YORKLAND

- Distributor / Systems Solutions Provider with over 35 years of controls experience
- Represent major control manufactures
- Uniquely positioned to offer integrated control systems from various control manufacturers
- Support contractors as they offer control solutions
Distribution Channels

1. “ABCS” Distributor
2. Parts Sales
3. Energy Management Sales
4. Design
5. Engineering and Commissioning
Yorkland Controls
Value Added Services
“parts & smarts”

- High level of technical support
- Engineering
- Sales & Marketing Support
- Panel Building
- Training
- Commissioning
Agenda

- Building Automation Basics
- Communication
- Trends
- Energy Conservation Measures
- Optimization
Building Automation System (BAS)

- Automatic control of one or more major building system functions required in a facility, such as heating, ventilating, and air conditioning (HVAC) systems.
- BAS includes lighting, security, fire safety, industrial processes, and more
- Individual Equipment Controllers (DDC) are “stand-alone” or installed on a “network” to a “head-end”.
  - Airhandlers
  - Lighting
  - Boilers
- Controllers Communicate
  - Manufacture Specific protocol
  - Published Standard
    - LON
    - BACNET
    - MODBUS
    - N2
• Monitor
• Password
• Trends
• Alarms
• Reports
• Dial Out

• Energy Management
• Schedule
• Interlock
• Custom Programs

Data Providers
• Lighting
• HVAC
• MMS

Print

Coordinate with other N31s
Today, facilities are viewed as strategic resources... elevating the facility manager to the role of asset manager supporting the organization's overall business goals. ... managing facilities as a true profit center.

(From an E-mail promoting a new book “Total Productive Facilities Management - By Richard Sievert)
Perspective

- Building owners are looking for:
  - Building Controls to utilize the infrastructure of their existing intranets and Internet
  - Facilities to be a data source to help them better run their business or organization
  - Easy integration of all facility management tasks so that they can operate more efficiently
Building Automation
A Changing Market

- Integration and Convergence
  - System Integration
  - Enterprise Integration
The Market Today

Protocols % Share 2002
- BACnet: 15%
- LON: 12%
- Others: 3%
- Proprietary: 70%

Protocols % Share 2009
- Proprietary: 52%
- BACnet: 19%
- LON: 17%
- Others: 12%
- $784 Million*

$552 Million*

DDC Controllers:
Unitary & Applied System Controls

*Frost & Sullivan N. Amer. HVAC Controls Study, 10/03
Open Standards

- Open standards are an expectation by owners today
  - Single seat operations and the need for future options are driving forces
- BACnet and LonTalk are great solutions - but neither was designed for the web and are not readily integrated with business systems
BACnet / LonTalk Challenges

- Security (authentication and encryption)
- Database and other application compatibility
- Acceptance outside of HVAC industry
- Support through network firewalls
- Network routing of broadcast messages
Internet Standards

- Internet standards (Web Services) are the future. These include
  - Physical - Ethernet, TCP/IP
  - Human readable - HTML, JAVA, Active X
  - Machine readable - XML, SOAP, SNMP, SMTP
- Web pages for user interface
- IT data standards for open communications between devices

*These standards will dominate in the future*
Challenges

• Today many vendors are using XML and web services in their products in a non-standard method
• Standards are needed sooner rather than later
• These will not replace BACnet and LonTalk
IT Architecture

oBIX (Ethernet / TCP/IP/XML / HTTP)

Network based controller

Room Controller
 LonTalk Controller
 LonTalk Controller

LonTalk Controller
 LonTalk Controller
 LonTalk Controller

Network based controller

Other XML based system

Controller

Client PC’s with Web Browser

Intranet

Network based controller

Room Controller
 LonTalk Controller
 LonTalk Controller

LonTalk Controller
 LonTalk Controller
 LonTalk Controller

LonTalk Controller
 LonTalk Controller
 LonTalk Controller

Other Protocols

Controller

Enterprise Application Servers

XML based system

oBIX (Ethernet / TCP/IP/XML / HTTP)

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Enterprise Application Servers
Building Automation
A Changing Market

• Integration and Convergence
  • System Integration
  • Enterprise Integration
  • Open Systems
## Customer Requirements

- Reliable
- Operationally Efficient
- Cost Effective
- Interoperable
- Energy Efficient
- Web Accessibility
- Support Legacy Systems
- Open System
- Occupancy Comfort

System must meet Customer’s Business need!
Customer Requirements

System must satisfy Customer’s Business need.

Make Facilities Comfortable, safe and efficient!!

- Reliable
- Operationally Efficient
- Cost Effective
- Interoperable
- Energy Efficient
- Web Accessibility
- Support Legacy Systems
- Open System
- Occupancy Comfort

Yorkland Controls Ltd. www.yorkland.net
Engineered to meet Business needs

- Open & Interoperable: LONMARK®, LONWORKS®, BACnet™, TCP/IP are standard with MODbus, DDE and others fully supported options.
- Web Powered: Designed from the ground up as a Java based web enabled product family.
- Full Range of Control Solutions: The industry’s most complete line of fully programmable controllers to maximize comfort and energy efficiency.
- Proven Technology: Manufactured for excellence in Performance and Quality
- Control and Monitoring: Complete, efficient and simple day-to-day access for system management and/or monitoring.
- Investment Protection: Utilize current “proprietary” system

- Interoperable
- Open System
- Web Accessibility
- Energy Efficient
- Occupancy Comfort
- Reliable
- Operationally Efficient
- Cost Effective
- Support Legacy Systems
Architecture

Ethernet LAN

Hub

Workstation

Router

BACnet Systems

LonMark Devices

Internet

Pager or PDA

Single Site

Single JACE

Yorkland Controls Ltd. www.yorkland.net
Architecture

Ethernet LAN

Router

Hub

Workstation

BACnet Systems

LonMark Devices

Single Site

Multiple

JACE
BACnet/Ethernet

M3 Operator Workstation

N30

N2 BUS

VAV

UNT

DX Display

DX Expansion Modules

DX-9100

N2 BUS

AHU

IFC

VMA

N2 BUS

N2 Products

Metasy n Integrator

N2 Products

N2 BUS

Lighting Controllers
Niagara Architecture

Internet

Router

Ethernet LAN

Hub

Workstation

JACE-NP

DDE Server

PLCs, CNCs

Robots, Weld Control

DH+, DeviceNet, Other

Proprietary Control System

Modbus Devices

Other Integrations
Architecture

Multiple Site

Internet

Router

Hub

Web Browser

Hub

Web Browser

Hub

Browser

Ethernet LAN

Pager or PDA
For years, building automation systems have been sold as “Energy Management” Systems…

Thus, disappointing engineers and end users with results that yielded less than what was promised.
Energy Management is the control/automation of energy consuming devices via some form of technology for the purpose of minimizing energy demand and consumption.

Many times customers would get the “control” of the devices, but never see a relative drop in energy demand and consumption.
Energy Conservation Measures

• Typical Measures are “built into” most manufacturer systems

• Need to implemented
Scheduling

• Nothing saves energy than turning equipment off. The trick is know what to turn off and when
  • Exhaust Fans
  • Lights
  • Seasonal Interlocks : Baseboard heaters

• Duty Cycling
  • Rotating the on/off time of equipment to avoid “Demand” Energy Charges
    • Electric Heat
Setback / Setup

- Heating and Cooling set points are adjusted (lower for heating-higher for cooling) during un-occupied periods
- Savings result in:
  - FAN electrical savings (not continuous as in occupied periods)
  - Controlling at lower/higher temperature setpoints
  - Savings depend on the amount of temperature setback/setup
  - Typical savings 5% to 15%
Optimum Start – Stop (OSS)

- Attempts to “OPTIMIZE” the equipment start time – determines the best time for morning warm up
- Replaces "worst case" time clock settings, an optimum start/stop ECM will calculate the minimum equipment runtime daily based on current conditions.
- Fan and heating savings from reducing the equipment operation beyond a normal night setback.
- Controls adapts and calculates Optimum start time for heating or cooling
- Difficult to calculate but can expect addition savings 5% to 10%
Typical OSS Curve

- Control Range (Comfort Zone)
- Zone Air Setpoint (SP)
- Delta Time
- Optimal Start Curve
- Zone Air Temperature (ZT)
- Purge Time
- Maximum Startup Time
- Delta Temp
- Start Plan (OSnOUT=1, OSnPRE=1, TSnOUT=0)
- Occupancy (TSnOUT=1, OSnPRE=0, OSnOUT=1)
Typical Parameters

• Space Setpoint (Comfort)
• Setback / Setup
• Time Schedule
• Minimum Heat/Cool Time
• Maximum Startup Time – when control can begin calculating optimum equipment start
• Maximum Shutdown Time – when control can begin calculating early shutdown
• Outdoor Air Design Temp – Coldest or Hottest OA-T that equipment is designed to handle
Economizer and Demand Control Ventilation

- Economizer utilizes outside air (when conditions are favourable) as FREE COOLING by modulating dampers as the “First Stage of Cooling” instead of mechanical cooling.
- When outdoor air is above a dry bulb temperature or enthalpy, Economizer is disabled.
- Demand Control Ventilation (DCV) utilizes Co2 sensors to gauge occupancy and control ventilation rate.
- Significant savings result by reducing the amount of outside air required during occupied periods.
DCV Savings Example

- School class room designed for 30 spaces
  - Ventilation: 20 CFM/student = 600 CFM
    (Minimum Position usually set for maximum occupancy)
- 15 students enroll
  - Actual ventilation required = 15 x 20 = 300 CFM
- Savings result by bringing only the required amount of outside air
- Minimum position can be adjusted lower to meet new minimum (account for non-human ventilation requirements)
Supply Air Reset

- In Constant Volume systems, the Discharge Air temperature maybe set to handle worst case space temperatures
- Discharge air is RESET based on the worst case space temperatures or return air (average)
- Savings result be reducing the heating and cooling loads
- Reset Schedule Example:
  - $RA-T = 74 : SA-T = 55$
  - $RA-T = 71 : SA-T = 62$
- Savings: 5% to 15%
Boiler Reset

- As outdoor temperatures become colder, heat losses from a building increase, which requires the addition of more heat to prevent the indoor air temperature from also becoming colder. The reset control measures the outdoor temperature and as the outdoor temperature becomes colder, it balances the heat loss by making the heating supply water hotter.

- Outdoor reset keeps the supply water temperature as low as possible while still satisfying heating requirements. Overheating is prevented and heat losses from the distribution piping and the heat source are minimized.
Boiler Reset

- Hotwater supply temperatures are RESET based on outside air. Goal is to reduce the seasonal average temperature.
- Typical reset schedule
  - OA-T = 0 F  HWS-T = 190
  - OA-T = 65 F  HWS-T = 140
- Savings calculation are often derived from estimates
What to do when the engineering department becomes the complaint department.

I can't hear myself think.

To type with your mittens on.

Another day at the sweat shop.

Turn down the #@&! heat.

It's too quiet in here.

Another day working in the dark, literally.

I think I can see my breath.

I can still smell Wally's chili.

I don't think this air moved since 1957.

Our new task force on cubicle comfort has been very effective. They've eliminated any trace of it.

You could fly a kite in this breeze.
Buildings need to be an information source

- Energy
- Comfort / productivity
- Safety
- Asset tracking
- Required repairs
Summary of Human Performance Research (David P. Wyon, et al)

Group Performance with No Individual Control

Group Optimum Temperature

- Thinking
- Typing
- Skill
- Speed
- Mean
Convergence

• IT and BAS Systems
• BAS as an “Information Engine”

• Tim Horton’s
  • Energy consumed per coffee Cup served
System Optimization
“Continuous Commissioning”

• “Comprehensive and ongoing process to resolve operating problems, improve comfort, optimize energy use, and identify retrofits for existing commercial buildings....”
Optimization

- Facility performance data is gathered or “mined” continuously from a BAS using open protocol then downloaded to a database
- Process is enabled by IT
- Data is analyzed by “experts” or “expert software”
- Results:
  - Reduced Operating and Energy Costs
  - Increasing Equipment and Manpower efficiency
  - Cost avoidance
Optimization Example & Opportunities

- **Building Pressurization**
  - Maintain Positive Pressure in the building to:
    - Reduce heating costs & comfort complaints

- **Airhandler Control**
  - Monitor Valves for improved stability (PID Control Tuning)
    - Stabilized Central Heating and Cooling Plant (Boiler and Chiller)
    - Maintenance savings from reduced cycling
    - Improved comfort

- **Chiller Cycling**
  - Fluctuation in chilled water temperature can contribute to the instability of the valves and pumps
Optimization Example & Opportunities

• VAV Box Monitoring
  • Trending of the VAV boxes can show:
    • Correlation to Central Plant Supply temperatures and Main AHU discharge air temperatures
      – For examples boxes are open, zone reheat are closed, yet boiler is running.
    • Supply Air Pressure Reset Strategy
Optimization Example & Opportunities

• VAV Box Operation
  • Common issues:
    • Simultaneous Heating and Cooling
    • Incorrect minimum heating air flow set point
    • Incorrect minimum cooling flow set point
      – Reduce Complaints
      – Energy saving
      – Correct ventilation (IAQ)
      – Longer damper actuator life
Optimization Example & Opportunities

- Boiler/Chiller Temperature Sensor Placement
  - Heating system controls to the wrong point
- Supply Air Reset
  - Reset Discharge Air Temperature based on Zone or Return Air
Optimization Example & Opportunities

• Eliminate Exhaust Air Recirculation
  • Air exhausted for AHUs is warmer than outside air. Blending of exhaust and incoming air.
  • The “increased” outside air causes economizer, “free cooling” to be less effective and chiller plant is required.

• Optimized Start Stop Control
  • Variable On-Off Schedule
Optimization Example & Opportunities

- Night Purge
  - Use outside air to pre-cool a building
    - Fans are allowed to run, mechanical equipment is off.

- Morning Warm Up
  - Return Air is re-circulated into the building
    - Verify operation to limit mechanical cooling equipment run times

- Economizer Dampers Shut on Fan Off
  - Prevents warm air rising through dampers in the evening “chimney effect”
Optimization Example & Opportunities

• Over Ventilation
  • Limit excess air which requires energy to heat and cool
    • Add VFD
    • Interlock Equipment
    • CO2 Strategies

• Tune Cooling Tower Controls
  • Adjust controls to optimize condenser water supply temperatures and reduce fan cycling
  • Lower minimum condenser water temperature
  • Add VFD
Optimization Example & Opportunities

- **Relative Humidity Sensors**
  - Require frequent calibration to ensure accurate air conditions
  - Most sensors "drift high" (show higher humidity)
    - Minimizes cooling requirement for "de-humidification"

- **Use Enthalpy change-over rather than dry bulb to enable economizer**
Optimization Example & Opportunities

• Simultaneous Heating and Cooling by Make-up Air Unit
  • Low Outside Air is first heated at the heating coil to a temperature higher than setpoint.
  • Cooling equipment then cools to set point
Barriers to Optimization

- “Too good to be true”
- Lack of awareness of the benefits
- Perception that it is expensive with long paybacks
- Split benefits between owners and tenants
- Accounting practices that do not return savings to those who fund the services
- Lack of qualified providers
The Future in Now

- Accelerated Integration with Non HVAC systems
  - Applied to smaller facilities
- Machine to Machine data sharing (XML)
  - MS OUTLOOK as SCHEDULAR for HVAC EQUIPMENT
  - “Virtual” Thermostat
  - Internet Weather Services sharing data with BAS
Questions