

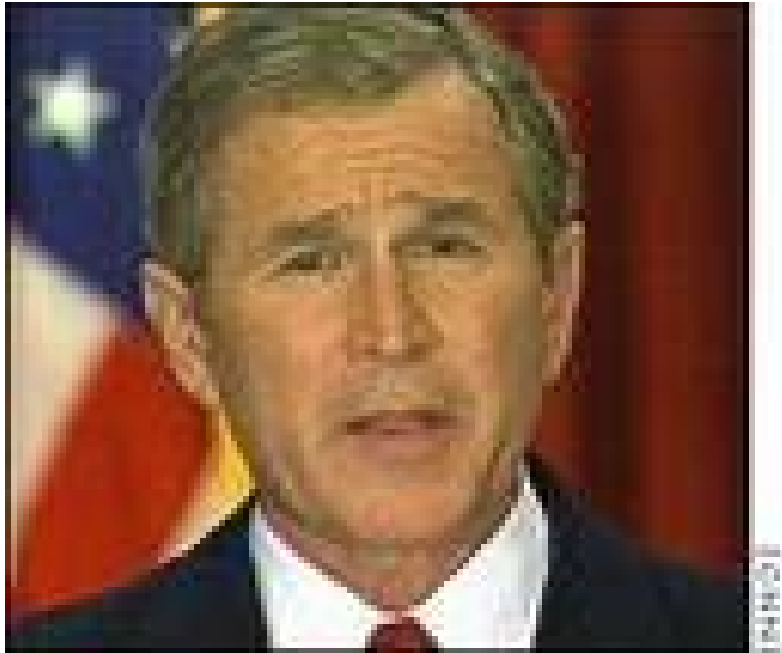


CMMS – Integration Technology & Innovation in Facility Control Systems

Honeywell

Facility Automation is Changing

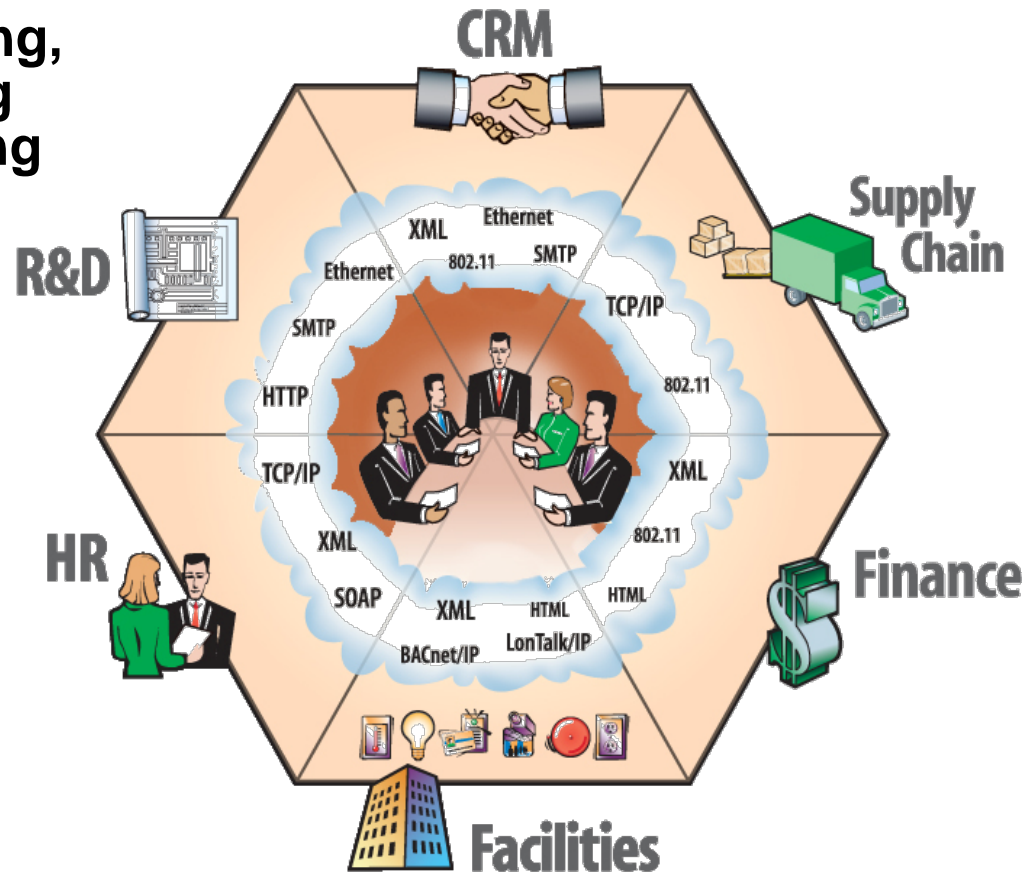
Honeywell



Facility Automation is Changing

- New value proposition for facilities automation ...

- Value is no longer installing, programming, maintaining or even integrating building systems ...
- Value is in creating ... services ... solutions that can be offered by using the POWER of the systems that are installed



New Facility Automation Hierarchy Model **Honeywell**

Level 3 - Enterprise

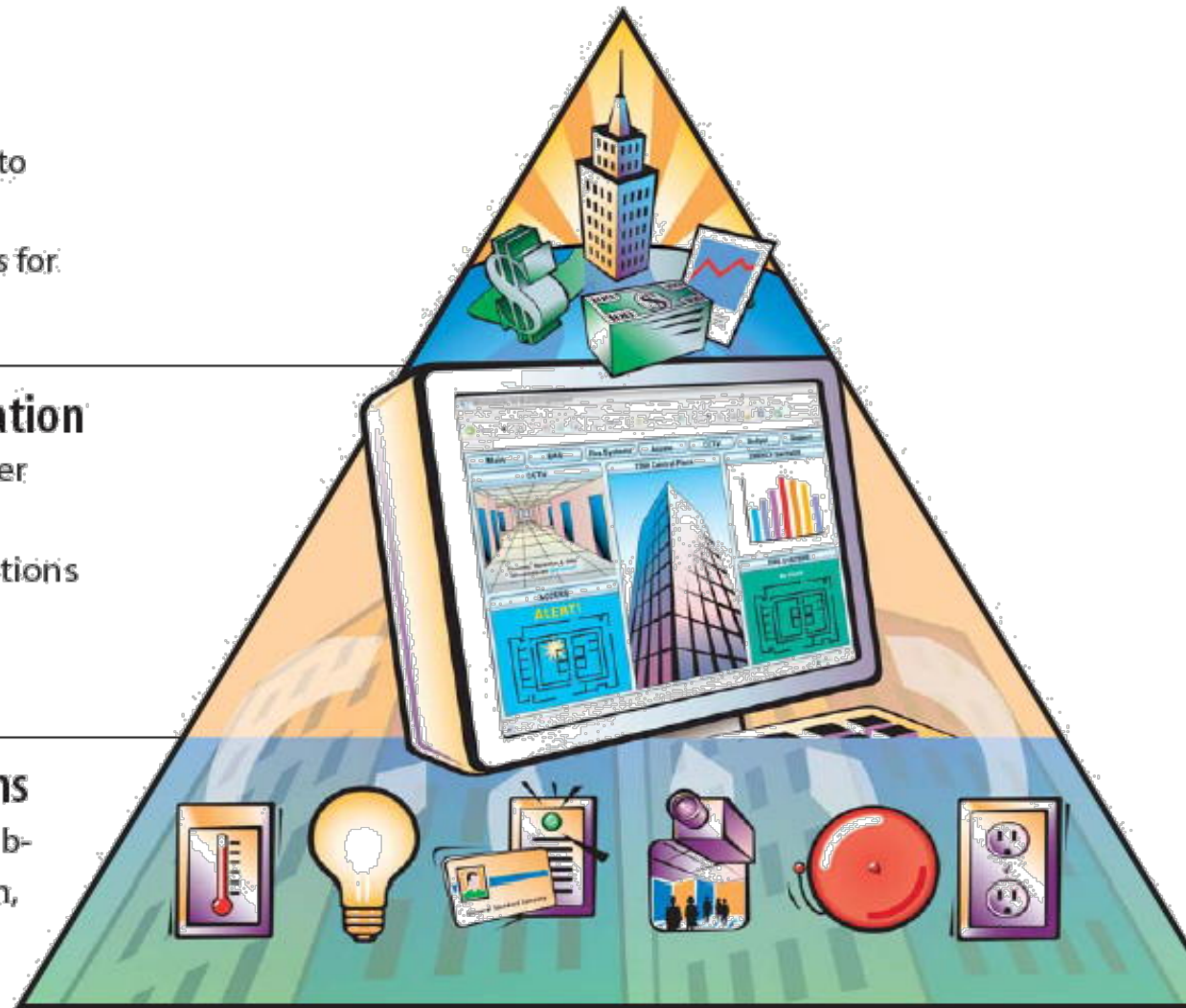
- Connects building systems to business systems
- Connects multiple buildings for remote operations

Level 2 - Systems Integration

- Connects systems together within a building
- On site and remote operations

Level 1 - Building Systems

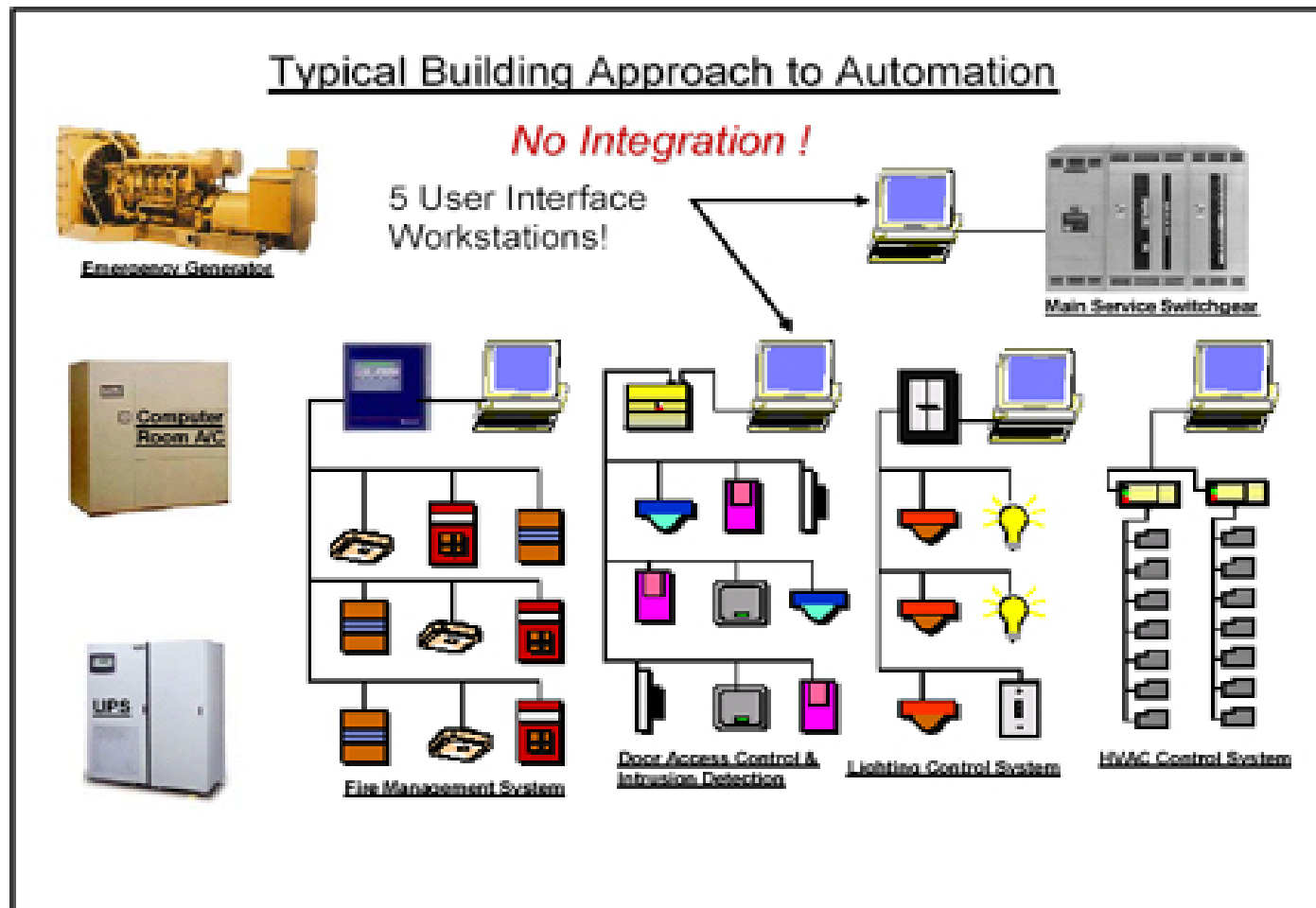
- Major building system or sub-system (i.e. HVAC, Fire Alarm, CCTV, Security, Lighting, etc.)
- Devices within a system (i.e. controllers, smoke detectors, etc.)



Where Have We Come From?

25+ Year Transition From 'Old Standards' and Abilities

- Technology brought proprietary approaches to building automation ...



Where Have We Come From?

25+ Year Transition From 'Old Standards' and Abilities

- **Today's industry drivers and change agents ...**

- Green Design (LEED)
- Utility Deregulation
- Energy Benchmarking
- Proprietary System Problems
- Locked in expansion costs
- Staff Downsizing
- Litigation
- Terrorism
- Code Changes



Where Have We Come From?

25+ Year Transition From 'Old Standards' and Abilities

- **Today's enabling technologies ...**

- Distributed Computing
- The Internet
- Wireless
- "Deregulation" of computing & communications industries
- Standardization
 - ◆ LAN/WAN Networking
 - ◆ Operating Systems
 - ◆ Data Management



- **Resulting in ...**

- Open Standards for Real-Time Control of Building Systems

Open Systems Should ...

Honeywell



- ... Provide a modular based architecture not locked into a single communication protocol
 - Expansion should allow Lon, BACnet, Modbus, oBIX, etc.
- ... Be able to incorporate new technologies as they emerge and from many sources
 - Not limited to “invented here”
 - Identify best technology and implement for best customer solutions
- ... Provide a common application environment
 - Integration of dissimilar facilities apps
- ... Be able to utilize the web browser as primary user interface
 - Control staff can work from any location in real time

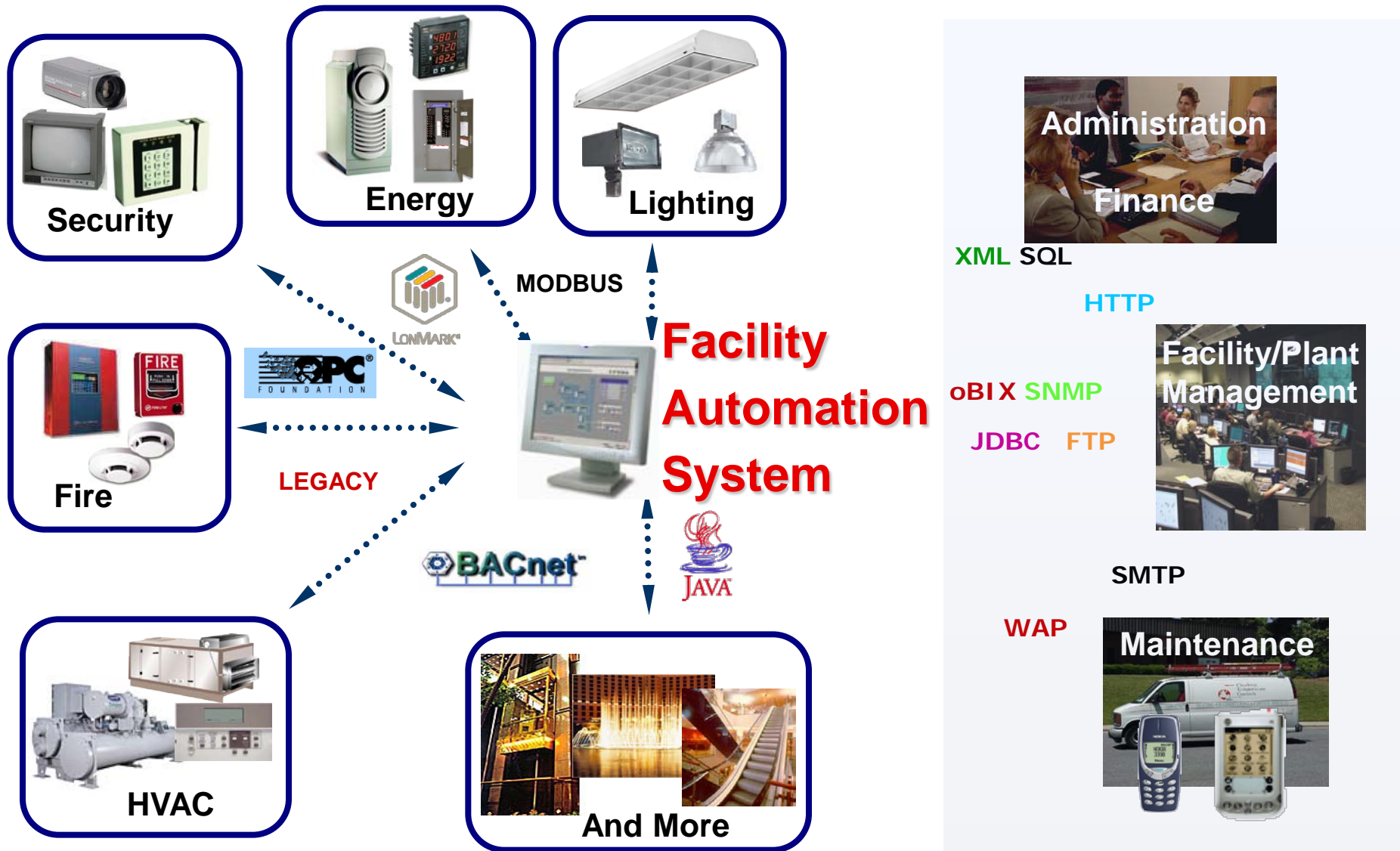
Lets look at 3 areas of ongoing innovation in building control systems ...

- **Connectivity of Building Systems**
- **Data Presentation**
- **Energy Measurement, Analysis and Response**



Connectivity of Building Systems

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Value throughout the entire operation

Building System Connectivity Should ... Honeywell

... Create **Value** in the delivery of a functionality integrated system that provides one or more of the following:

- Improved decision making
- Enhanced facility comfort
- Reduction of energy costs
- Streamlined processes
- Better use of existing investments
- Increased overall equipment efficiency
- Lasting cost savings
- Reduced financial risk
- Compliance with regulatory requirements
- Minimized system disruptions and downtime
- Maximized facility operations
- Merging of data and presentation options to match customer needs



HVAC

Site-wide User Interface

- Integrating all of the HVAC systems in a facility allows the owner to view all of the systems from one front end, saving money on **installed cost** as well as providing **long-term savings** on training and upgrades.
- Allows the owner to use **advanced paging, reporting, and trending features** of the Automation System across many systems, increasing the value of their investment.
 - Other Automation Systems
 - VFD
 - Lighting
 - Critical Environments & Data Centers
 - CMMS
 - Security & Access
 - Fire & Life Safety
 - Hotel Reservation Systems
 - Other Workstations ... SCADA, etc.
 - Power / Generator Systems
 - Automatic Demand Response Interaction
 - Energy Usage

- **Freight train accident near a controlled building**
 - **Security cameras**
 - ◆ Captured train derailment explosion
 - ◆ Visual inspection of emergency generators for damage
 - **Monitor / control of equipment**
 - ◆ Current running parameters of building systems
 - HVAC equipment
 - OA dampers
 - Generators
 - ◆ Ability to shut down outside air dampers to avoid smoke intake
 - **Alerted off-duty personnel to respond to building needs**





HVAC

Scheduling

- Using the Automation System, [one central location](#) allows all equipment to be scheduled as needed. When special events take place, little effort is required to change to Occupied status, as the Automation System allows third-party equipment to be set up in zones that can be overridden in unison.

Energy Management

- HVAC systems are one of the highest energy costs in a facility. One of the key benefits of integrating HVAC systems is to allow the HVAC systems to work in concert to adjust building conditions based on the current demand and use of the building.
- Monitoring equipment performance trends through the Automation System allows the customer to [see where energy costs can be cut](#).

Computerized Maintenance Management System Integration

- Browser based programming technology provides a [CMMS software system](#) allowing customized, unlimited access points to a single database.

Honeywell



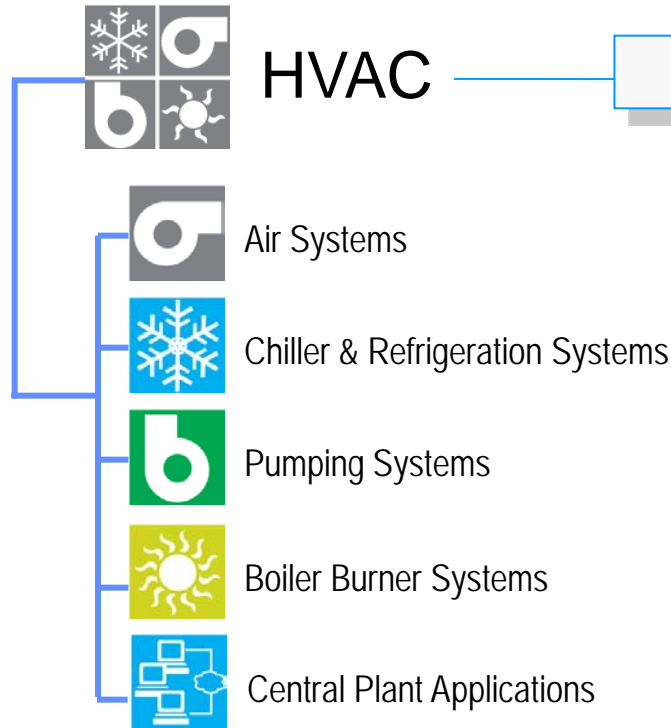
- Track & organize any type of asset anywhere in your facility, region, world
- Detailed information including asset information, warranty, documents, pictures, emergency procedures, lock-out/tag-out, tool crib management, fleet, custom, etc.
- PM, WO and other history for any/all equipment.

- PM reminders for any equipment - daily, weekly, monthly, yearly, etc. in any increment or combination.
- Automatic reminders so PMs will not slip thru the cracks.
- Future PM reports, PM balancing and optimization, and other reporting and analysis.



Typical CMMS Functions

Honeywell



Computerized Maintenance Management

Work Order Management:

- Quick summary / links for any / all users. A maintenance tech can log in and quickly print out his / her WO's for that day. Managing work orders by facility, department, person, etc.
- WO has detailed information including dates, work requested, action taken, status, priority, downtime, parts used, labor used, problem codes, cause codes, custom fields and more.
- Analyze historical work orders for any type of equipment, person, area, etc.

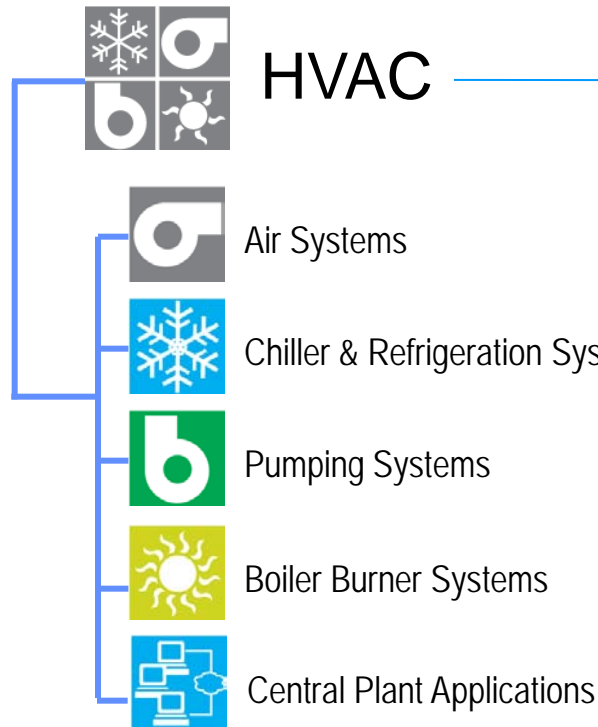
Inventory and Purchase Orders:

- Organize any parts by type, location, vendor, etc. Quick and easy part checkout with a WO
- Auto create and manage purchase orders by par levels, re-order points, consumption, etc.
- "Just In Time" inventory management - share parts with other locations or facilities.



Typical CMMS Functions

Honeywell



Computerized Maintenance Management

Predictive Maintenance Analysis and Reporting:

- Numerous reports by overall organization, region, facility, etc. Track labor, costs, etc. Drill down from high-level reports to detail level.
- Numerous predictive reports for capital expenditure planning, repair vs. replace, good PM vs. bad PM, "lemons" vs. quality equipment, asset life cycle analysis, and much more.
- Flexible reporting for novice users. Custom reporting for more advanced.
- Anywhere Web based access to reports & data

The screenshot shows the 'Bigfoot Asset Life-Cycle Analysis' software interface. It displays a table with columns for Name, Category, Sub-Category, Grade, and various financial and operational metrics. The table lists assets such as Air Conditioning Unit, Boiler Unit 1, Chiller B1, Chiller B2, Shipping Dock, and Graveler A. The table is filtered by 'To date: 10/25/2008' and 'Include sched. pmt: Yes'. The table shows data for various assets, including their purchase cost, book value, and replacement cost.

Name	Category	Sub-Category	Grade	DS/PL Year in factor	Pred Event factor (slope)	Pred Cost factor (slope)	DS/PL Asset life (years)	DS/PL Book value	DS/PL Purchase cost	DS/PL Replace cost	DS/PL A.P.M.E.	Pred Proj 12m Exp
1 Air Conditioning Unit	Building East	HVAC	A	1.00	good	good	10	\$1,000.00	\$10,000.00	1996	\$15,000.00	201
2 Boiler Unit 1	Building West	HVAC	A	1.00	good	good	10	\$16,250.00	\$50,000.00	2003	\$11,000.00	121, \$226,262.30
3 Chiller B1	Building East	Chillers	A	1.00	good	good	10	\$5,000.00	\$67,000.00	1996	\$0.00	\$5,475.00
4 Chiller B2	Building West	Chillers	A	1.00	good	good	10	\$16,000.00	\$45,000.00	2003	\$0.00	\$5,475.00
5 Shipping Dock	Shipping Dock	Delivery Trucks	A	1.00	good	good	8	\$7,250.00	\$20,000.00	2003	\$34,000.00	\$4,322.37
6 Shipping Dock	Shipping Dock	Delivery Trucks	A	1.00	good	good	6	\$7,000.00	\$17,000.00	2005	\$0.00	\$4,322.37
7 Graveler A		Gravelers	A	1.00	good	good	%	\$0.00	\$10,000.00	2004	\$15,000.00	\$9,981.27

HVAC Integration Solutions

Honeywell



HVAC

Central Plant / AHU Load Based Optimization



Air Systems



Chiller & Refrigeration Systems



Pumping Systems



Boiler Burner Systems



Central Plant Applications



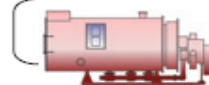
Condenser Water Balancing

Tower energy is balanced against chiller efficiency to yield optimum condenser water temperature.



Low ΔT Compensation

Chiller sequencing points are adjusted on-line for actual ΔT to eliminate unnecessary chiller operation and improve efficiency.



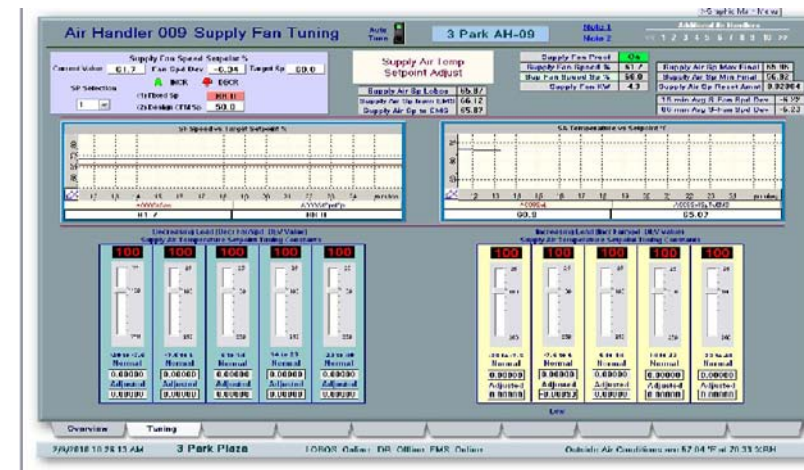
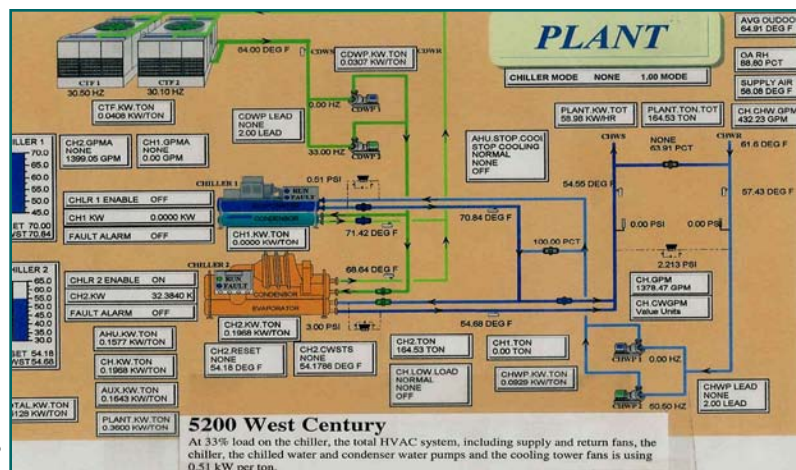
Combustion Efficiency Sequencing

Dynamic adjustment of boiler staging setpoints optimizes overall fuel consumption.



Flow Management

Pump speed regulation and kW input sequencing optimizes efficiency and reduces pump wear.



HVAC Integration Solutions

Honeywell



HVAC

Fault Detection & Diagnostics for HVAC Equipment



Air Systems



Chiller & Refrigeration Systems



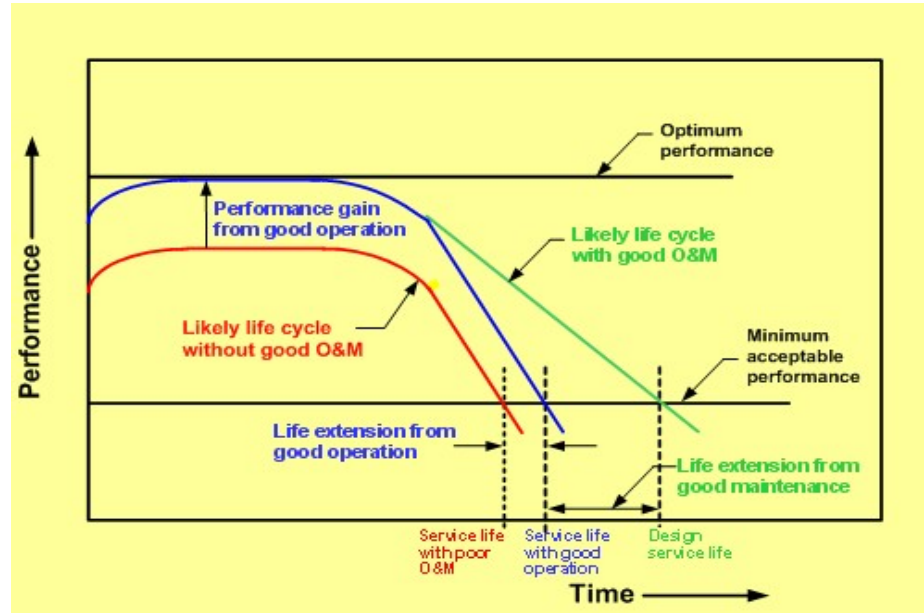
Pumping Systems



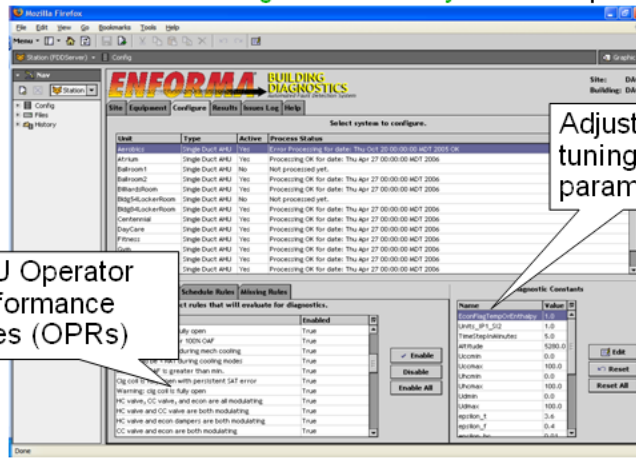
Boiler Burner Systems



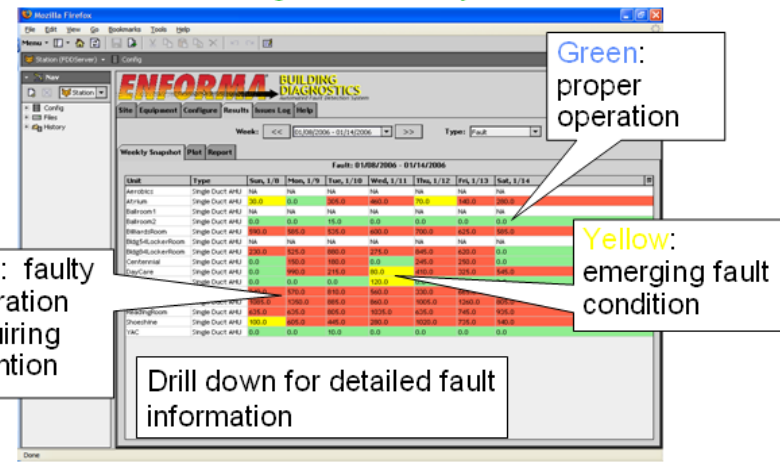
Central Plant Applications



Fault Detection & Diagnostics in BAS systems - Setup



Fault Detection & Diagnostics in BAS systems - Results

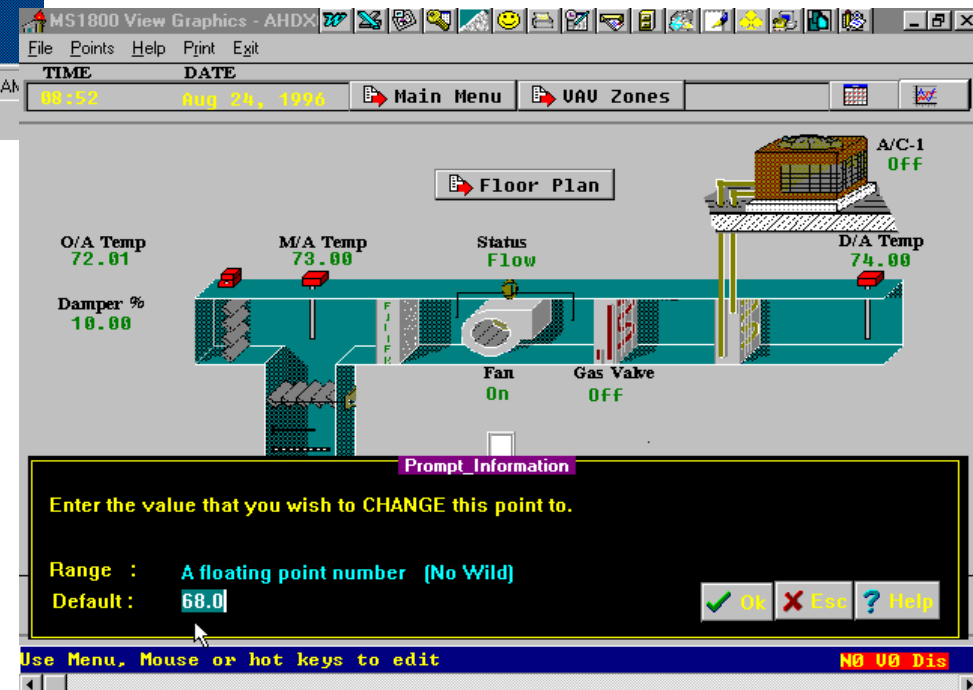
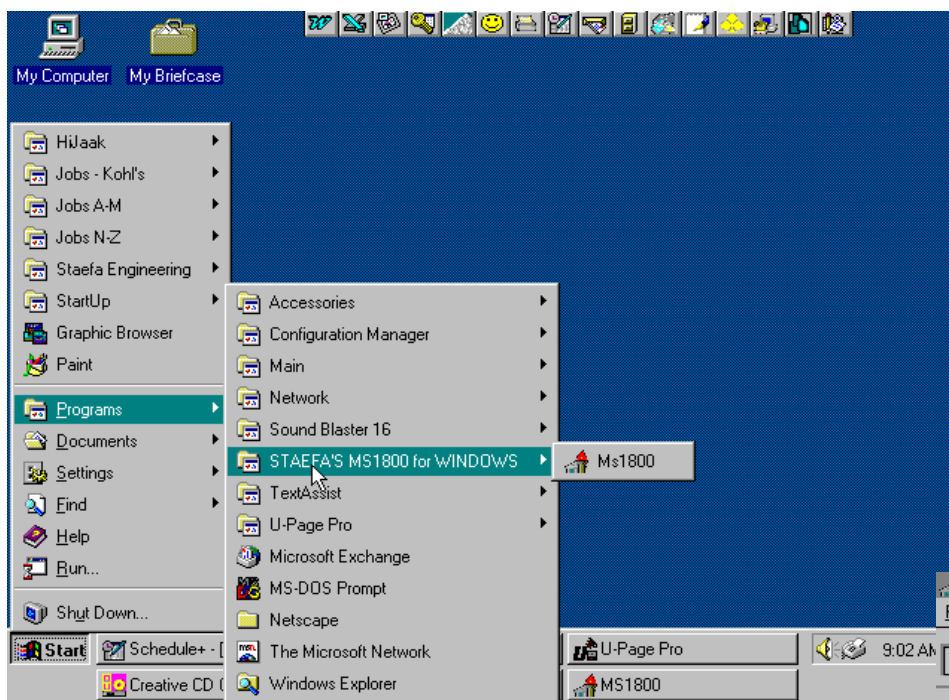


Lets look at 3 areas of innovation in building control systems ...

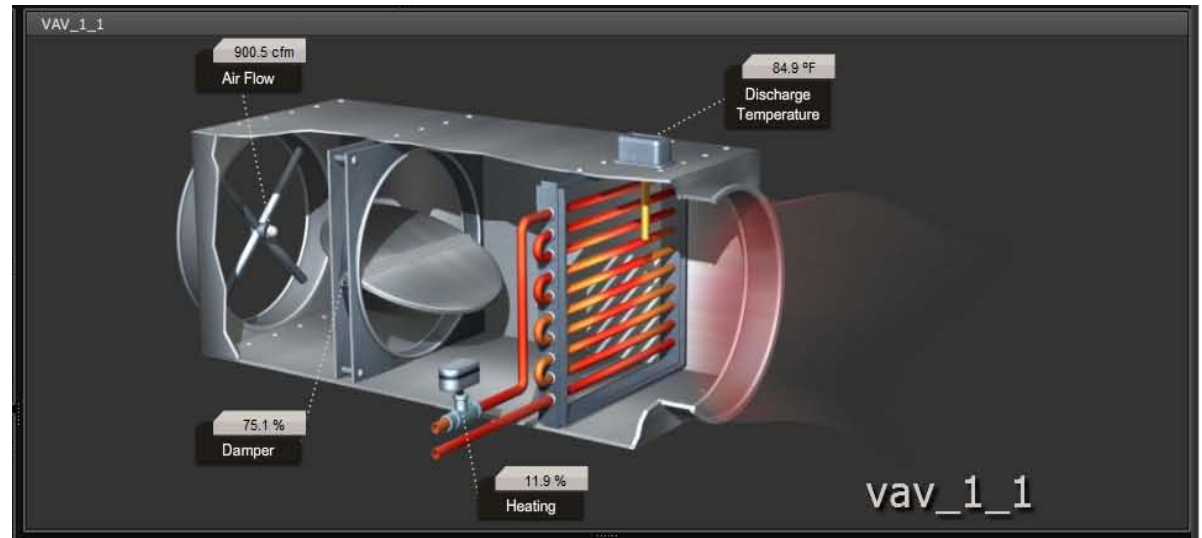
- Connectivity of Building Systems
- Data Presentation
- Energy Measurement, Analysis and Response



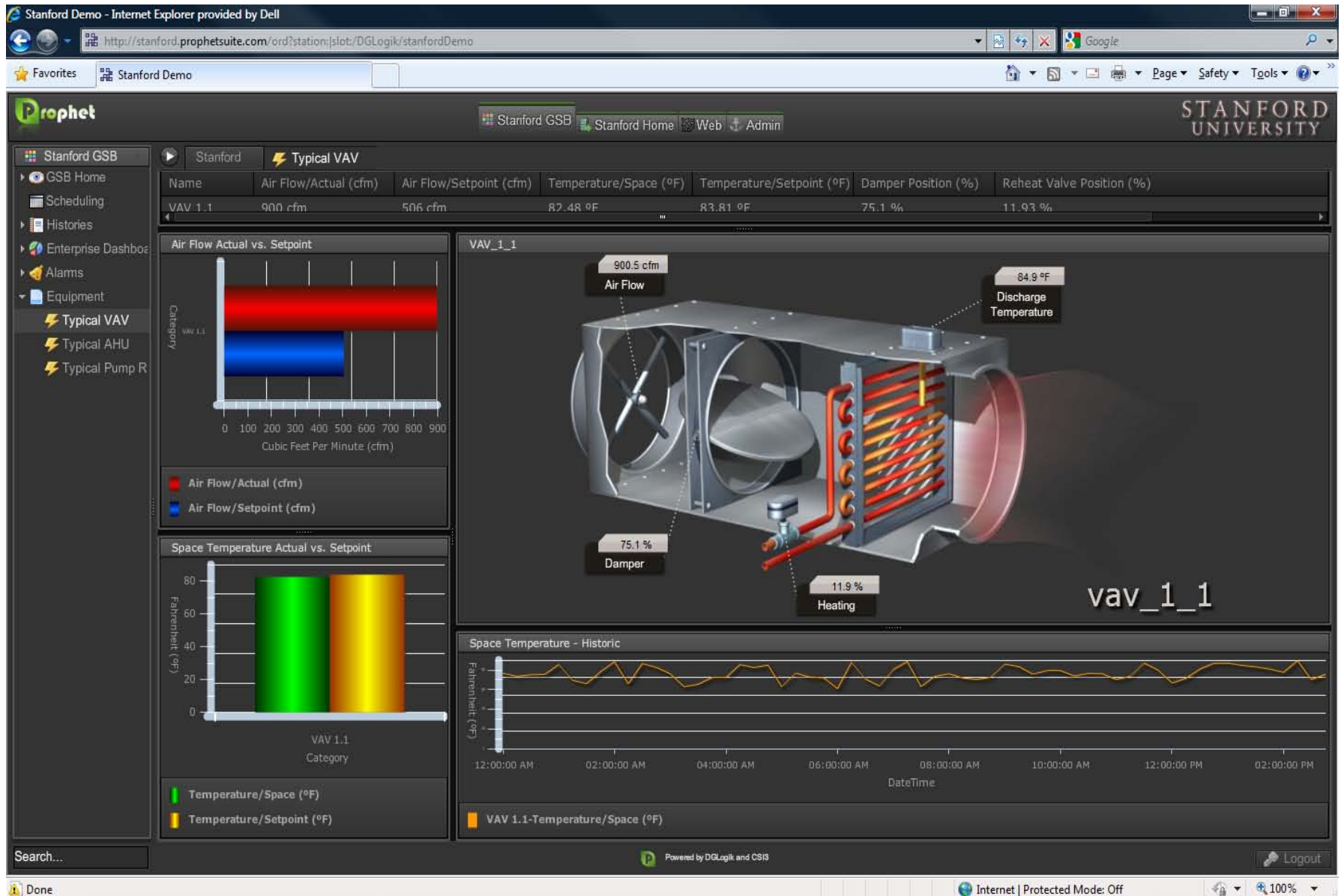
Graphics Evolution



Dynamic 3-D and Flash Graphics

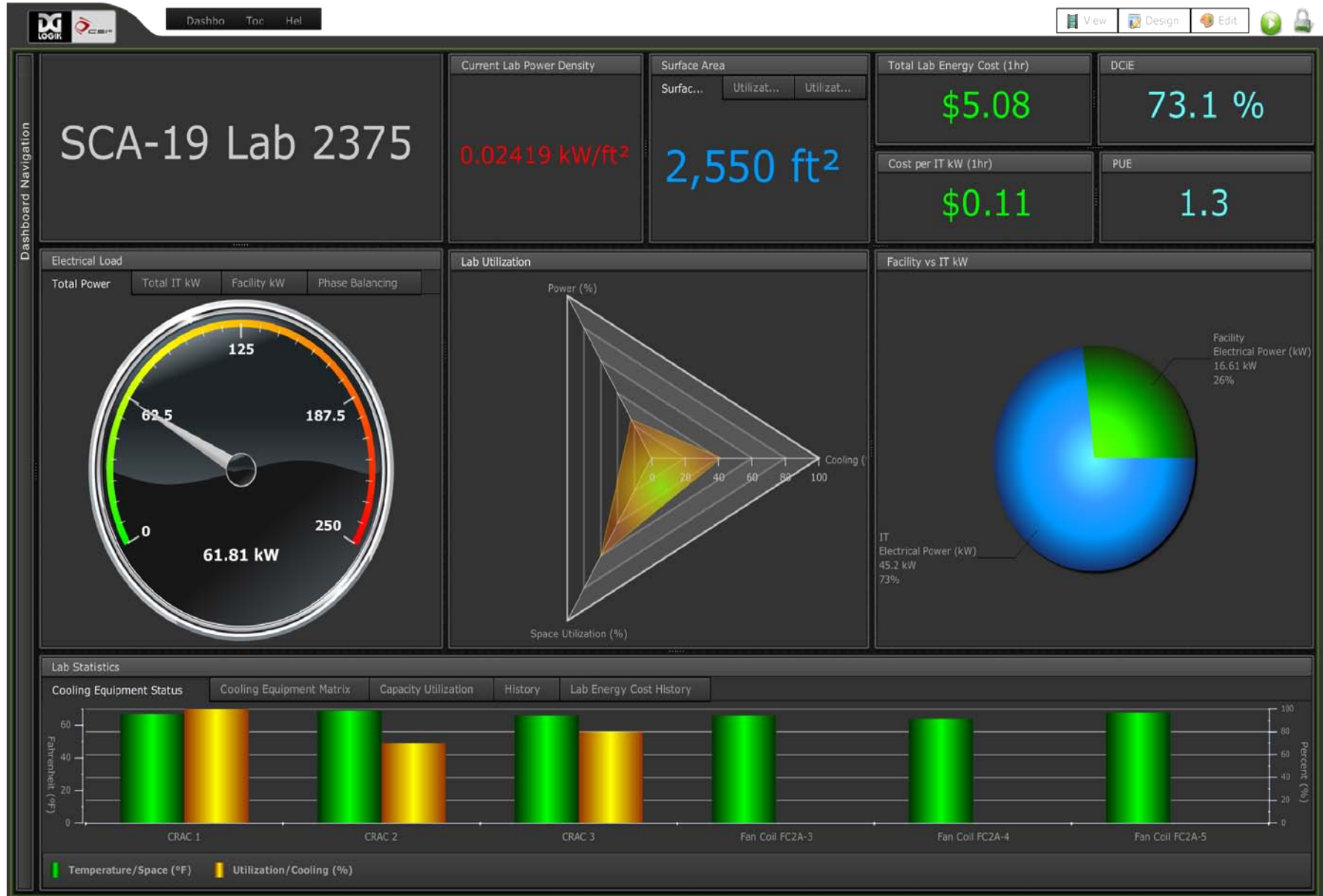


Adding Dashboard Content



Intuitive/Meaningful Data Visualization

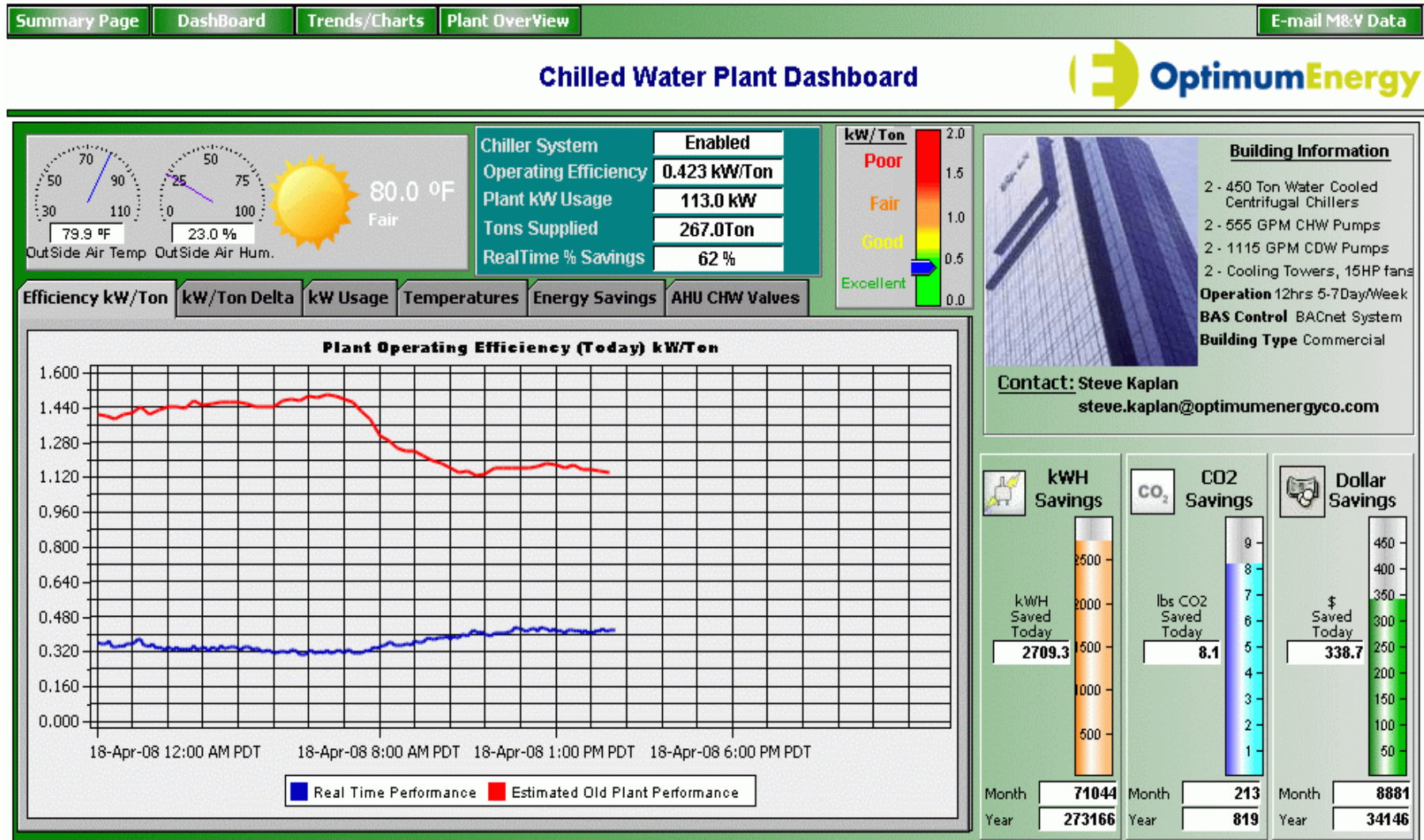
Honeywell



Customer Value With Dashboards

Honeywell

- An engineering control panel



Customer Value With Dashboards

Honeywell

Tips | Blog | Last update: Feb 29, 4:38 pm

MyGoogle Home Page

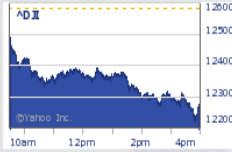
Web | Images | Video | Local | Shopping | more ▾
Search: Web Search

Automation Content on MyGoogle Page

[Home](#) [My Front Page](#) [What's New](#) [My New Page](#) [My New Page](#) [Add Page](#) [\[Sign Out \]](#) [Help](#)

[My Quicklinks](#) [Personalize this page](#) [Don't miss a beat on American Idol](#) [Share this page](#)

Market Summary



Dow 12,266.39 -315.79 -2.51%
Nasdaq 2,271.48 -60.09 -2.58%
S&P 500 1,330.63 -37.05 -2.71%

Friday, February 29, 2008, 5:30PM ET
U.S. Markets Closed.

[Market Update](#)
4:25 pm : February ended on a down note after steep losses in Friday's trading. Each of the major indices finished more than 2% lower, dragged down by underwhelming economic data and corporate headlines. Stocks opened trading lower today despite slightly better ... [more »](#)

[US Indices](#) - [World Indices](#) - [Most Actives](#) - [Currency Converter](#)

Get Quotes [GO](#) [Symbol Lookup](#)

Nasdaq delayed 15 minutes

NCAA Hockey News

Team Calendars

NHL - Minnesota Wild News

- Wild Team Report (The Sports Xchange) - 1 day ago
- Pierre-Marc Bouchard has 2 assists in Wild's 3-2 win over Lightning (AP) - 1 day ago
- Tuesday's three stars: Conklin to the rescue for Penguins: 50 saves (Yahoo! Sports) - 2 days ago
- Kolzig shines for Capitals on night he faces new competition (AP) - 2 days ago
- Wild make move at deadline, deal for Isles bad boy Chris Simon (AP) - 2 days ago
- Wild acquire troubled LW Simon (PA SportsTicker) - 2 days ago
- Bettman to testify on steroids on Wednesday to House subcommittee (AP) - 2 days ago
- Kiprusoff makes 38 saves and Flames top Wild 2-1 to take over first in Northwest Division (AP) - 4 days ago

ESPN.com - NHL

Sports - MLB - Minnesota Twins News

Stock Portfolios

Last update: 04:38 pm CST - [Refresh](#)

Market Portfolio - Edit

Symbol	Price	Change	
<input type="checkbox"/> ^DJI	12,266.39	↓ 315.79	2.51%
<input type="checkbox"/> ^IXIC	2,271.48	↓ 60.09	2.58%
<input type="checkbox"/> ^OEX	613.62	↓ 16.44	2.61%
<input type="checkbox"/> ^GSPC	1,330.63	↓ 37.05	2.71%
<input type="checkbox"/> ^TYX	0.44	↓ 4.11	90.30%
<input type="checkbox"/> ADCT	13.67	↓ 0.14	1.01%
<input type="checkbox"/> AMIS	6.82	↑ 0.02	0.29%
<input type="checkbox"/> AMZN	64.47	↓ 3.38	4.98%
<input type="checkbox"/> ATK	104.94	↓ 1.48	1.39%
<input type="checkbox"/> ATML	3.25	↓ 0.20	5.80%
<input type="checkbox"/> BBY	43.01	↓ 1.81	4.04%
<input type="checkbox"/> C	23.71	↓ 1.30	5.20%
<input type="checkbox"/> CC	4.42	↓ 0.11	2.43%
<input type="checkbox"/> CSCO	24.39	↓ 0.27	1.09%
<input type="checkbox"/> CY	21.74	↓ 0.27	1.23%
<input type="checkbox"/> CYBE	10.42	↓ 0.22	2.08%
<input type="checkbox"/> DELL	19.90	↓ 0.97	4.65%
<input type="checkbox"/> EMR	50.96	↓ 1.93	3.65%
<input type="checkbox"/> GE	33.14	↓ 0.71	2.10%
<input type="checkbox"/> GOOG	471.18	↓ 4.21	0.89%
<input type="checkbox"/> GPS	20.17	↑ 0.72	3.70%
<input type="checkbox"/> GRMN	58.71	↓ 1.73	2.86%
<input type="checkbox"/> HON	57.54	↓ 1.64	2.77%
<input type="checkbox"/> INTC	19.97	↓ 0.52	2.54%
<input type="checkbox"/> KO	58.46	↓ 1.00	1.68%
<input type="checkbox"/> KSS	44.44	↓ 0.80	1.77%

Personal Assistant

[Mail](#) [Bookmarks](#) [Portfolio](#)

[Weather 28°F](#) [Local](#) [Sports](#)

My Web Vision System

Web Vision (San Jose Office)

Lobby	74° F	No Alarms
East Conference Room	72° F	1 Alarm
Break Room	72° F	No Alarms
Main Office Area	69° F	2 Alarms
Loading Dock	64° F	No Alarms

Web Vision (Milpitas Office)

Lobby	74° F	No Alarms
North Conference Room	72° F	No Alarms
Break Room	72° F	No Alarms
Main Office Area	69° F	No Alarms
Loading Dock	- ° F	2 Alarms

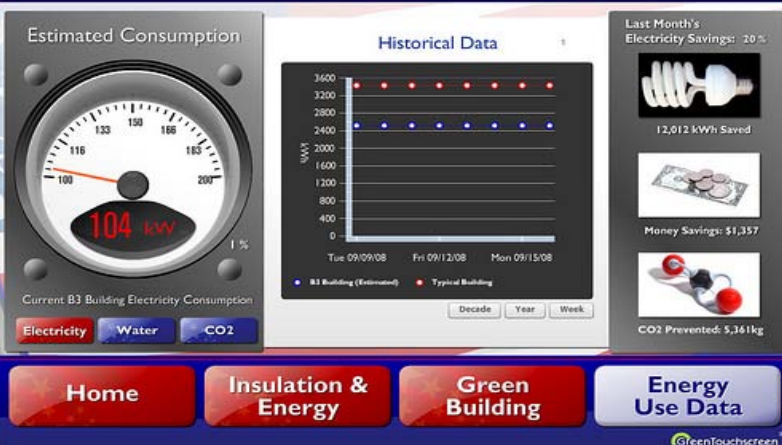
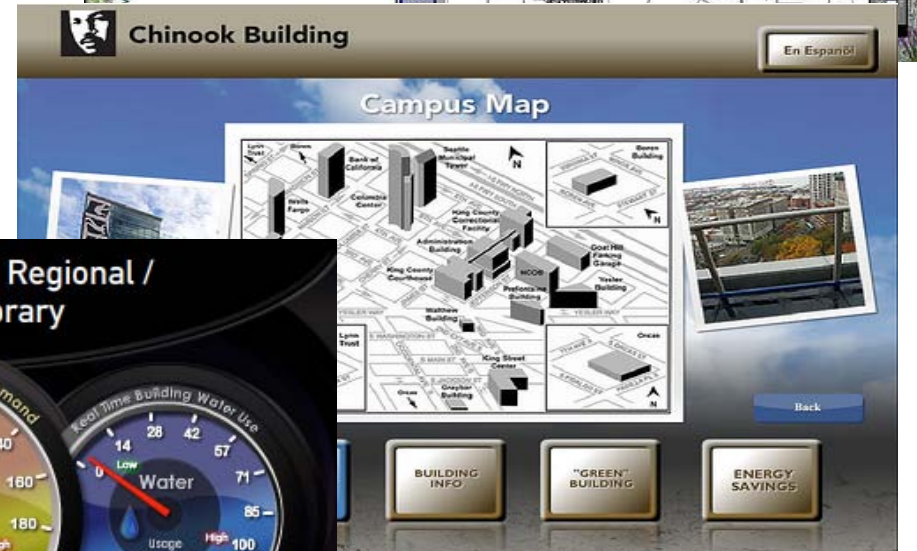
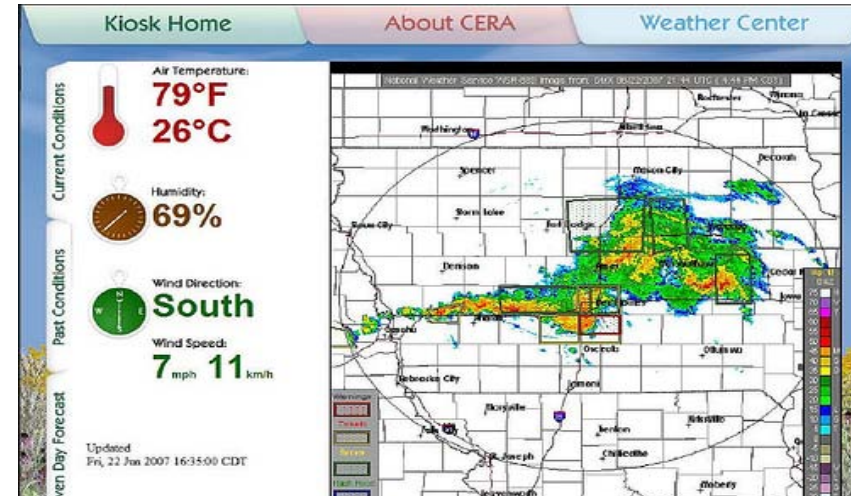
Web Vision (Freemont Office)

Administrative Office	73° F	No Alarms
Sales Office	74° F	No Alarms

Web Based Dashboard Content

Honeywell

- Energy efficiency education touchscreen display of key facility information

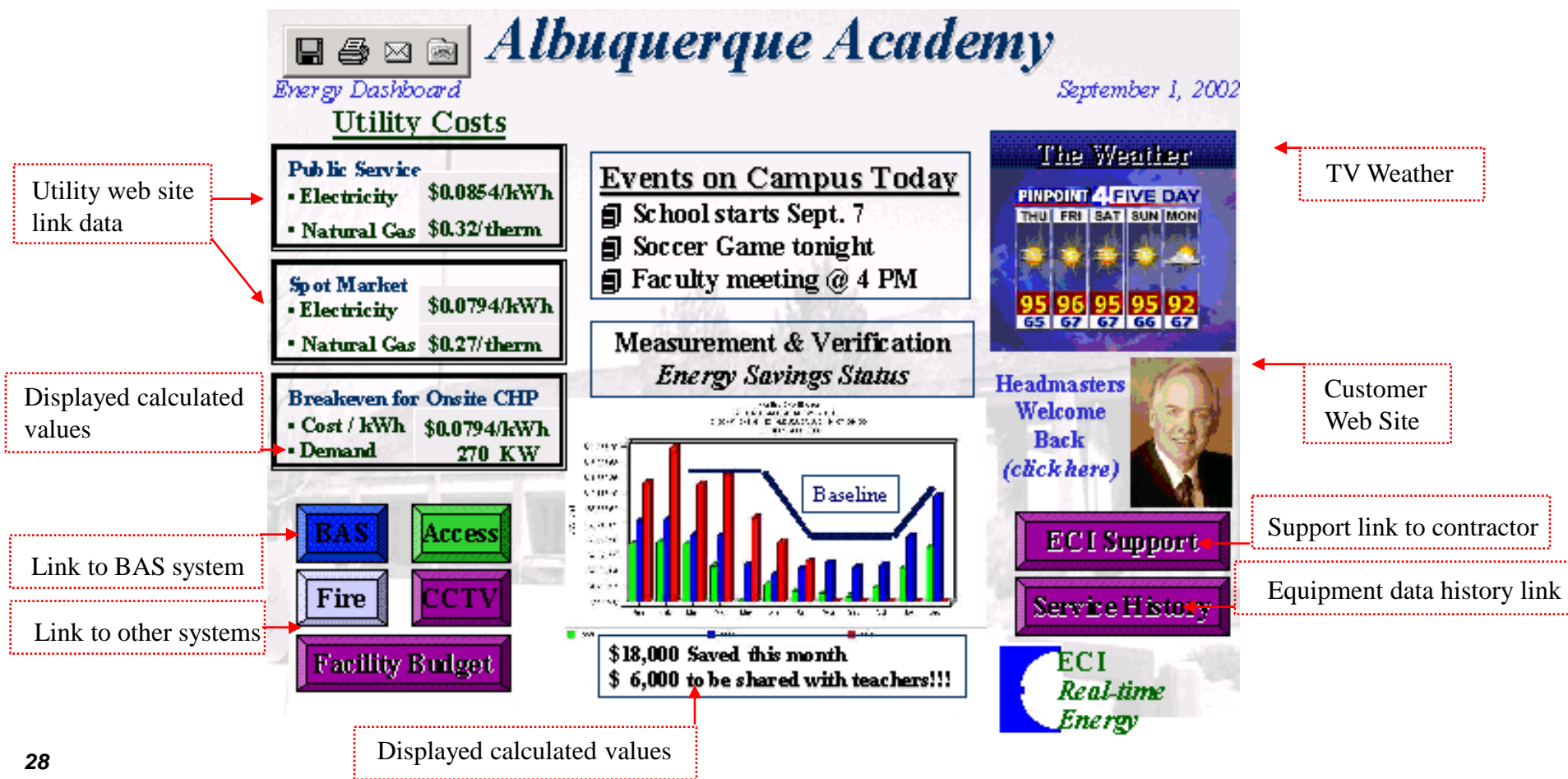


Customer Value With Dashboards

- User based information

- Linking real-time data together from multiple sources ...

- ♦ Utility info, calculated data, links to other systems, web real-time info, TV, weather, internal LAN site link, web cam, etc.



Other Visual System Connection Options

Honeywell



Lets look at 3 areas of ongoing innovation in building control systems ...

- Connectivity of Building Systems
- Data Presentation
- Energy Measurement, Analysis and Response



Honeywell

-

Billing your Profile

Dunings's Restaurant

BILLING STATEMENT

Meter Number: P(Dunings)181
 Account Number: 44881
 Billing Date: 06/06/16
 Due Date: 06/07/16
 Total Amount Due: \$7,654.31

Usage by Day

Time Period	Meter Display	06/01/16	Actual	Charge
on	04/56/01	0	3711	3711 @ 196.0000 = 729.31
off	0	1055	1055 @ 0.001000 = 1.06	
off	0	0	1042	1042 @ 0.000000 = 0.00
				Sub Total: \$1,329.37

Peak Demand

Time Period	Peak Time	kW	kVA	Rate	Charge
on	05/00/01 12:15	55.00	65.38	12.5000	691.25
on	06/00/01 06:15	36.00	38.30	6.0000	216.00
on	06/00/01 23:15	70.00	76.50	0.0000	3.00
off	06/00/01 00:15	0.00	0.00	0.0000	0.00
				Sub Total: \$1,159.30	

Contract Demand is 15.0kW

Time Period	Peak Time	kW	Rate	Charge
on	06/00/01 06:15	147.50	4.000000	590.00
				Sub Total: \$590.00

Energy Charge

Time Period	Peak Time	kWh	Rate	Charge
on	06/00/01 06:15	147.50	4.000000	590.00
				Sub Total: \$590.00

Service Charge

Time Period	Peak Time	kWh	Rate	Charge
on	06/00/01 06:15	147.50	4.000000	590.00
				Sub Total: \$590.00

Tax

Time Period	Peak Time	kWh	Rate	Charge
on	06/00/01 06:15	147.50	4.000000	590.00
				Sub Total: \$590.00

Total

\$7,654.31

Grand Total

\$7,654.31



Water



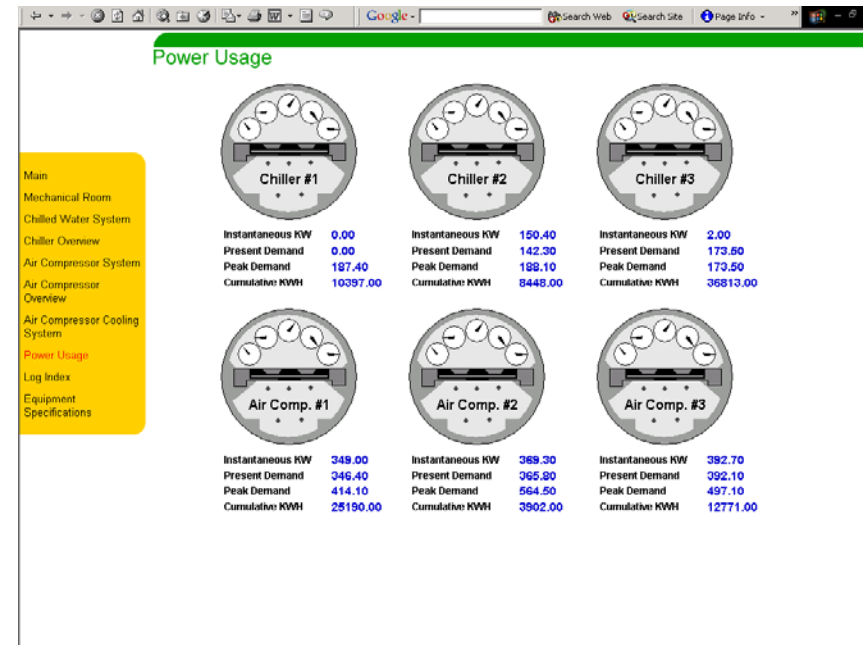
Gas



Meter and Sub-Meter Solutions

Honeywell

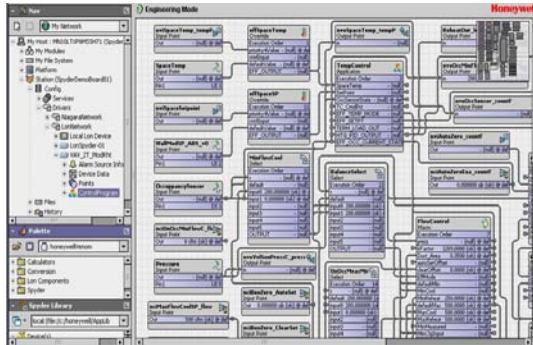
- A solution for Every Business
 - Office Buildings
 - Retail Operations
 - K-12, Universities and Colleges
 - Government Facilities
 - Multi-Use Commercial
- Applications
 - Demand Control to Shed Loads
 - Energy Cost Control
 - Load Reduction Including DR Curtailment
 - Facility Performance Benchmarking
 - Power Quality Monitoring and Analysis
 - Tenant Sub-Metering
 - Utility Bill Verification
 - Monitor of Demand Charge Peak Shaving
 - Data Integration of All Facility Meters and Applications



A Complete Energy Management Cycle

Honeywell

- Metering validates effectiveness of energy strategies



Implement Energy Strategies



Starting Energy Bills

Billing using Pre-Paid						Print
BILLING STATEMENT						
Durango's Restaurant		Meter Number		P-Durango-1881		
		Account Number		44891		
		Billing Date		05/15/01		
		Due Date		05/20/01		
		Total Amount Due		\$7,654.91		
Usage Data						
Time Period	Meter Display	Actual	Rate	Charge		
on 04/15/01	03711	3711	0.160000	\$75.82		
off 0	1000	1000	0.001000	1.00		
off 0	9040	9040	0.000000	\$0.00		
Meter with Multiplier of 32		14736		Sub Total	\$1,322.82	
Peak Demand						
Time Period	Peak Time	kW	Rate	Charge		
on 05/01/01 14:45	36.00	36.00	12.2500	\$440.00		
off 05/01/01 06:15	36.00	36.00	6.6000	160.00		
off 05/01/01 23:15	70.00	70.00	4.0000	300.00		
Distribution Demand		0.00	0.0000	\$0.00		
Total Demand		0.00		Sub Total	\$5,159.39	
Other Charges						
Type	Basis	Rate	Charge			
Service Charge			22.00			
Energy Adjustment	14736 kWh	0.000000	\$0.00			
Total				Sub Total	\$2,564.43	
Tax		6%		Tax	\$150.26	
Grand Total					\$7,654.91	

Meter Energy Measurement



Water



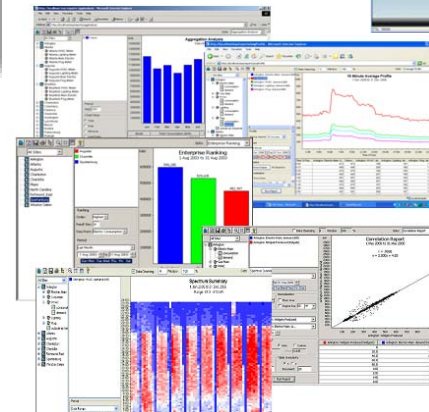
Gas



Tenant Billing/Invoicing



Energy Analysis Tools



Energy Analysis Tools Should ...

Honeywell

- Identify site & area inefficiencies ... compare exceptions & trends
- Normalize comparative data for weather, production, and square footage
- Determine better usage strategies
- Improve commodity negotiations / reduce the amount paid for energy
- Reduce the amount of energy consumed
- Understand how building characteristics affect energy costs
- Measure results of energy strategy decisions

