Systems Integration using Communications Drivers and Open Protocols

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Innovative Concepts in Electrical, Lighting & Telecommunications

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Rebuild America / Clean Energy Expo

State College, PA

Agenda

- Introductions
- Goals and Objectives
- Background
- Definitions, Types of Integration
- Protocols, Avenues
- Interoperability and Central Control
- Why Integrate? Benefits
- Solutions, Markets, Examples
- Economic Summary
- Keys to Success
- Questions

Introduction

Systems Integration using Communications Drivers and Open Protocols

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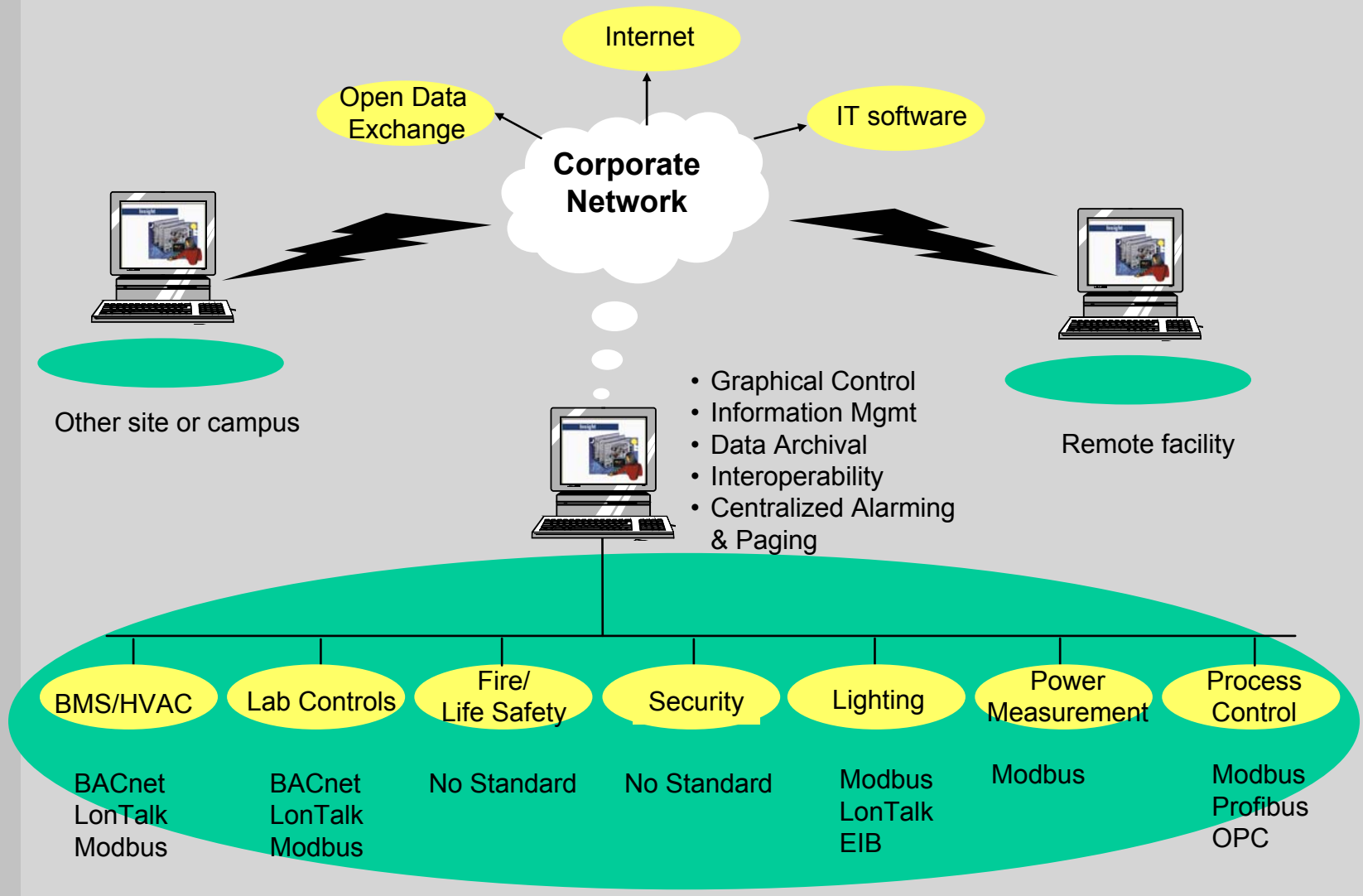
Goals and Objectives

- **Goal:**
  - Bring attention to the benefits of integrated systems.

- **At the conclusion of this seminar you should be able to:**
  - Describe what integration is.
  - Describe the key benefits of integration.
  - Understand the financial impact of different forms of integration.

- **Initiate conversation and discussion about integration.**

Background: State of the industry



What is “Integration”?

Definition:

- “To make or become whole or complete”
- “To bring parts together into a whole”
- “To remove barriers”

What is “Integration”?

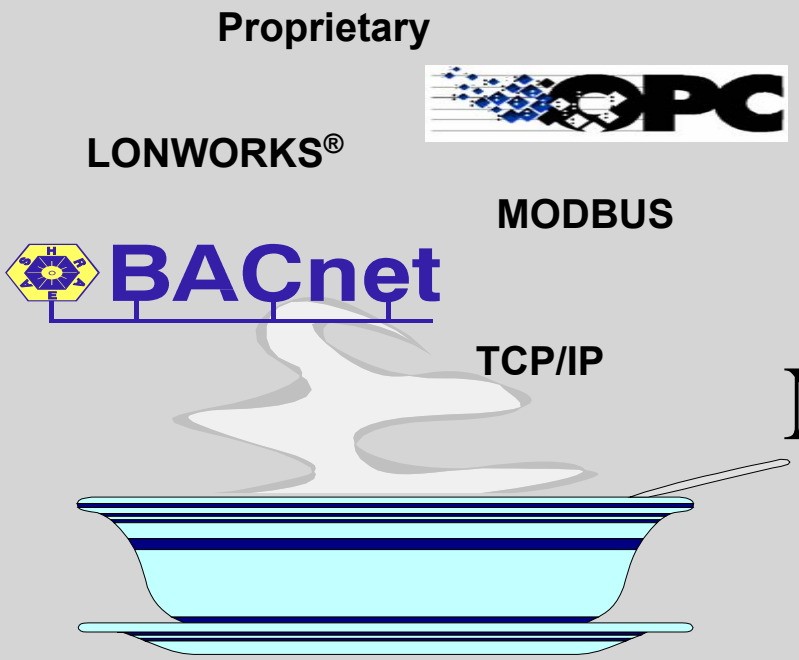
Typically involves:

- Hardwiring between devices or systems or
- Communications using:
  - Protocols
  - Gateways
  - Drivers
- Applications work
  - Valuable integration is about providing solutions, not just a connection

- Supports current standards and technologies
- Provides flexibility for unknown future technologies or advancements

- The value and usability of the integrated system is greater than many separate systems

Types of Integration



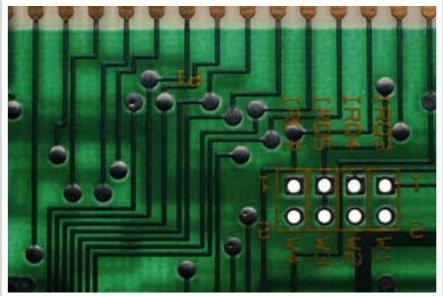
No Soup for YOU!

Protocol Soup

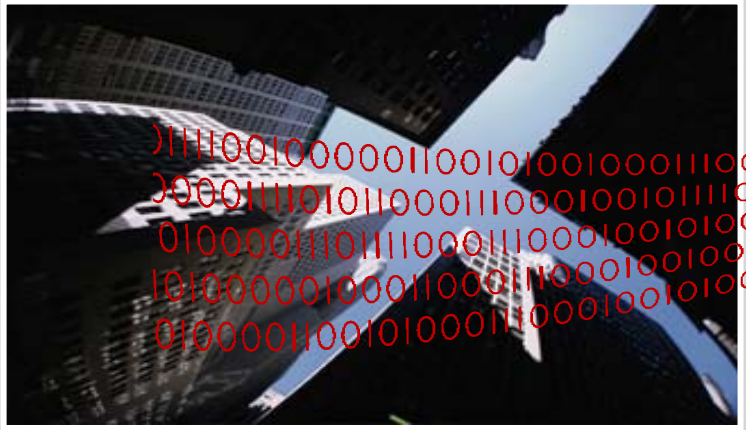
Open Systems

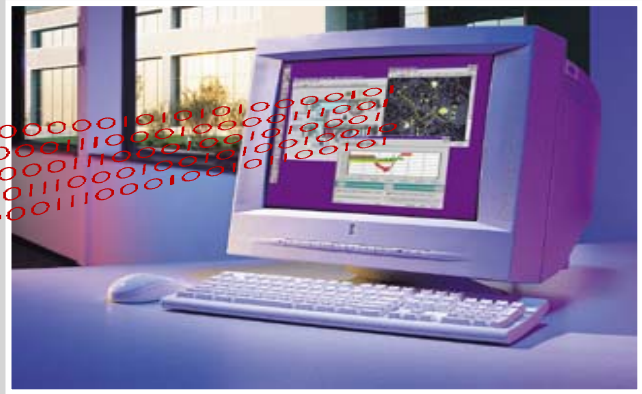
Uses the best of all developments:

- Leverage Technology Standards
- Leverage Protocol Standards
- Leverage Alliances and Partnerships



How Open is “Open”???





Leveraging Technology Standards

- **PC standards**
  - Based on the dominate operating system
  - Active X (COM/DCOM)
  - SQL/ODBC
  - Web/html
- **Communication industry standards**
  - Ethernet (802.3)
  - Internet
  - Wireless / cell / paging (TAPI)

Worldwide Protocol Standards

Building automation:

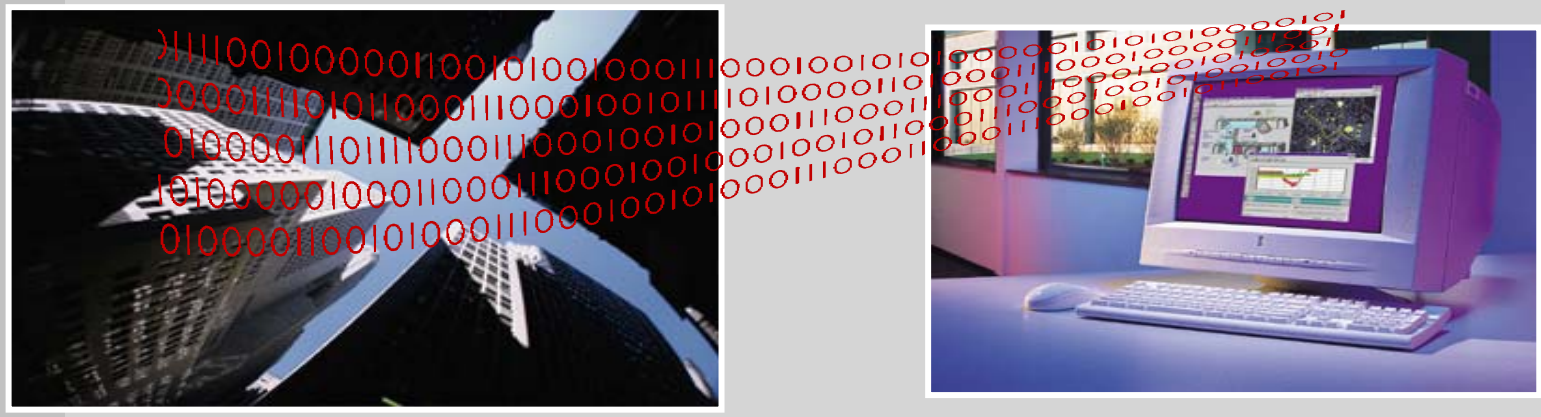
- BACnet
- LonWorks/talk
- EIB
- Profibus
- Cab
- Ethernet TCP I/P
- WWW

Process Control:

- Profibus
- Modbus
- Device Net
- Field Net
- CAN

Office Automation:

- Novell
- Ethernet TCP I/P
- Arcnet
- SNMP



Leverage Alliances & Partnerships

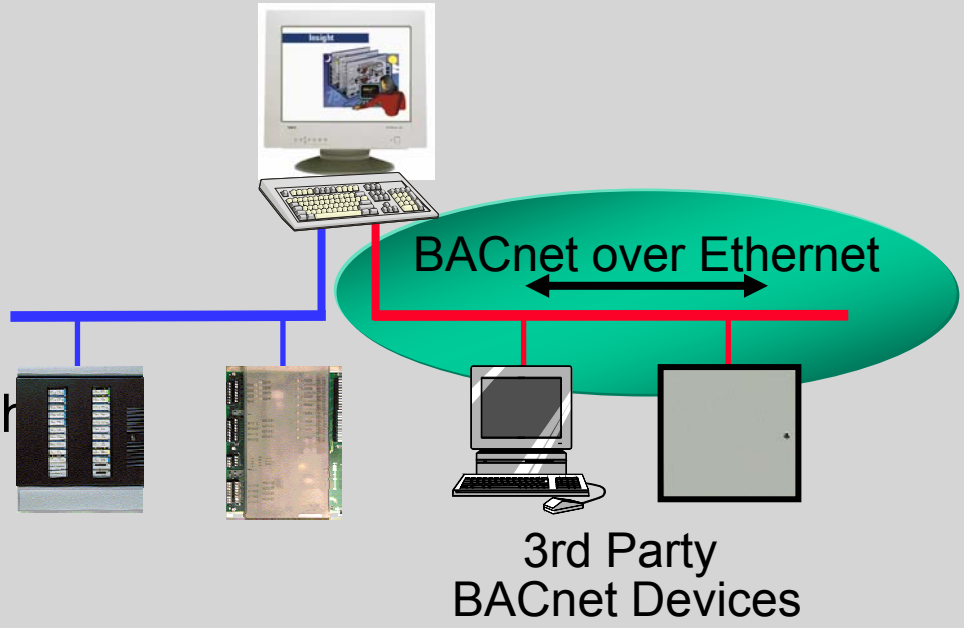
- Solution specific development by two vendors
- Commonly thought of as gateways or drivers based on proprietary protocols

- Value of alliances & partnerships:
  - Communication with other systems that don't support standards
  - Cooperation in testing and support from 3rd party

BACNET

Evaluation of BACnet: ASHRAE/ANSI standard

- Available from most BMS and HVAC equipment vendors
- Allows for flexibility in implementation
- BACnet manufacturers association will address interoperability testing in th future - BTL listing
- Does not include tools, programming, or network management

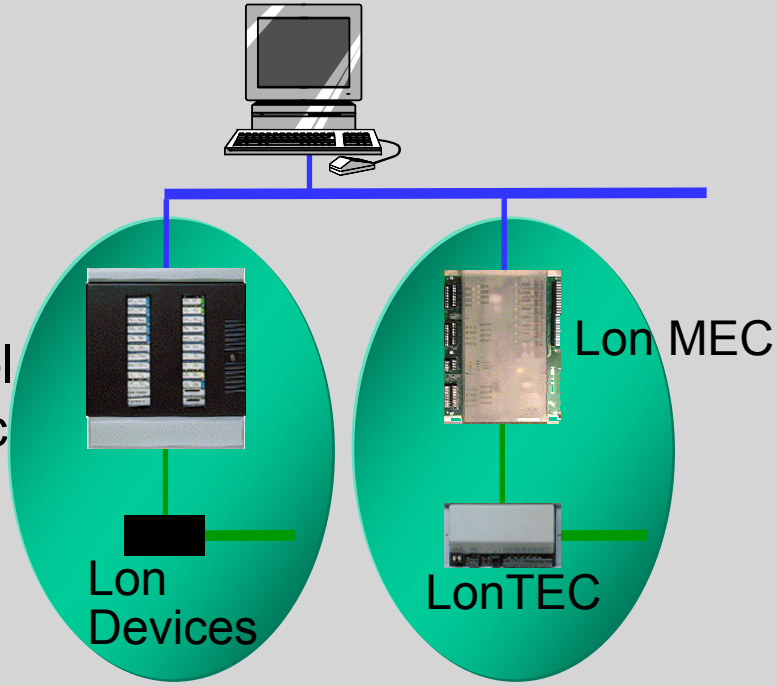


LonWorks or LonTalk

LONWORKS®

LonWorks:

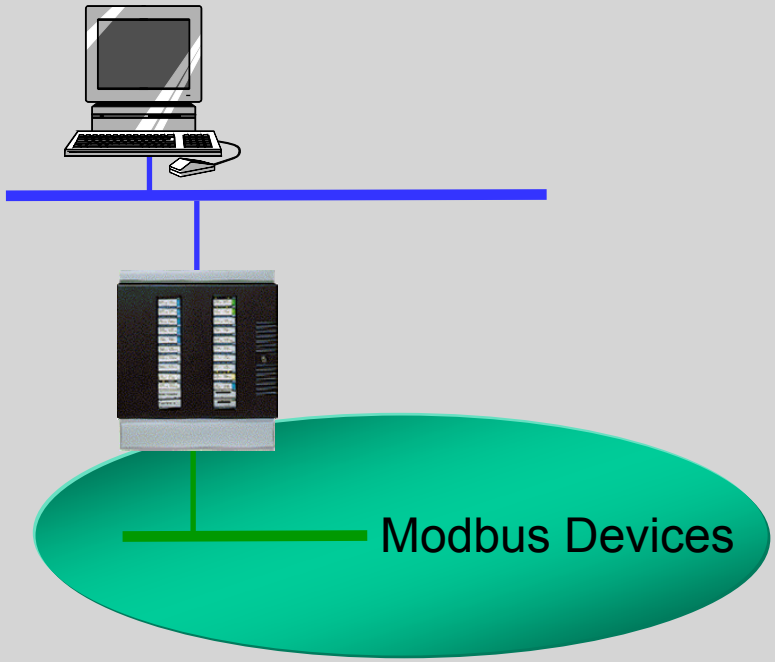
- Impeded “proprietary” chip.
- Used for many different types of floor level devices.
- Used for integrating devices on a single network.
- System applications and tool sets become vendor specific
- Mostly HVAC but other industries soon.



Modbus

Modbus:

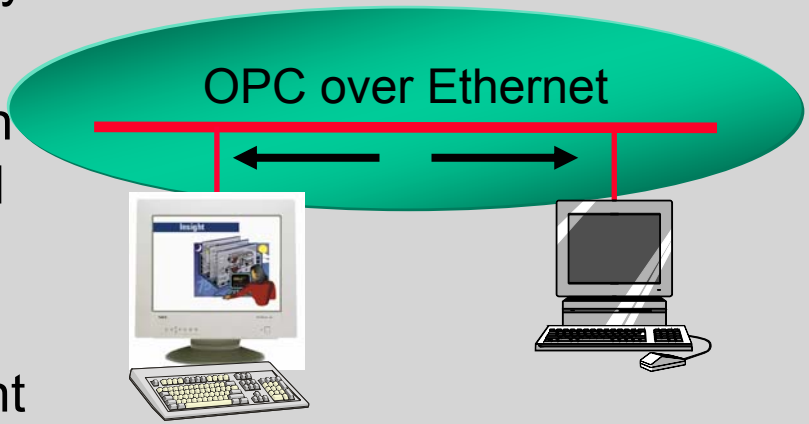
- Started as a public “open” protocol in the process control industry (PLCs).
- Defacto-standard protocol.
- Used for many different types of floor level devices.
- Simple protocol has lead to wide implementation in many building systems including: process controls, power meters, chillers, boilers, and BMS.



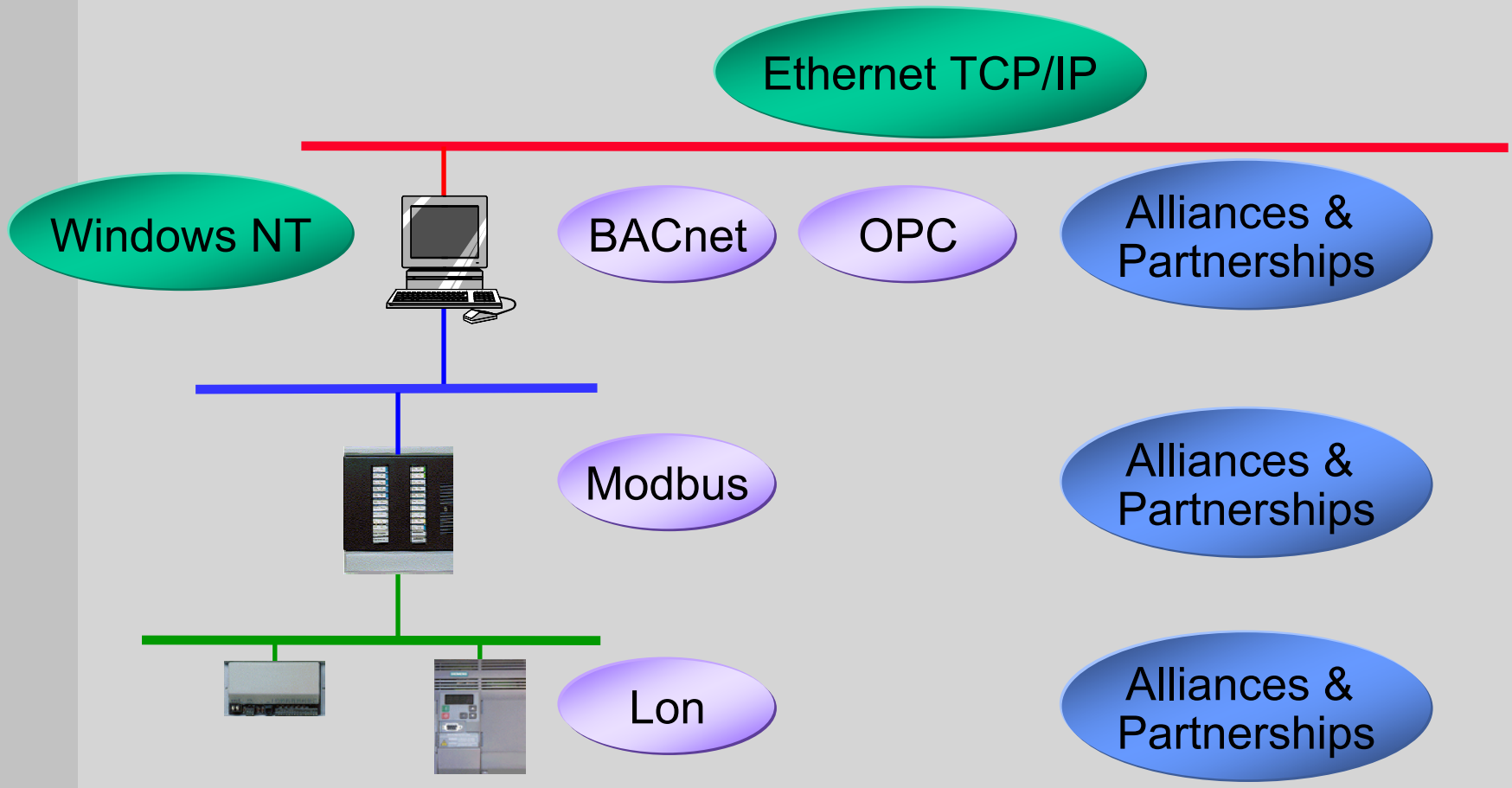
OPC-OLE

OPC – OLE for process control:

- Based on Microsoft technology
- OPC is an acronym for OLE for process control. OLE is an acronym for object linking and embedding
- Used between windows applications to transfer present value and alarm data directly from one database to another

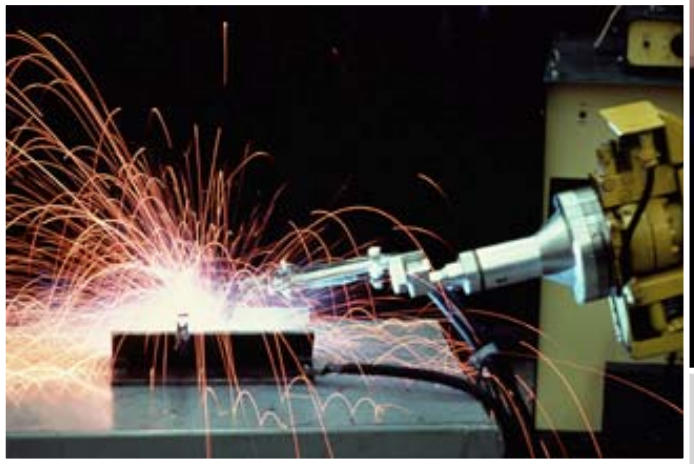


Leverage the best technology



Integrated Systems Often Include:

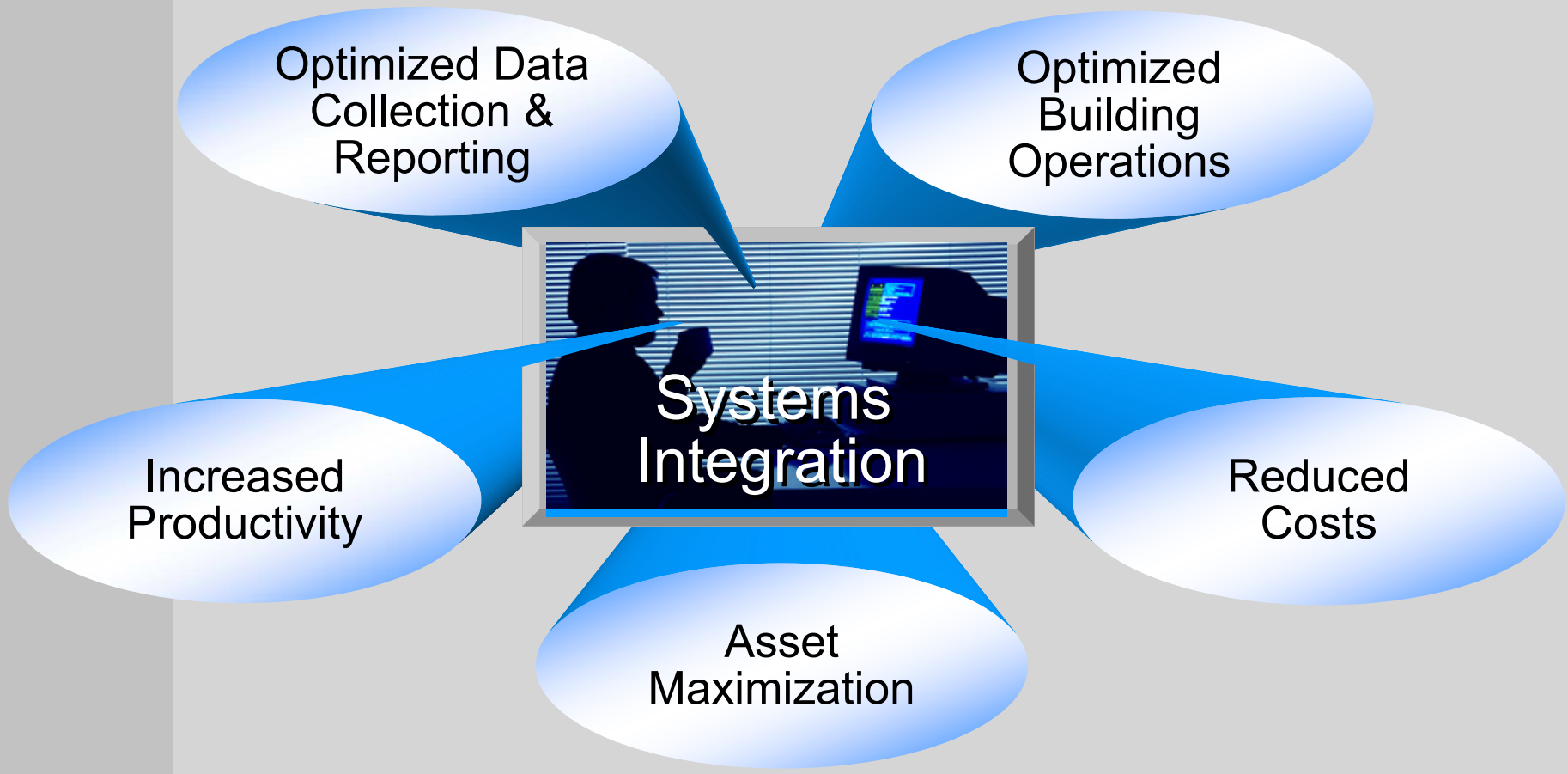
- Electrical distribution
- Metering
- Electrical back-up
- Manufacturing & production
- Building automation, energy management systems
- Paging and maintenance management



Integrated Systems Often Include:

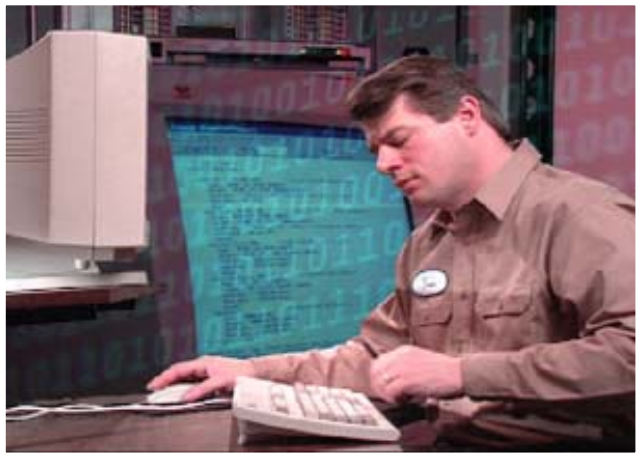
- Central plants
- Ventilation, indoor air quality
- Fire alarm and smoke control
- Access & security
- Research systems and devices
- Critical environments

Integration Benefits:



Delivering Integration Benefits:

- Site-wide user interface
- Information access
- Information collection
- Information management
- Intersystem control
- Shared resources



Site-wide User Interface

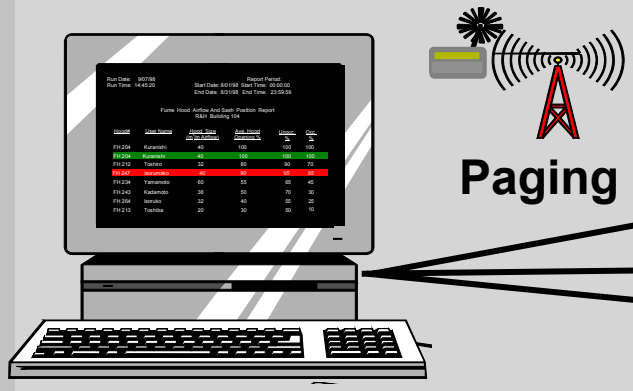
- Single-seat operation
- Integrate all systems to a single workstation
  - From multiple and remote facilities
  - For centralized alarming and paging
  - For alarm routing
  - For event management

Site-wide User Interface - Benefits

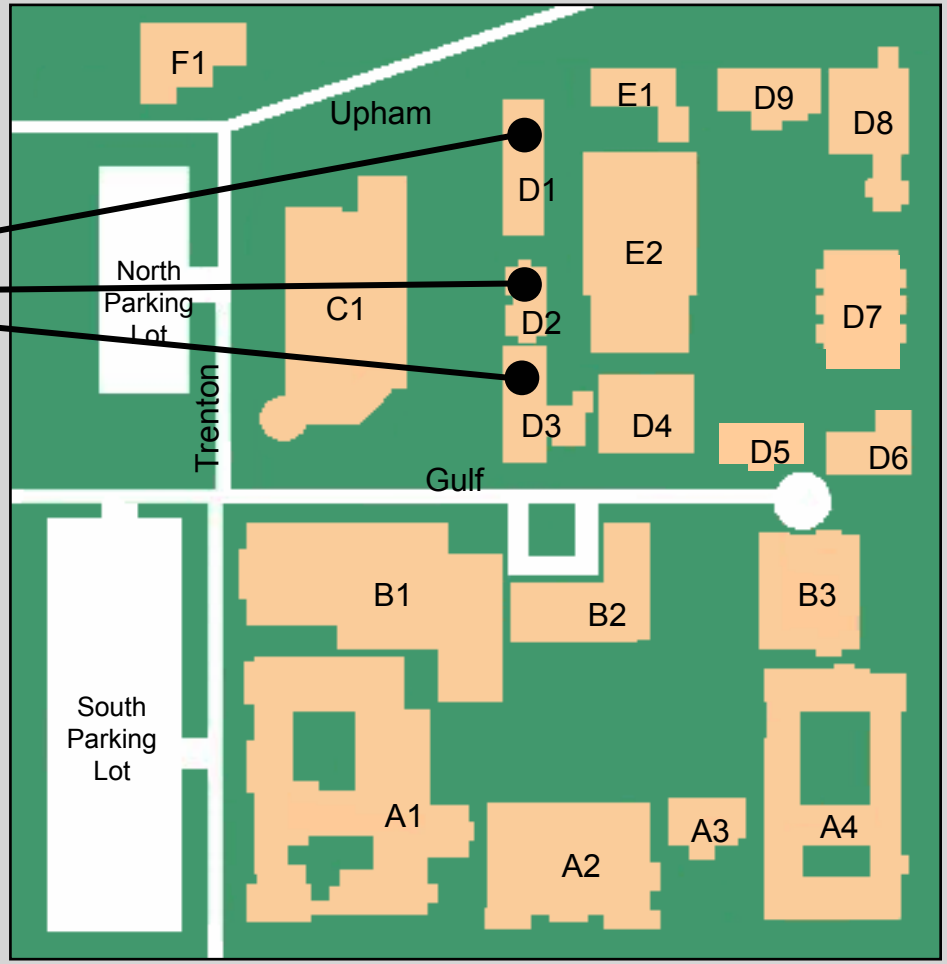
- **Centrally monitor all facilities**
  - More efficiently direct personnel
  - More efficiently handle and escalate alarms
  - Reduces after-hours night shift requirements

Reduce Costs

Site-wide User Interface - Example



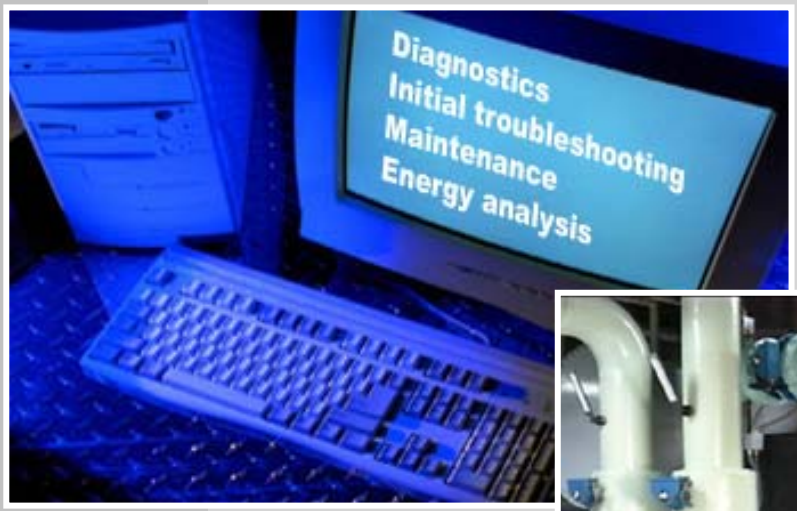
Paging

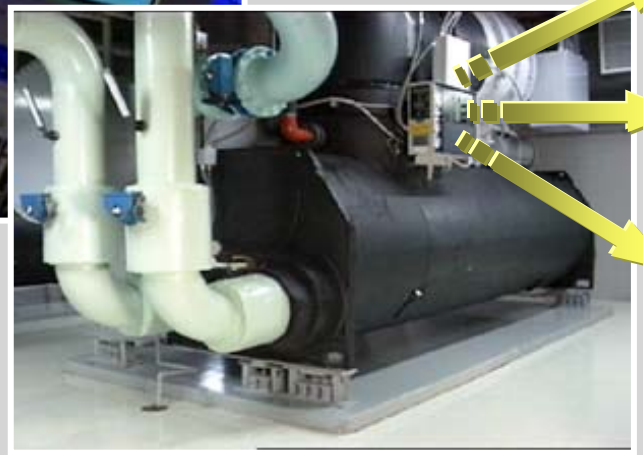


- Centrally monitor environmental conditions and room status for laboratories and animal holding areas
- Remotely monitor to ensure reliable 24/7 coverage

Information Access

- Significantly more information available
- Information that was previously inaccessible





COMPRESSOR KW

Energy Management

OIL TEMPERATURE

Centralized Alarms and Diagnostics

BEARING TEMPERATURE

Preventive Maintenance

Information Access - Benefits

- Monitor, alarm and track key information
  - Avoid critical system shutdown and unscheduled repairs
  - Avoid catastrophic failures
  - Determine when service is required

Ensures animal study integrity

Temperature
78.62ºF

Relative Humidity
54.83%

Predictive Maintenance

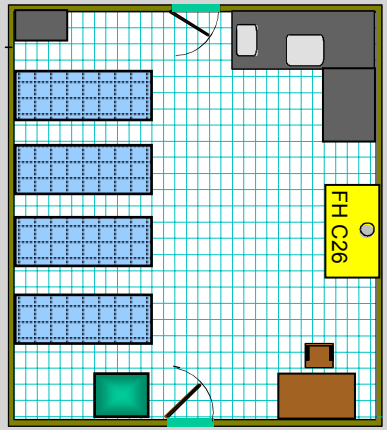
COMPRESSOR KW
Energy Management

OIL TEMPERATURE
Centralized Alarms and Diagnostics

BEARING TEMPERATURE
Preventive Maintenance

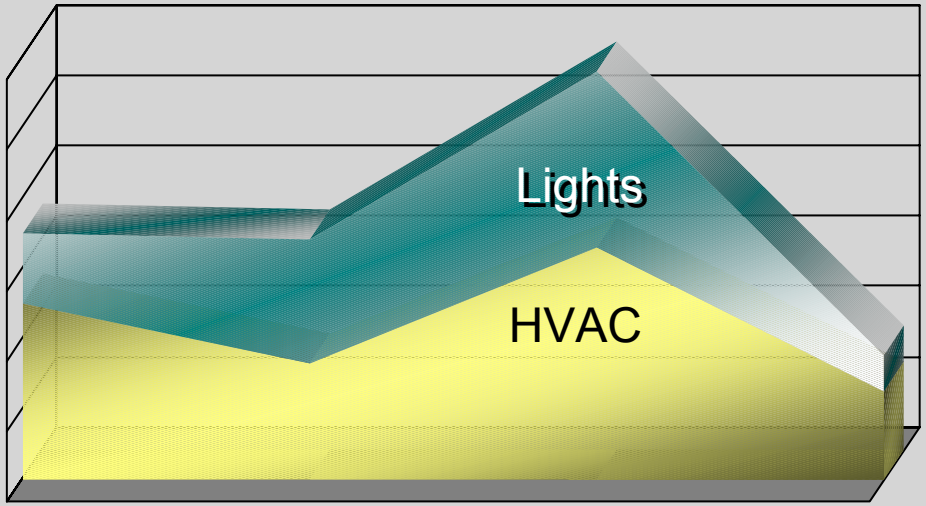
Provides cooling

Provides dehumidification



Information Collection & Management

- **Centralize information at a single location**
- **Combine information for analysis and reporting**
  - Energy usage
  - Equipment operation
  - Temperatures



Information Management - Benefits

- Store and archive important information for regulations and accreditation
- Automate data collection to reduce labor costs
- Use past reports to predict future costs for budgeting
- Gain insight in how to optimize building performance

Reduces Cost & Increases Productivity

DAILY ANIMAL ROOM REPORT

Friday, June 16, 2000

Rodent AHR 15

	Average	High		Low	
Air Changes Per Hour	12.35	14.00	11:00 AM	11.09	5:00 AM
Humidity	43.11	42.22	1:00 AM	39.01	1:00 PM
Temperature	70.19	72.03	2:00 PM	69.09	7:30 PM

Rodent AHR 16

	Average	High		Low	
Air Changes Per Hour	11.75	13.36	11:00 AM	10.00	5:00 AM
Humidity	40.31	41.32	1:00 AM	38.91	1:00 PM
Temperature	71.44	72.53	2:00 PM	69.22	7:30 PM

Rodent AHR 17

	Average	High		Low	
Air Changes Per Hour	11.75	13.60	11:00 AM	10.50	5:00 AM
Humidity	40.11	44.28	1:00 AM	39.41	1:00 PM
Temperature	70.19	71.32	2:00 PM	69.59	7:30 PM

Intersystem Control

- Decisions and information from one system affects another

- Security ⌫ Lighting ⌫ Lab Ventilation ("LAB OCCUPIED")

-usage and occupant information trended for control documentation and cost allocation

Intersystem Control - Benefits

Optimizes Operations

- **Systems interact with each other to:**
  - Reduce energy costs
  - Increase security and safety
  - Shorten response time
  - Meet specific operational strategies (efficiencies)
  - Maximize use of assets
  - Optimize building operation

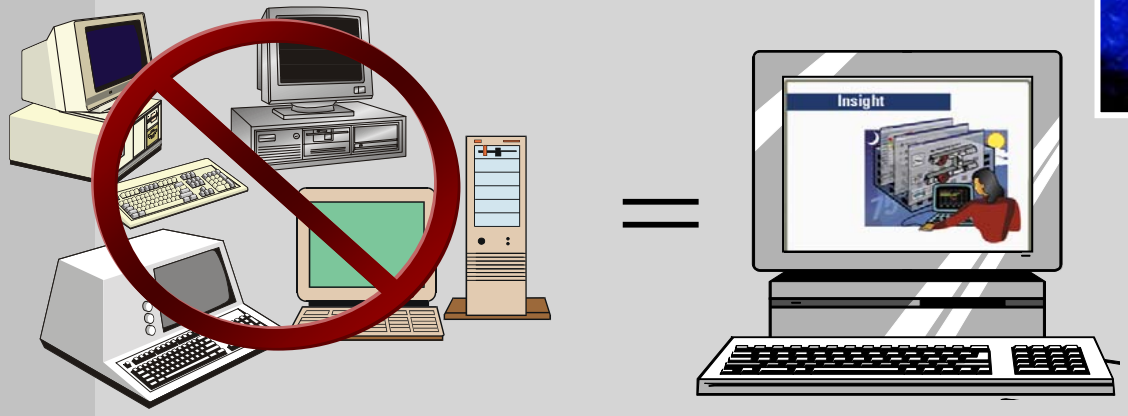
Shared Resources

- Shared network infrastructure
- Expanded connectivity options
  - Utilizes an open system approach
  - Uses protocol communication methods instead of hardwiring
    - Reduces redundant instrumentation
    - Easier check-out
    - Simpler documentation
  - Current and future changes or additions easier
- Fully leveraged investments
  - Extend the features of the BAS to all systems
- Legacy system support

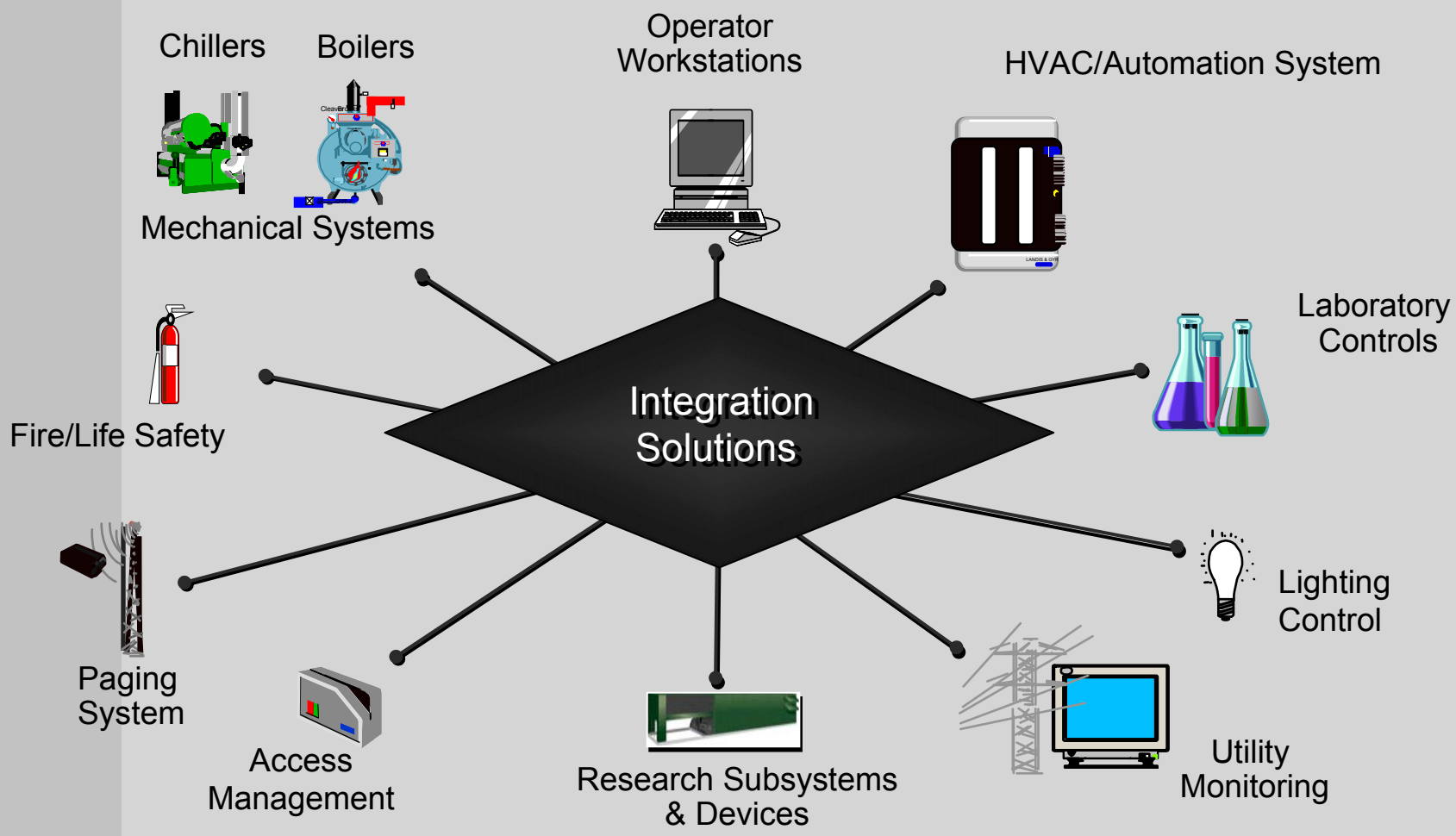
Shared Resources - Benefits

Reduces Costs

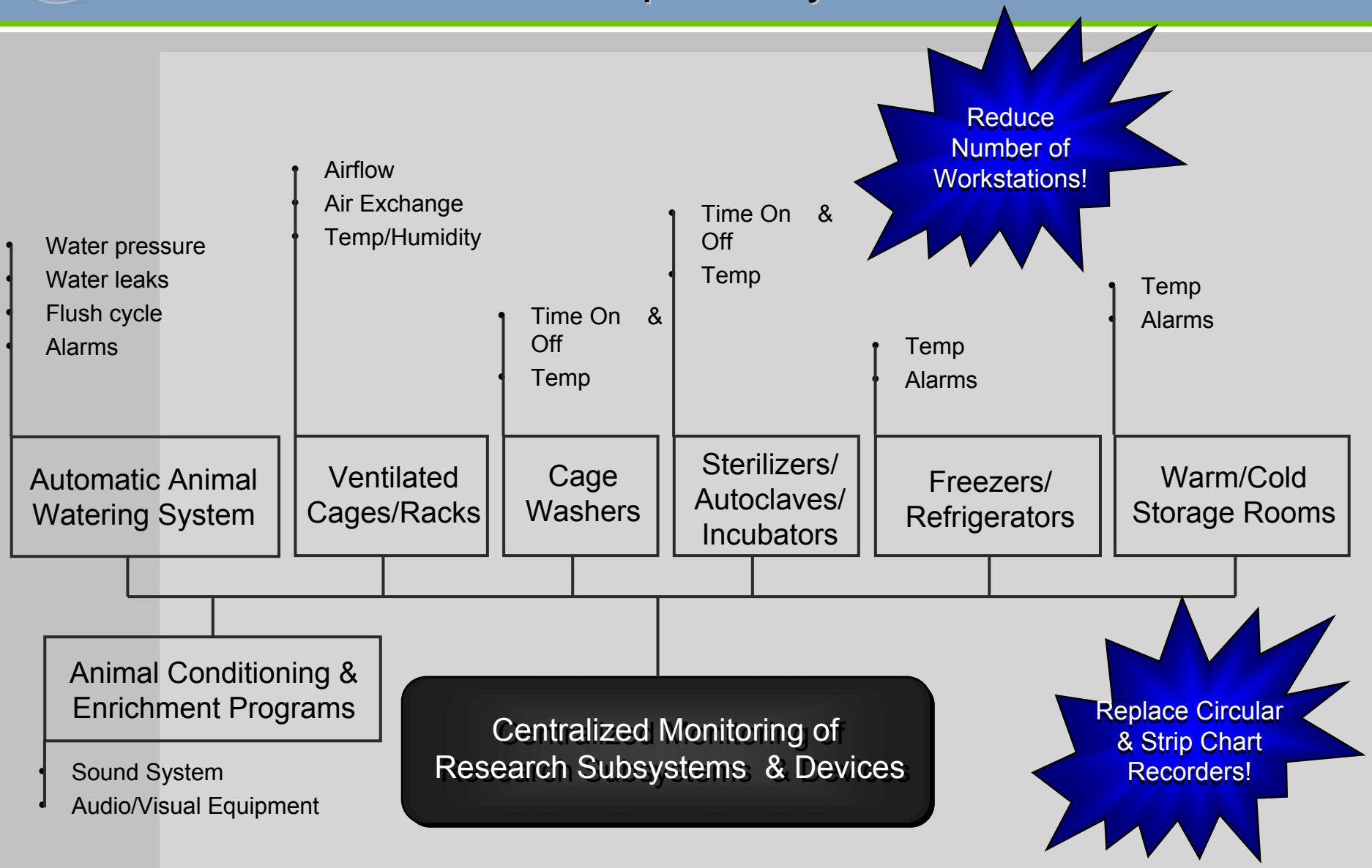
- Shared network infrastructure
  - Saves money
- Expanded connectivity options
  - Saves money
- Fully Leveraged Investments
  - **only purchase a feature set once**



Interoperability and Centralized Control



Interoperability and Centralized Control



Examples

Systems Integration using Communications Drivers and Open Protocols

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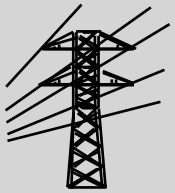
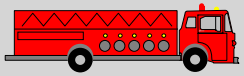
Pennsylvania Association of School Business Officials
Pennsylvania School Board Association

Example #1 - Office / Industrial

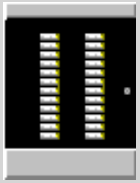
- Background:
  - Rebates for energy efficiency
  - Large electrical loads
- Installed Systems:
  - BAS, Lighting Control, Fire Alarm, Security, Power Monitoring



Power Monitor

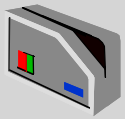


Fire



BAS

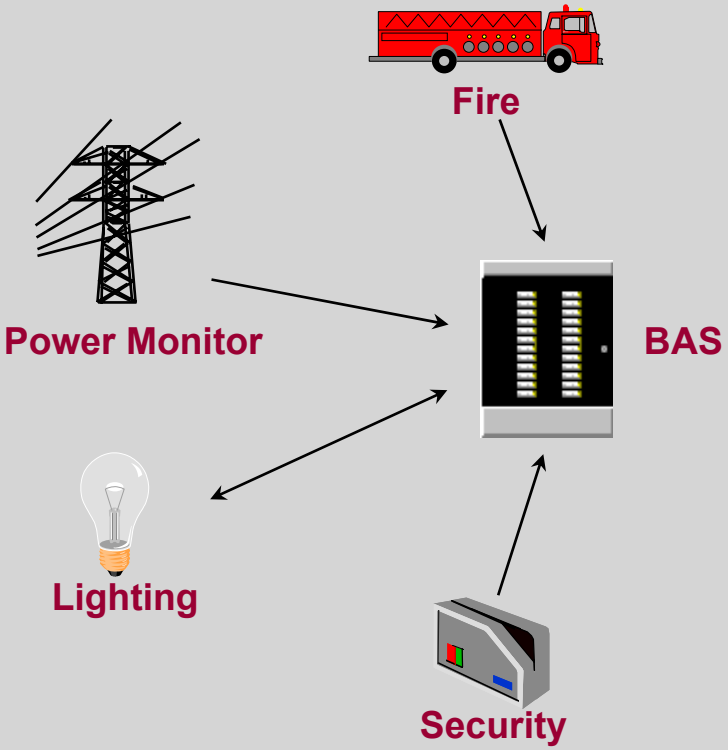
Lighting



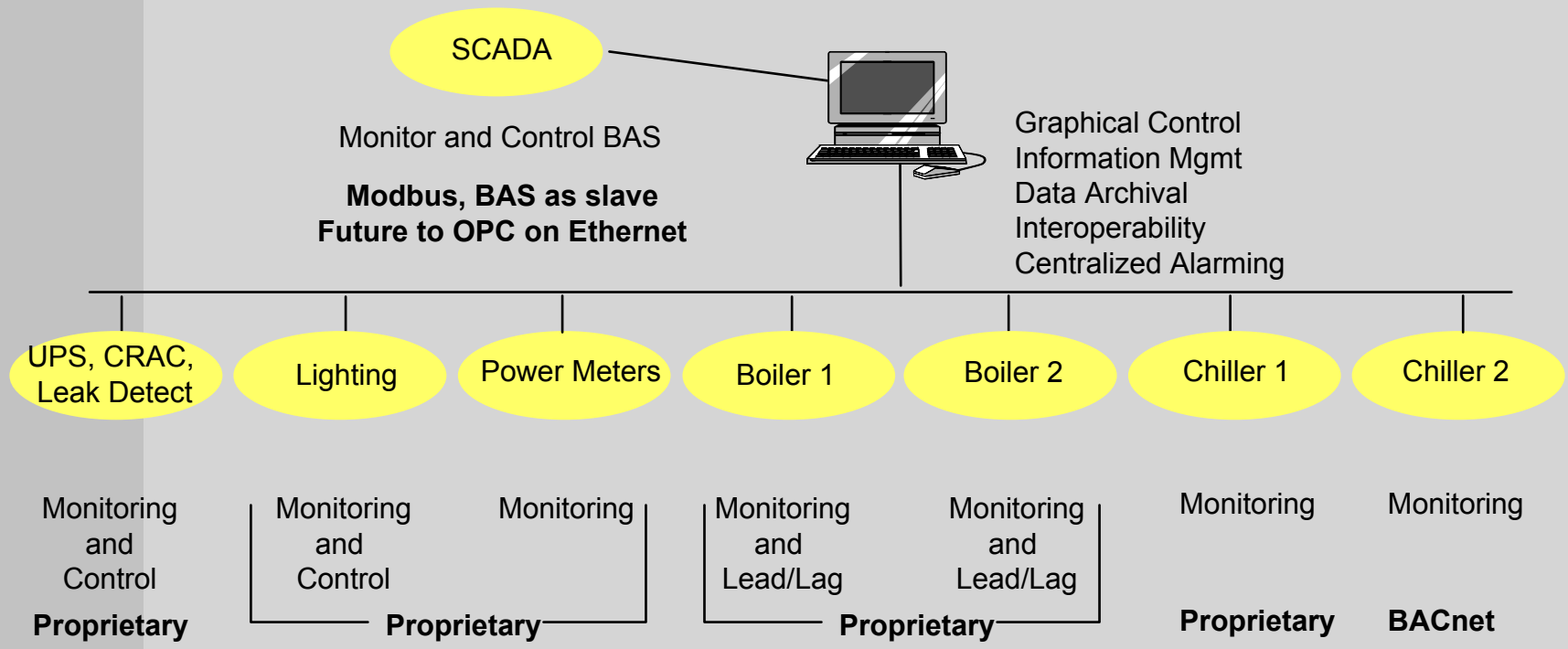
Security

Example #1 (cont.)

- Objective:
  - Energy Efficiency
  - Central monitoring
  - Future expansion
- Chosen Solution
  - System Interaction
- Benefits Received
  - Cost reduction
  - Operational features



Example #1 - Manufacturer



Final Examples

Three Gorges Dam Project:

- 34 million cubic yards of concrete.
- Continuous, properly mixed concrete must be delivered timely.
- Sensors, meters, actuators, drives, belt systems, mixers, PLCs, MCC and a Human Machine Interface (HMI) using multiple cameras all accessed by one system using visual basic programming over optical fiber cable.

Healthcare:

- Med-check software, Barcode Technology, wireless communication
- Avoid 84 to 264 errors a week at a major hospital.

Economic Summary

Sitewide User Interface

Benefit	Potential Savings	Healthcare Issues Addressed
Central Monitoring		
- efficiently direct personnel	soft	Patient Satisfaction
- efficiently handle and escalate alarms	soft	Staff Shortage
- reduce after hours night operations	1 or more FTEs ($50K - $60K)	Reduce Operating Expenses
- reduce training costs	1 class / FTE / year	Reduce Capital Expenses
- eliminate front end equipment	$5K - $50K in installed, service and maintenance costs	Increase Services

Economic Summary

Information Access

Benefit	Potential Savings	Healthcare Issues Addressed
Track Key Information - avoid critical system shutdown - avoid catastrophic failures	*cost avoidance (ex. chiller $20 - $50K)	Patient satisfaction Reduce costs
Monitor built-in equipment energy information	varies ($1000s in energy and hardwired instrumentation)	Cost Allocations
Analyze equipment trends - priortize service work	soft	Staff shortage

*Example: 400 Hp equipment, reactive maintenance can cost over 2 times more than predictive maintenance

*"The Power of Prediction", Industry Week, July 4, 1994, p. 45-47

Economic Summary

Financial Advantages

Benefit	Potential Savings	Healthcare Issues Addressed
Lower installed costs	*25% - 30% reduction in installed controls costs	Reduce Capital Costs
Prolong life of older systems	Cost avoidance	Reduce Operating Expenses

*Example: Large central plant project

*"Chiller Plant Control using Gateway Technology", HPAC, January, 2000, p. 83

For a complete solution...

- What is the desired functionality?
- What information will be shared?
- Which technologies will be used?
- Which protocols will be used?

Integration - Keys to Success

- Understand expectations
- Define requirements which become part of the master plan
- Document appropriately
- Communicate at a technical & project level:
  - Internally
    - Facilities, engineering, scientific, quality, safety & security
  - Externally
    - System integrator, engineering firm
- Proper commissioning
- Customer training

Questions?

- How open is open?
- What is the future of integration?
- Will your integrated solution migrate with the changes you need to make?
- Will that solution be there for you…8 track tapes, VHS, floppy disks…