How to use IoT Platforms for the Smart Buildings and Data Centers

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What does IoT look like?
What does IoT look like?
It's not the device, it's the pattern

Sensors
End Device

Actuators
End Device

Others
End Device

IoT Gateway

Data

IoT Gateway

Information

Added Context

Cloud Solutions

Added Business Objectives

Actionable Decisions

IoT Platform

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What does IoT look like?

Value comes from ...

- Understanding the data
- Optimizing the whole, not the parts
- Delegation of decision making to the edge
Benefits of IoT

Improving Products/Services

• Understand Use Cases
• Improve Capabilities, Reliability
• Optimize Outcome Costs
Benefits of IoT

Optimizing Operations

- Optimize Resource Usage
- Predict Failures
Benefits of IoT
Support Experience

• Understand Issues better
• Faster Response
Benefits of IoT
Discovering new Markets

- Understand untapped needs
- Assess business opportunity
Pre-IoT Automation
The Landscape
Pre-IoT Automation

The Landscape

- Only specialists know how to operate
- Brittle Operations
- Tightly Coupled
- Security was not a concern
Pre-IoT Automation
The Focus

- Keep the device running
- Avoid disasters
- Keep know-how
Evolution of IoT
Standard Connectivity

- Hardware
  - Peripheral Programming
  - Network Programming
  - Web API’s

- Software
  - Effort:
    - Hardware: 10 x
    - Network Programming: 3 x
    - Web API’s: 1 x

- Time
Evolution of IoT
Standardized Components

Generation 1
Special Purpose Device

- Wi-Fi Add-on
- Ethernet Add-ons
- Displays
- Custom Boards
- Input
- Console Ports

Generation 2
PC Add-ons

- Custom Add-on Boards
- PC

Generation 3
IoT Devices

- Micro Sensors
- IoT Gateways
Evolution of IoT
Simultaneous Improvements

Special Purpose Hardware XX → Special Purpose Hardware XY

Component1 V1 → Component1 V2
Part V1 → Part V2 → Part V3 → Part V4
Sensor Feature x → Sensor Feature x,y → Sensor Feature x,y,z
Evolution of IoT Prototyping
Evolution of IoT

Lots of Sensors

- Proximity Sensor
- Motion/Accelerometer
- Ambient Light Sensor
- Moisture Sensors
- Gyroscope
- Compass
- Barometer
- Touch ID
- Face ID
- Thermal Sensors
Evolution of IoT

Lots of Sensors

- Analog->Digital output
- Less power usage
- Auto Calibration
- More sensitivity
- Quicker Response

Huge Data from Physical World!
Evolution of IoT

Big Data

- Data Velocity
- Data Variety
- Data Volume
Evolution of IoT
Predictive Power

Data → Models → Predictions → Validation

- Analytical Models
- Machine Learning

Better Decision Making
Feedback
Evolution of IoT

Digital Twins

- Represents real thing
- Feeds from real-world data
- System Engineering Model
Evolution of IoT Data Analytics

- Better Analysis Tools
- Machine Learning
- Predictions
Example IoT Scenarios

Scenario 1 – Crypto Currency Rig monitoring

- Workload: GPU
- Work Package: GPU
- USB 3.0
- Output: GPU
- Cloud Services
- Temperature
- Power Usage
- Fan Speed
- Hash Rate
- Job Management
- Data Analytics
Example IoT Scenarios

Scenario 1 – Crypto Currency Rig monitoring

- Reality, not fiction
- Scalability
- Predicting Failures
- Optimized Performance
- Cloud Monitoring Platform
Example IoT Scenarios

Scenario 2 - Smart Buildings

- Lights
- Occupancy Sensors
- Smoke Detectors
- Temperature Sensors
- IP Phones

- Energy Usage
- Ground Currents

- Air Flow
- Air Quality

- Environmental Security
- PIRs
- Door Locks
- Vibration Sensors

HVAC
Telecom
Room
Metrics

Power
Plant

Computer
Room
Example IoT Scenarios
Scenario 2 - Smart Buildings

• Benefits
  – Occupancy Metrics
  – Room level comfort monitoring
  – Cross discipline analytics

• Risks
  – Cybersecurity
Example IoT Scenarios
Scenario 3 - Computer Room Air Conditioning Unit
Example IoT Scenarios
Scenario 3 - Computer Room Air Conditioning Unit

• Benefits
  – Operational Analytics
  – Predictive Maintenance
  – Capacity Planning
IoT Security
Consumer vs Business Approach

- Consumer
  - Functionality

- Business
  - Manageability
  - Return on Investment
  - Reliability
  - Security

Reliance Trap!
IoT Security
Device/IoT Gateway Security

- **Software**
  - Strong Authentication
  - Network encryption

- **Firmware**
  - Secure boot
  - Secure Updates

- **Hardware**
  - Voltage/Temperature monitoring
  - Tamper resistance
IoT Design and Selection Guidelines
Device/IoT Gateway Security

• Device management.
  – Secure Data storage on network outages
  – Remote firmware and application software updates
  – Remote configuration

• Easy Integration
  – Easy to consume API’s
  – Standard application protocols

Diagram:
- Gateway
- Software Updates
- Updated Configuration
- Consumable Data
- Operational Data
IoT Design and Selection Guidelines

Device/Sensor Selection

- Recommended native TCP/IP network connectivity
  - Bluetooth (min BLE Version 4.1) in short range
  - PoE ethernet for larger devices/longer distances
  - Device density is important for wireless
IoT Design and Selection Guidelines
Device/Sensor Selection

- Not recommended
  - Serial cabling: Stability AND Security is hard to maintain
  - Wi-Fi: High energy consumption
- Security should NOT be optional/add-on
IoT Design and Selection Guidelines

Gateway Selection

- Remote management platform
  - Remote firmware and application software updates
  - Remote configuration and KPI monitoring
IoT Design and Selection Guidelines

Gateway Selection

- Resistant to physical tampering.
- Firmware/OS end to end encryption
- Use TCP/IP; prefer PoE
IoT Design and selection guidelines

Gateway Selection

• Easy software development platforms
  – Linux or Windows
  – Phyton, or .NET development platforms
• No BacNET and Modbus, hard to secure
IoT Design and selection guidelines
Cloud Services Selection

• Central device management
  – API’s for easy development
  – Geo distributed
  – Resilient for failures
IoT Design and selection guidelines

Cloud Services Selection

• Machine learning
  – Use it when you need it
  – API’s for Machine learning
  – Ease of change
  – Analysis tools
IoT Design and selection guidelines

Cloud Services Selection

- Big data storage
  - Geo Replication
  - Cheap Storage
  - Data management tools
- Data Governance
Further Reading

• [Cyber Security in Data Centers](#), BICSI Fall 2017

• [Are you ready for IoT to change our buildings?](#), BICSI Winter 2018
Questions?