IoTfying your Applications

A quick look at the trends and applied use cases, pain points and recommendations

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Business Development Manager

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Agenda

• IoT Trends
• Use Cases
• Lessons Learned
• Recommendations
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The Emerge of IoT is at Peak of Inflated Expectations and has significant Momentum to boost towards Productivity

- 61% of organizations with IoT projects believe they have barely begun to scratch the surface of what IoT can do for their business.

- 73% of organizations are using data from IoT projects to improve their business already:
  - Improved product quality or performance
  - Improved decision-making
  - Lowered operational costs
  - Improved or new customer interactions
  - Reduced maintenance or downtime

Source: Gartner, Cisco, Bosch
Current Status of IT and OT Relationship

The IT <--> OT Gap

Operational Technology

Information Technology

- Product Development
- Planning
- Manufacturing
- Forecasting
- Inventory
- Service
Target Status Driven by IoT

1. Digital Twin
2. Artificial Intelligence
3. Machine Learning

and

3. Digital Thread
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## Use Cases

### Manufacturing
- Shop floor equipment monitoring
- Predictive Analytics for machine failures
- Integration with MES and ERP
- Real-time filtering and processing of events
- Proactive parts replacement
- Integration with CRM and Service Ticketing system

### Asset Tracking
- Tracking of assets in conference center and warehouses
- Track utilization, dispatch/returns
- Integration with ERP for orders & invoicing

### Inventory Monitoring
- Monitoring humidity, temperature of smart Freezers
- Monitoring load for inventory levels
- Integration with Mobile App, Inventory systems

### Automotive
- Automobile monitoring for predicting maintenance needs
- Usage based insurance
- Just in time parts ordering driven by IoT events
- Integrated billing, subscription & marketing support
- Machine Learning & AR to analyze performance deviations
## Use Cases

<table>
<thead>
<tr>
<th>Fleet Management</th>
<th>Facilities Management</th>
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<tbody>
<tr>
<td>Connected Fleet solutions</td>
<td>Next generation sensor-driven building automation</td>
</tr>
<tr>
<td>IOT to monitor fleet/cargo and reduce response time</td>
<td>Reduce the number of “truck rolls”</td>
</tr>
<tr>
<td>IOT and Big Data processing for Predictive maintenance</td>
<td>Integration with Service Management and ERP systems</td>
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<tr>
<td>IOT to deliver mobility as a service (city e-bikes and similar)</td>
<td>Predictive maintenance of building assets (HVAC)</td>
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<thead>
<tr>
<th>Smart Cities</th>
<th>Communications</th>
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<tbody>
<tr>
<td>Insight into KPIs like energy efficiency, indoor air quality, etc</td>
<td>Proximity sensing services</td>
</tr>
<tr>
<td>Lower public utility and transport costs</td>
<td>Enabling M2M collaboration</td>
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<tr>
<td>Smart traffic, parking</td>
<td>Physical and Environmental Protection of Telco sites</td>
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<tr>
<td>Faster time to resolution of incidents</td>
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<tr>
<td>High trust collection of video surveillance for criminal investigation</td>
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</table>
Use Cases

FSI
- Wearables – from contactless payment solutions to insurance premium/loyalty
- Mobile ATMs part of connected car story
- Fraud detection with Big Data
- Smart contracts with digital assets with help of Blockchain
- Beacons – secure entry to ATM lobbies during off hours, location based offers

Energy & Utilities
- Prescriptive maintenance
- Failure prediction and alert in the grid
- Energy conservation (smart lighting, thermostats, ...)
- Replacement of some expensive SCADA solutions

Key use case opportunities for International Trade:
- Maritime IoT Clouds for vessels, containers and related equipment for predictive maintenance, lower OpEx
- Dynamic product value assessment for new dimensions in trade financing
- Location based fund transactions with Smart Contracts
- IoT output data to track insured goods and enable real-time claim payments
- Pre-shipment financers are also using IoT to verify the state of warehoused goods used as collateral
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It is definitely worth exploring Opportunities with IoT to optimize organizational KPIs and realize Benefits

- **OEE**
  - 5 – 20%
- **Asset Availability**
  - 5 – 50%
- **Cost per Unit**
  - 5 – 10%
- **Labor Productivity**
  - 5 – 15%
- **Transportation Costs**
  - 5 – 10%
- **Cycle times**
  - 5 – 10%

*OEE: Overall Equipment Effectiveness*
However, success is not as easy as it seems

Only... of companies are successful with their IoT Initiatives.

- 26% of IT Executives think they were successful
  - Important factors:
    - Technologies
    - Organizational culture
    - Expertise
    - Vendors

- 35% of Business Executives think they were successful
  - Important factors:
    - Strategy
    - Business Cases
    - Processes
    - Milestones

Collaboration between IT and the Business

- IoT expertise: internal & external partnerships

- Technology focused culture

Source: Cisco Journey to IoT Value Survey, May 2017
Bottlenecks need to be identified and dealt with in advance for a successful outcome

**Predictable impediments typically encountered**

<table>
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<tr>
<th>EARLY STAGE</th>
<th>MIDDLE STAGE</th>
<th>LATE STAGE</th>
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<tbody>
<tr>
<td>Information challenges</td>
<td>People problems</td>
<td>Options issues</td>
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</tbody>
</table>

- Trouble distinguishing meaningful and irrelevant information
- Trouble interpreting conflicting information
- Trouble identifying correct architecture
- Competing priorities
- Different success criteria definitions
- Identifying correct skill set requirements
- Conflicting views on need for change
- Hidden concerns yet to be communicated
- Having too many solution options is overwhelming (cloud, on-premise) → referring back to early stage architectural decisions and forcing changes
- Late introduction of new solution options creating confusion
- Unclarity of implementation options
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The Future of IoT

- Digital Twin
- Artificial Intelligence, Machine Learning
- Digital Thread
Digital Twin

Visibility & Digital Interaction model
• Past, Current & Future view – metrics and device states
• Augmented Reality enabled

Single pane of glass – 360 degree view of assets
• KPIs
• Incidents

Business Context, Hierarchical, Relationships
• View the asset in the context of the business processes, and relate it to other assets

What if simulations
• Verify your business process by defining what-if-simulation scenarios
AI & ML

Prescriptive
- Recommendation on the best action

Optimality
- Optimization based on multiple simultaneous constraints

Demand Predictions
- Demand predictions based on multiple demand sensing signals

Business & Domain expertise
Applied AI
Application Development
Data Science

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Digital Thread

Seamless Exchange of Asset Information
- Design → Manufacturing → Logistics → Transportation → Service

Integrate Organization Silos
- IT and OT, Logistics and Finance, Production and Design

Transformative Business Models
- Product as a Service, Dynamic planning based on demand signals
To make your applications IoT ready, you need to connect them to OT and evaluate solutions to cover 4 Aspects

**Event Processing**
If temperature is greater than 100, create an event

**Business Metrics**
Calculate my OEE (Overall Equipment Efficiency) based on Availability, Performance and Quality

**Machine Learning**
Alert me when the vibration of an equipment is anomalous. Predict my OEE for next Tuesday

**Artificial Intelligence**
Example: Recommend an optimal course of action to deal with the predicted outage.
Define the Algorithms you are going to need

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<tr>
<th>Real Time</th>
<th>Batch</th>
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<tr>
<td>Anomaly Detection</td>
<td>Forecasting</td>
<td>Pattern and Trend Detection</td>
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<tr>
<td>Time Series Analytics</td>
<td>Clustering</td>
<td>Network Analysis</td>
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<tr>
<td>Data Processing</td>
<td>Classification</td>
<td>Optimization</td>
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<tr>
<td>Classification and Prediction Model Evaluation</td>
<td>Regression</td>
<td>Statistical Analysis</td>
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<td>Positioning Algorithms</td>
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<td>Recommender System</td>
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<td>Feature Engineering</td>
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<td>App Specific ML &amp; DL</td>
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Define your Metrics, Anomalies & Predictions

**Business Metrics**

- Cumulative key performance indicators (Metrics) for assets
- System Metrics appear on the dashboard by default
- Custom Metrics allow business users to track metrics relevant to business processes

**Anomalies**

- Anomalies detect deviations from normal asset behavior
- Point-in-time anomaly to look for deviations in a Metric value
- Pattern-based anomaly to look for telltale patterns in sensor data

**Predictions**

- Predictions help warn you of impending asset failure in advance
- Categorical Prediction help predict whether something will happen or not
- Predictions can be Anomalies intrinsically contribute to the predictions
- All data (sensor and contextual) split in training (80%) and testing (20%).
- Use training data for creating predictive models
Make sure IoT Applications apply smart data preparation techniques

**MY DATA IS NOT NORMALIZED**

- e.g. Convert 3 machine states (running, idle, stopped) to binary (is running, is idle, is stopped)

**MY DATA IS MISSING**

- e.g. Machine data lost due to connectivity issues
  - Perform missing value imputation

**MY DATA ARRIVES IRREGULARLY**

- e.g. Temp data arrives every 30 mins, but vibration arrives every 10 mins
  - Perform time frequency matching

*Perform 1HotEncoding*
Summary

• Establish IoT skill set (partners, architects, data scientists or other resources needed internally or externally) and work on ideas

• Cloud is a good option for rapid prototyping your ideas and identify good use cases

• Once use cases are defined, analyze your applications and their integration needs to OT (APIs, gateways, interaction with other technologies like Blockchain, Big Data, ...)

• Refine the architecture: Consider OOTB solutions, cloud solutions

• Always check security needs for all solution possibilities

• Define success criteria early before PoC or PoV stages, gather executive sponsorship as well as IT-Business partnership
Thank You