Smart Buildings
Creating Intelligent Spaces

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Industry Innovation,
Enterprise Commercial Business, Microsoft

#Azure
#Buildings
#ConnectedFieldService
#DigitalTransformation
#IntelligentCloud

#IntelligentEdge
#IoT
#MicrosoftDigital
#SmartBuildings
#SmartCities
Why are we having this conversation?
Whom are we trying to help?

Building owners, occupants

Operators
Where are we having an impact?

- Facilities Management
- Space utilization
- Health and wellness
- Travel and transportation
- Safety
- Workplace experience
Facilities management

Use cases

Facilities management
Space utilization
Health and wellness
Travel and transportation
Safety
Workplace experience
Learnings

Operating expense reduction
Sustainability/energy conservation
Tenant experience improvement

MS Puget Sound
550,000+ data points polled
160M+ sensor readings/day
7,000 active issues
Space utilization

Use cases
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Reduction in square footage leased/owned
Space configuration
Health and wellness

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Wellness scenarios for workplace
Travel and transportation

Use cases
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Transportation and parking optimization
- Building access
- Visitor registration

MS Puget Sound
- 94 buses, 213 shuttles
- 7,000 daily shuttle passengers
- 103 Lobby Desks
- 522k guests checked in
Safety

Use cases
Facilities management
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Jobsite accident reduction
Safety violation identification
Emergency response

Industry statistics
$58B cost to businesses from workplace injuries
5K workplace deaths due to accidents
Workplace experience

Use cases
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Learnings

Tenant productivity improvement - room availability, comfort
Indoor navigation
Personalized experiences

MS Puget Sound
10,232 Rooms
55,000 tenants
<table>
<thead>
<tr>
<th>Level</th>
<th>Requests</th>
<th>Use cases</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Top (Level 3)</strong></td>
<td>Ambient intelligence</td>
<td>Workplace experience</td>
</tr>
<tr>
<td>People Centric</td>
<td>Identify people</td>
<td>Space utilization</td>
</tr>
<tr>
<td></td>
<td>Know my preferences</td>
<td>Transportation</td>
</tr>
<tr>
<td></td>
<td>Know my schedule</td>
<td>Health &amp; wellness</td>
</tr>
<tr>
<td></td>
<td>Adapt to me</td>
<td>Facilities management</td>
</tr>
<tr>
<td><strong>Middle (Level 2)</strong></td>
<td>Moving objects</td>
<td></td>
</tr>
<tr>
<td>Facilities Centric</td>
<td>Count people</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Know activity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adjust activity</td>
<td></td>
</tr>
<tr>
<td><strong>Base (Level 1)</strong></td>
<td>Fixed assets</td>
<td></td>
</tr>
<tr>
<td>Facilities Centric</td>
<td>Measure performance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Optimize performance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reduce costs</td>
<td></td>
</tr>
</tbody>
</table>

- **Use cases**:
  - Facilities management
  - Workplace experience
  - Space utilization
  - Transportation
  - Health & wellness
The deck which we’re dealt
What can I do with my existing building(s)?
The built environment – diversity, volume

Buildings
- 125 buildings
- 10,232 rooms

Fixtures & equipment
- 30,679 AHU
- 20,357 FCU
- 4,287 chillers
- 3,324 generators

Sensors & actuators
- 456,000 BACnet objects

Field controllers
- 17,700 BACnet devices

IP enabled global controllers
- 35 Foreign devices
- 125 BBMDs
All monitored and managed independently
The costly trap of multiple non-communicating systems
<table>
<thead>
<tr>
<th>Installation Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Plant Multiple VFD Installations</td>
<td>Install VFDs on cooling tower fans, condenser water pumps; adjust control logic to reduce speed based on load conditions. This item also requires the completion of items #9, #10 and #12.</td>
</tr>
<tr>
<td>Chiller VFD Installation</td>
<td>Install VFD on lead chillers for N5 and N6, and reprogram the central plant to perform condenser water relief.</td>
</tr>
<tr>
<td>Heating Plant VFD Installation</td>
<td>Install VFDs on heating water pumps, and use differential pressure to control them.</td>
</tr>
<tr>
<td>Production AHU VFD Installation</td>
<td>Install VFDs on all production AHUs and control them based on load in the space.</td>
</tr>
<tr>
<td>Multiple Equipment VFD Installations</td>
<td>Install VFDs on PAH, EF, and AHU equipment of sufficient size, and reprogram system to control based on cooling or heating output requirements.</td>
</tr>
</tbody>
</table>
How we are using technology to have an impact

Data acquisition
Ingestion & enrichment of data

Analytics
Use case specific strategies
- Facilities management
- Occupancy/space utilization
- Transportation/journey management
- Workplace safety
- Workplace experience

Presentation
Universal and domain-specific
- Azure Maps
- ICONICS GraphWorX
- Power BI
- Time Series Insights (TSI)

Remediation
Field service strategy
Data acquisition
Strategy
Network and data consolidation, normalization

Reduces operating costs
Increases security
Shortens time to test and deploy new applications
A common starting point – network anarchy
Network consolidation
Better network consolidation

IoT Hub

Azure
On-premises
Testing, deploying new solutions
Analytics
Strategy
Use Azure IoT Hub as source of data
Require interoperability

Increases the number of solutions you can run
Supports cross-domain queries for additional value
Reduces operating costs
Application isolationism

The costly trap of multiple non-communicating systems

- Power meter data
- Operations data
- Occupancy data
- Asset data
- Lighting data
- Utilization data
Application interoperability
Supports analyses using data and insights from disparate applications

- Power meter data
- Operations data
- Occupancy data
- Asset data
- Lighting data
- Utilization data
Infrastructure interoperability
Supports using the right tool for the job
IT dominance

OT expertise needed determine how useful insights will be

- Larger number of faults – maybe more informative, but maybe too many to prioritize, too many false positives, too much noise
- Smaller number of faults – easier to prioritize, maybe missing important data
- Regardless, fault rules only as good as the engineering knowledge used to create them. Today: (Trying to change)

400-550 faults/day based upon fault rule set

150-175 faults/day based upon different fault rule set
Presentation
Strategy
Use best of breed graphics platforms
Integrate data from different sources
Supports better UX for different audiences
Real estate disputes
Interoperability increases options
Use all the form factors that work for your audience

Many options can use the same data sources
Remediation

Field service strategy
Strategy
Use Dynamics 365 Field Service
Integrate with insights from analytics solutions

Fixing problems before they become critical
Better scheduling of workforce
Fixing problems with the first visit
Uncoupled workforce management
System integration can improve efficiency

Dynamics Field Service
Azure IoT Hub
Azure Stream Analytics
Azure Service Bus
Azure Functions

IaaS/PaaS/SaaS
3rd party analytics

Analytics – Dynamics Connector

Dynamics Field Service
Demo
What is the Microsoft Smart Building vision?

Innovation is a journey without an end,

Smart Spaces video with subtitles
Facilities management

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Energy consumption - Microsoft Advanta A

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>1st year</th>
<th>2nd year</th>
<th>3rd year</th>
<th>4th year</th>
<th>5th year</th>
</tr>
</thead>
<tbody>
<tr>
<td># bldgs with baseline + 5 years of data</td>
<td>59</td>
<td>59</td>
<td>59</td>
<td>59</td>
<td>59</td>
<td>59</td>
</tr>
<tr>
<td>Square footage metered</td>
<td>11.7M</td>
<td>11.7M</td>
<td>11.7M</td>
<td>11.7M</td>
<td>11.7M</td>
<td>11.7M</td>
</tr>
<tr>
<td>kWh consumed</td>
<td>505.0M</td>
<td>484.9M</td>
<td>449.7M</td>
<td>414.0M</td>
<td>383.4M</td>
<td>350.7M</td>
</tr>
<tr>
<td>Savings (kWh)</td>
<td>20.1M</td>
<td>55.3M</td>
<td>91.1M</td>
<td>121.6M</td>
<td>154.3M</td>
<td>154.3M</td>
</tr>
<tr>
<td>Savings (%)</td>
<td>4.0%</td>
<td>11.0%</td>
<td>18.0%</td>
<td>24.1%</td>
<td>30.6%</td>
<td>30.6%</td>
</tr>
</tbody>
</table>

Buildings onboarded 5+ years ago
30% reduction in kWh consumption
Space utilization

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Space utilization

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MS Puget Sound
46% reduction in meeting travel time
13% decrease in meeting length
## Health and wellness

### Use cases

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### Dashboard | Solutions
---|---
**Building Insights** | Building Wellness Index
| Air Quality Insights
| Social distancing compliance
| Lobby & Elevator People Counting (CV)
| Facemask detection / compliance
| EBT insights
| Building occupancy & density
| Bathroom occupancy
| Cleaner Tracking

**Tenant Insights** | Air quality insights
| Social distancing compliance
| Occupancy & density insights
| Restroom cleaning insights
| Community Pulse

Sample Infosys wellness solutions
Travel and transportation

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MS Puget Sound
50% reduction in booking time
5 mins average wait time
11 mins average journey duration
Safety

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Monitoring pedestrian traffic in the Giralda bell tower, Seville
Safety

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Industry statistics
% reduction in accidents – tbd
% reduction in lost time – tbd

PCL Construction https://www.youtube.com/watch?v=InUMBj4Ps3U