BACnet and the Cloud

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Sierra Monitor Corporation

- Headquartered in Milpitas, California
- Industrial Internet of Things (IIoT) solutions for industrial and commercial facilities
- Provide IIoT Gateways and Device Cloud to 100’s of Solution Providers and 200+ Device Vendors (OEMs)
- Over 200,000 IIoT Gateways installed

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Agenda

• The Limitations of Traditional BMS
• Lessons from the Consumer IoT
• BACnet and the Cloud: The Facility Manager & IT Perspective
• BACnet and the Cloud: The OEM Perspective
Typical World of Industrial Devices

- Hierarchical architecture
- Devices / products / controllers connect locally to BMS/SCADA
- Central visibility / alarms / dispatch through BMS/SCADA
Some Limitations of BMS

• Adding new functions to BMS is complex

• Device information and insights are lost as data is filtered and consolidated to BMS

• Device vendors (OEMs) do not have visibility to their products and cannot be proactive
  – IT will not open up access to individual controllers (security concerns)
  – Even if access to BMS is available, only a subset of data is available

• And only 20% of facilities have a BMS
The Brave New Consumer IoT World

- Non-hierarchical architecture, smart and independent devices
- All have their own applications and cloud point-of-presence
- Independent of a “central management” system
Cloud-Based “Orchestration”

Controls lights, switches, and thermostats with compatible WeMo, Philips Hue, Samsung SmartThings, Wink, Insteon, Nest, and ecobee smart home devices

Sort of a “mini BMS” for your home!
Consumer World Ideas for the FM

If the FM has a BMS at the facility

- Create ONE consolidated Facility Cloud Point of Presence (PoP) for the facility
  - Central and secure access point for all your vendors (OEMS), so they can be proactive and collaborate with facility manager
  - Feeds data to enterprise’s IT/business applications
  - Enables new “orchestration” applications that supplement BMS

And if no BMS at facility (but BACnet devices), also consider

- Adding a cloud-based “mini BMS” for that facility
- Using the Facility Cloud Point of Presence to feed the new cloud-based BMS
Facility Cloud PoP: With BMS

NEW CONCEPT: Next Generation Cloud-Connected BACnet Explorer!!

Implement BACnet Discovery and Management Platform
• Auto-discover all devices
• Select points for monitoring and upload
• Virtualize the physical facility!

Integrator / OEM Provided BACnet Gateway
• LonWorks
• Modbus
• SNMP
• BACnet MS/TP
• Proprietary
• Etc.

BMS

BACnet/IP
Facility Cloud PoP: No BMS

NEW CONCEPT: Next Generation Cloud-Connected BACnet Explorer!!!

FM / integrator implements a Protocol X to BACnet Gateway

FM implements BACnet Discovery and Management Platform
- Auto-discover all devices
- Select points for monitoring and upload
- Virtualize the physical facility

LonWorks, Modbus, SNMP, BACnet MS/TP, Proprietary, Etc.

BACnet/IP

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**Register this FieldServer on FieldPoP™**

Register this FieldServer with the FieldPoP™ device cloud and begin to enjoy the benefits of the Industrial Internet of Things (IIoT).

**Why register the Field Server to FieldPoP?**

Visibility: Once the FieldServer is registered, the FieldServer will appear in the FieldPoP device cloud portal on a geospatial map and be available for remote configuration, diagnostics, and maintenance.

1. **Enter the address and get device location**
2. **Select a device location on map**
3. **After registration, log into the FieldPoP device cloud portal with your user credentials and validate that you have geospatial visibility and remote access to the registered FieldServer.**
Discovers and “Uploads” Facility

BACnet Configuration

Discover

Devices
- Discover All Devices

Networks
- Discover All Networks

Reliability: no-fault-detected
Relinquish-Default: 0
Status-Flags: [in-alarm: false; fault: false; overridden: false; out-of-service: false]
Units: percent-relative-humidity
Campus – with Facility Cloud

Each vendor can access their devices and data through the Facility cloud – and – Facility adds new applications

Secure transfer of device data to Facility cloud

BACnet Explorer discovers all devices

Vendor provided devices: boilers, chillers, etc.
## The IT / CIO’s “Cloud” World

<table>
<thead>
<tr>
<th>Business Applications</th>
<th>IoT Application Development Platforms</th>
</tr>
</thead>
<tbody>
<tr>
<td>salesforce</td>
<td>Microsoft Azure</td>
</tr>
<tr>
<td>ORACLE®</td>
<td>Google Cloud Platform</td>
</tr>
<tr>
<td>SAP HANA</td>
<td>Amazon Web Services™</td>
</tr>
<tr>
<td>servicemax</td>
<td>ThingWorx A PTC Business</td>
</tr>
</tbody>
</table>
**Where does a Facility Cloud fit?**

The Facility Cloud is the “blue collar cloud”

- Does “dirty” work of field device connection, and security
- Middleware and staging layer for device data

Provides secure device access

- To device vendors for visibility
- To routine business processes like ERP
- To new BMS / BEMS / Orchestration Applications … which can drive action through vendor-provided controls
Consumer World Ideas for the OEM

Instead of waiting for facility manager to build a cloud and give you access ....

Or waiting for facility’s BMS to provide data to you ....

Or not even knowing where your products are ......

• Do what all the consumer device makers do ...

• Implement your own Vendor/OEM Cloud Point of Presence (PoP)!
  – Secure way for to “access” own devices
  – Vendor can be proactive on support and insightful on operation
The entire “solution stack” is provided by the OEM
• Device cloud PoP
• The Gateway / Router / Local app (fog) platform
• Devices / Controllers

In addition to OEM Benefits, also provides benefits to facility manager
• Visibility to asset base
• Better support from vendors with good security

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OEM Cloud PoP: BACnet/IP Backbone

OEM “overlays” a BACnet Explorer into the network

NEW CONCEPT: Next Generation Cloud-Connected BACnet Explorer!!!

Implement BACnet Discovery and Management Platform
- Auto-discover all devices
- Select points for monitoring and upload (yours)

BACnet/IP
- LonWorks
- Modbus
- SNMP
- BACnet MS/TP
- Proprietary
- Etc.
Campus – Multiple OEM Clouds

Each vendor can access their devices and data through their own vendor cloud

Secure transfer of device data to vendor clouds

Vendor gateways connect their device to Internet

Vendor provided devices: boilers, chillers, etc.
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OEM Configures Data Points for Upload

Example: Boiler Vendor – Data points discovered and selected on the Gateway

Full set of data points on boiler

<table>
<thead>
<tr>
<th>Points List - Profile</th>
<th>Data Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>PumpA - On/Off</td>
<td>CH STATUS</td>
</tr>
<tr>
<td>PumpB - On/Off</td>
<td>CH SETPOINT SOURCE</td>
</tr>
<tr>
<td>PumpC - On/Off</td>
<td>CH HEAT DEMAND</td>
</tr>
<tr>
<td>Blower_Mtr - On/Off</td>
<td>CH BURNER DEMAND</td>
</tr>
<tr>
<td>Cat Ignition - On/Off</td>
<td>CH REQUESTED RATE</td>
</tr>
<tr>
<td>Hot-Marinier_Vale - On/Off</td>
<td>CH FROST HEAT DEMAND</td>
</tr>
<tr>
<td>Main_Valve - On/Off</td>
<td>CH FROST BURNER DEMAND</td>
</tr>
<tr>
<td>Alarm - On/Off</td>
<td>DHW STATUS</td>
</tr>
<tr>
<td>Interlock - On/Off</td>
<td>DHW BURNER DEMAND</td>
</tr>
<tr>
<td>Low_Fire_Switch - On/Off</td>
<td>DHW REQUESTED RATE</td>
</tr>
<tr>
<td>High_Fire_Switch - On/Off</td>
<td>DHW PUMP STATUS</td>
</tr>
<tr>
<td>Start_Demand - On/Off</td>
<td>DHW PUMP STATUS</td>
</tr>
<tr>
<td>TimeOfDay - On/Off</td>
<td>SYSTEM PUMP STATUS</td>
</tr>
<tr>
<td>Safety_Relay - On/Off</td>
<td>BOILER PUMP STATUS</td>
</tr>
<tr>
<td>E Ag Switch - On/Off</td>
<td>AUXILIARY PUMP STATUS</td>
</tr>
<tr>
<td>Low_Water - On/Off</td>
<td>AUXILIARY PUMP STATUS</td>
</tr>
<tr>
<td>Aux_Low_Water - On/Off</td>
<td>BURNER ENABLE</td>
</tr>
<tr>
<td>High_Limit - On/Off</td>
<td>LEAD/LAG SETPOINT DEG F</td>
</tr>
<tr>
<td>High Gas Press - On/Off</td>
<td>LEAD/LAG ENABLE</td>
</tr>
<tr>
<td>Low_Gas_Press - On/Off</td>
<td>CYCLE COUNT</td>
</tr>
<tr>
<td>Natural_Gas - On/Off</td>
<td>BURNER RUN_TIME</td>
</tr>
<tr>
<td>Propane_Gas - On/Off</td>
<td>BURNER BURNER ENABLE</td>
</tr>
<tr>
<td>DEMAND SOURCE</td>
<td>BOILER LEAD/LAG ENABLE</td>
</tr>
<tr>
<td>OUTLET WATER TEMP DEG F</td>
<td>BOILER CH SETPOINT DEG F</td>
</tr>
<tr>
<td>FAN SPEED</td>
<td>OUTLET WATER TEMP DEG C</td>
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<tr>
<td>FLAME SIGNAL</td>
<td>INLET WATER TEMP DEG C</td>
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<tr>
<td>INLET WATER TEMP DEG F</td>
<td>HW WATER TEMP DEG C</td>
</tr>
<tr>
<td>HW WATER TEMP DEG F</td>
<td>HEADER or DOT DEG C</td>
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<tr>
<td>HEADER or DOT DEG F</td>
<td>STACK TEMP DEG C</td>
</tr>
<tr>
<td>STACK TEMP DEG F</td>
<td>CH SETPOINT DEG F</td>
</tr>
<tr>
<td>CH SETPOINT DEG F</td>
<td>HW SETPOINT DEG C</td>
</tr>
<tr>
<td>HW SETPOINT DEG F</td>
<td>LEAD/LAG SETPOINT DEG C</td>
</tr>
<tr>
<td>ANALOG_INPUT</td>
<td>BOILER CH SETPOINT DEG C</td>
</tr>
<tr>
<td>BURN_CIL_STATUS</td>
<td>BOILER LEAD/LAG SETPOINT DEG C</td>
</tr>
<tr>
<td>BURN_CIL STATE</td>
<td>FIRING RATE PERCENT</td>
</tr>
<tr>
<td>LOCKOUT_CODE</td>
<td>HOLD CODE</td>
</tr>
</tbody>
</table>

System View

Data points Selected for Viewing by Local Application

Logged Points

Boiler Status 1
Boiler Status 2
Fan Speed
Flame Strength
Input Status 1
Input Status 2
Lockout History
Outdoor temp
Target Temperature
Boiler in Temperature
Boiler out Temperature
Elapsed Time

Logged Points

Boiler Status 1
Boiler Status 2
Fan Speed
Flame Strength
Input Status 1
Input Status 2
Lockout History
Outdoor temp
Target Temperature
Boiler in Temperature
Boiler out Temperature
Elapsed Time
• Vendor has complete visibility to their entire asset base of registered devices and customers on one comprehensive map
• You (facility manager) get access to your subset of these devices
Data from IIoT Gateway’s local data logging application is uploaded to the Device Cloud for handling.
• Remotely access the IIoT gateway / BACnet Explorer from the Device Cloud
• Based on a secure tunnel with authenticated end points, with no firewall dependencies
• Cloud-based notification through texting and email brings device information to the right people at the right time

• Typical notifications:
  - Device data (e.g. boiler temperature, humidity)
  - Status changes of the device, such as alarm notifications and online/offline times
  - Calibration and maintenance notices
Enabling Advanced Applications

Mobile “Installer” App

- Blended information
- Long-term history
- Workflows

Enterprise Applications

E.g. salesforce

Specialized Device Analytics

“Device Cloud”

The Power of REST APIs
To See Live Demos …

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To infinity and beyond...