $0.32/therm

Spot Market
Electricity - $0.0794/kWh
Natural gas - $0.27/therm

Breakeven for Onsite CHP
Cost/kWh - $0.0794/kWh
Demand - 270 KW

Utility History

Reports

30 Day kWh History
Utility Savings

Billings

Monthly Utility Bills
After hours Use Bills

Building Automation

Campus Map

North Campus
Main Campus

HVAC Systems

View by Building
View by Campus Map

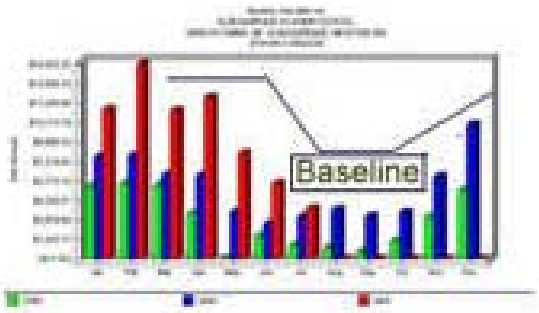
System Status

Service History

All Systems are Operational

Service History | Contact ECI

Energy Savings



$18,000 saved this month

Weather Forecast

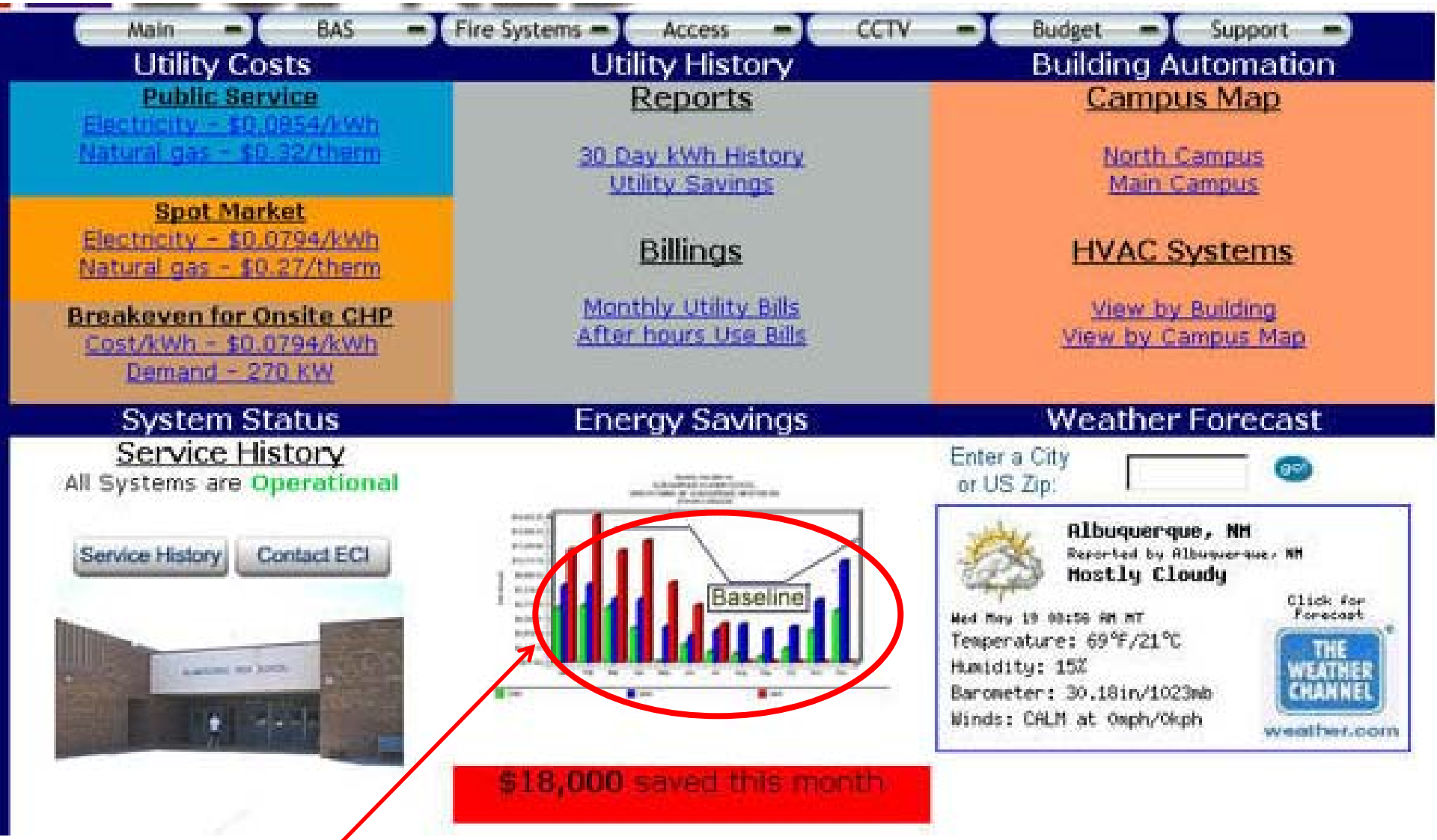
Enter a City or US Zip:

Albuquerque, NM
Reported by Albuquerque, NM
Mostly Cloudy

Wed May 19 08:50 AM MT
Temperature: 69°F/21°C
Humidity: 15%
Barometer: 30.18in/1023mb
Winds: CALM at 0mph/0kph

Click for Forecast
THE WEATHER CHANNEL
weather.com

Start Using Energy Dash Boards



Notice Savings is $18,000

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- *A DDC system is usually part of a building information* systems (I.S.) backbone
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- Control contractors are now system integrators
- *Software not hardware is the heart of today's DDC systems.*

CURRENT *DDC ISSUES AND TRENDS CONT'D:*

- *DDC systems have multi-tasking capacity and are being used for much* more than just control

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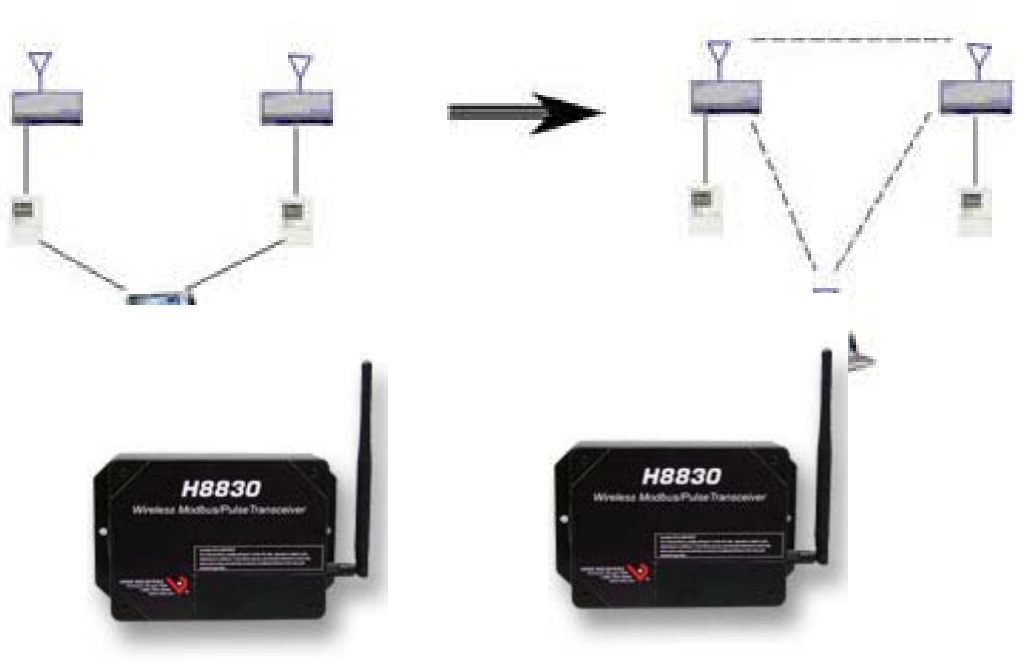
- *DDC systems have multi-tasking capacity and are being used for much* more than just control
- Wireless is expanding rapidly

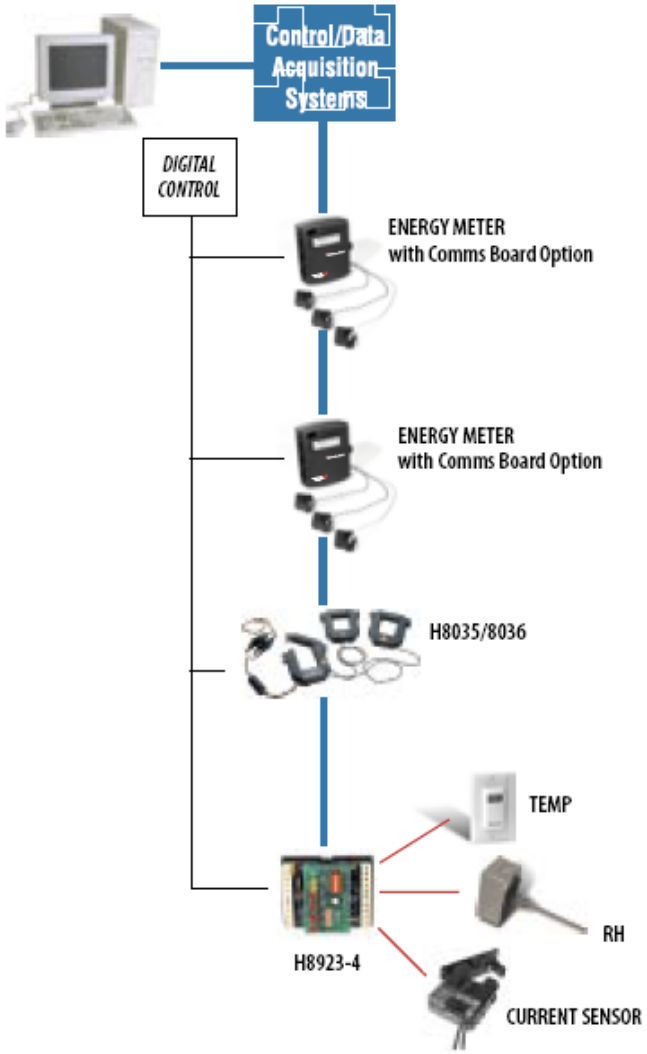
Present and Future Controls are Using Wireless Mesh Networks

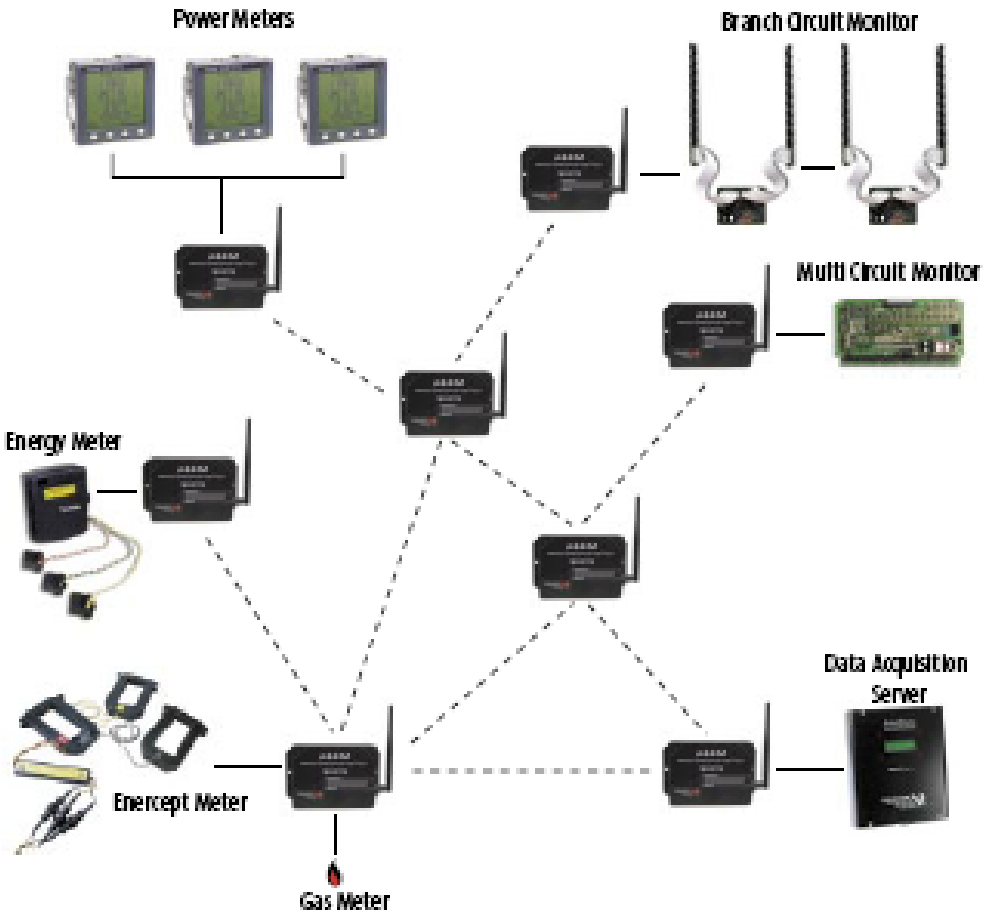
- Point to Point (sensor to VAV box)
- WIFI for using a laptop for commissioning
- MESH wireless networks
- Cellular modems on DDC equipment
- ZIGBEE, RFID, etc.



Wireless Networks Include:
Wibree
Bluetooth
ZigBee

Present and Future Controls are Using Wireless Power Meters





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- Power and control communications on the same wire is emerging
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- Full control systems are coming with HVAC mechanical equipment

DDC ISSUES AND TRENDS CONT'D:

- Knowledge of how to control HVAC and integrate are much more important than any vendor's system

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- *DDC systems are used in LEED projects for building* monitoring and performance verification
- Smart building systems are driving innovative uses of DDC into every area of a building
- *M2M networking is driving every connected component to being internet addressable*

Present and Future DDC Systems Are Using

Smart Card Access

- Employee ID Card
- Physical Access Badge
- Remote Access Token
- Combines function into a single smart card on a USB stick

Present and Future Control Systems are Using

- PDA’s by the building operators are used as diagnostic and maintenance tools.

Present and Future Control Systems Will Be Able to Do Anything Money Will Buy Including:

- **Using Cloud Height Ceilometers**
- Owners can know the weather without going outside. Performance and reliability in all weather conditions up to 25,000 feet
- GPS Tracking Systems on each individual in the Building

Present and Future DDC Controls are Smart at the Field Level

Telephone Thermostats

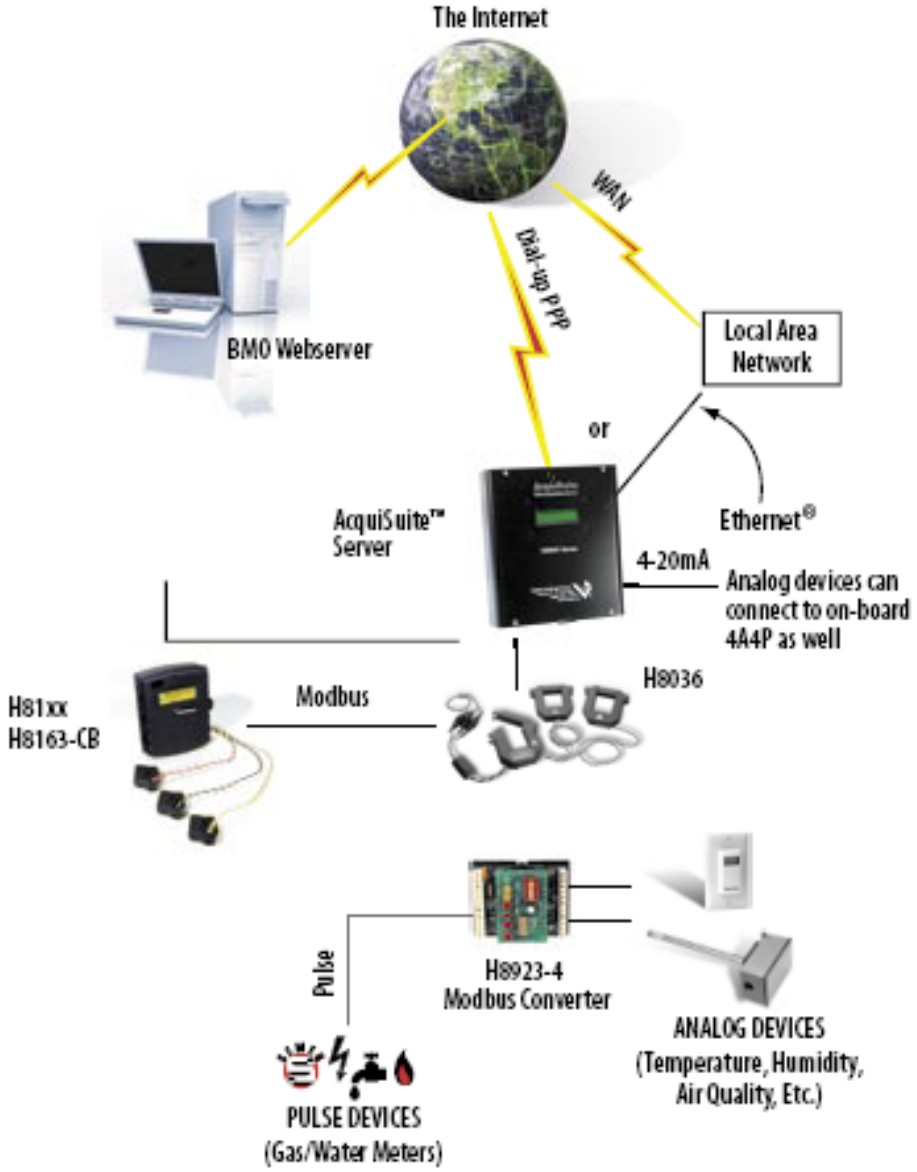
LON Sensor

Talking Thermostats

Smart Air Velocity Sensors

Veris Meter

Present and Future DDC Controls are Smart and on the Internet WEB



Present and Future DDC Building Control Systems Will

- Control Individual Lighting
- Monitor Each Tenants Total KwH Power
- Control Temp,RH and CO2
- Provide Customers Options to Control Individual Space or Cubicle Areas via the Web

DDC Challenges and Obstacles for Washington State Schools

- DDC Building Systems are becoming more complex.
- Information Tech (IT) Departments need to be involved in maintenance of building controls
- Future trends and demands for skilled labor is creating shortages (not enough people entering blue collar trades)

DDC Controls in 2010 and Beyond

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- Internet Dominated DDC systems

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- Wireless Technologies proliferate

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DDC Controls in 2010 and Beyond

- Internet Dominated DDC systems
- Wireless Technologies proliferate
- Smart Building Systems and Electrical Smart Grids are Evolving into Reality
- Full Building integration is reality
- Buildings Built LEED Green should Stay Green Not turn Brown and Gray
- Future is Unknown??

The Top Six Savings Opportunities of DDC Control Systems

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The Top Six Savings Opportunities of DDC Control Systems

1. Require BacNet or Lon Protocols
2. Adopt Tridium NiagaraAX
3. Use Universal DDC Controllers
4. Integrate all Systems
5. Use Energy Dash Board Metering

The Top Six Savings Opportunities of DDC Control Systems

1. Require BacNet or Lon Protocols
2. Adopt Tridium NiagaraAX
3. Use Universal DDC Controllers
4. Integrate all Systems
5. Use Energy Dash Board Metering
6. Invest in Training Operators and all Staff on your Control System

The Top Six Savings Opportunities of DDC Control Systems

1. Require BacNet or Lon Protocols
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3. Use Universal DDC Controllers
4. Integrate all Systems
5. Use Energy Dash Board Metering
6. Invest in Training Operators and all Staff on your Control System
7. Perform Continuous DDC Re-Tuning

DDC Controls Related Web Links

- http://www.bacnet.org/
- http://www.tridium.com/
- http://www.pnl.gov
- http://www.buildingsystemsprogram.pnl.gov/
- www.automatedbuildings.com
- www.lonmark.org
- www.johnsoncontrols.com
- www.honeywell.com
- www.sbt.siemens.com
- http://www.theboc.info/training.html

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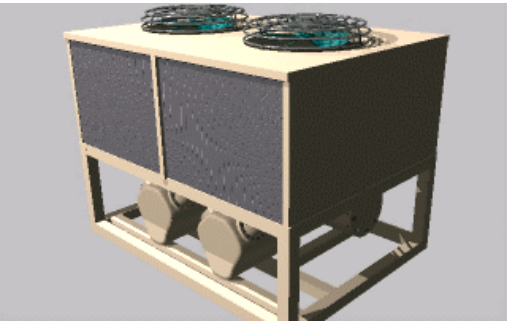

Any Questions?
Thank You
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