Agenda

1. Definition
2. Strategic approach & industry opportunity analysis
3. Architecture: conceptual, system, data
4. Role of AI
5. Summary
Microsoft and the Digital Twin.
DIGITAL TWIN ENABLES TRANSFORMATION

Engage customers
Empower employees
Optimize operations
Transform products
Virtual instance of a customer-unique asset

Physical asset operational in the field

- Operating parameters (pressure, temperature, ...)
- Consumables (quantity, flow, age ...)
- Environment (humidity, location, ...)

Virtual asset in digital space

- Engineering (as designed)
- Manufacturing (as built)
- Field service (as maintained)

Real-world, real-time data

© 2017 Microsoft Corporation. All Rights Reserved
Insights into a specific product or entire line

Physical Equipment

Product Model & Location by Customer

Customer A

Model A

Location 1

Model B

Location 2

Model C

Customer B

n

Telemetry

Digital Twin

Enterprise

As designed

Profile

Operational parameters
Location considerations

Interaction

Feature priority
Use model

Operation

Incidents or anomalies
Performance

Maintenance

Downtime
Characteristics

As built

As maintained

Lifecyle

Insights

Beneficiaries

Sales
Marketing
Design
Engineering
Quality
Support

Customers

Services

Performance Optimization

Efficiency

Uptime Management

Maintenance Planning

Anomaly Detection

Incident Resolution

© 2017 Microsoft Corporation. All Rights Reserved
Example workflow

1. **Identify device by physical attributes**
   - Scan; topology
   - Barcode
2. **Load the Digital Twin**
   - 3D visualization
   - Instantiate virtual asset
3. **Report performance**
   - Historical & real-time
   - Insights & predicted outcome
4. **Simulate new outcome**
   - New settings
   - Recommended parameters
5. **Take action**
   - Implement
   - Share, collaborate

© 2017 Microsoft Corporation. All Rights Reserved
Strategic approach and industry opportunity analysis.
Approach for a Digital Twin Strategy

**Purpose**
- Enterprise capability
- Customer facing service
- Product feature or capability

**Goal**
- Increase margin or revenue
- Decrease risk or exposure
- Accelerate innovation
- Improve quality, reliability or performance

**Readiness**
- Organizational change
- Equipment type and systems
- Business systems availability
- Data models and interoperability
- Compliance

**Solutions**
- People, process and practices
- Conceptual architecture
- Roadmap

Solution journey and roadmap

© 2017 Microsoft Corporation. All Rights Reserved
Industry traction

Market Segment
- Consumer
- Industrial

Industry Segment
- Industrial Machinery: 70%
- Consumer Electronics: 12%
- Marine: 6%
- Oil & Gas Equipment: 6%
- Aerospace & Defense: 6%

Target Business Benefit
- Mitigate Unplanned Downtime: 29%
- Improve Operational Performance: 17%
- Optimize Field Service: 16%
- Conserve Energy: 9%
- Overall Equipment Effectiveness: 5%
- Supply Chain Optimization: 24%

Process Integration
- Design (CAD)
- Simulation (CAE)
- Supply Chain (SCM)
- Manufacturing (CAM)
- Manufacturing (MES)
- Field Service (CRM)
Readiness index for Digital Twin

Case Study References

- Readiness
- Maintained
- Built
- Designed
- Mixed Reality Interactivity
- Design Visualization (3D, 2D)
- Graphical Display
- Interactivity
- Cognitive (Vision, Speech, ...)
- Predictions
- Diagnostics
- Alerts
- Analytics
- Reporting
- Historical Data
- Time Series Data
- Telemetry Data
- Device Connectivity (IoT)
## Key uses for Digital Twin

<table>
<thead>
<tr>
<th>Industries</th>
<th>Low value assets</th>
<th>High value assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discrete Manufacturing</td>
<td>Repair equipment and plan for its services</td>
<td>Increase manageability, flexibility and reliability, efficiency</td>
</tr>
<tr>
<td>Energy and Utilities</td>
<td>Predict equipment failure</td>
<td>Predictive, condition based asset maintenance</td>
</tr>
<tr>
<td>Healthcare</td>
<td>Increase operational efficiency</td>
<td></td>
</tr>
<tr>
<td>Defense and aerospace</td>
<td>Plan manufacturing processes</td>
<td>Develop new business models by providing insights into how products and services are used</td>
</tr>
<tr>
<td></td>
<td>Operate factories</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Perform enhanced product development</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Improve customer experience</td>
<td></td>
</tr>
</tbody>
</table>
High value Digital Twin characteristics

- Industrial or commercial equipment
- High complexity, configurability and supply chain variability
- Maintenance, repair and overhaul requirement
- Remote operation (not in-house)
- Mission critical: tied to business performance
Architecture: conceptual, system, data.
Digital Twin Solution Architecture

SMART CONNECTED PRODUCT
- Computing Platform, Sensors, Connectivity
- Connected services, data and capabilities
- Joinable with other devices

DIGITAL TWIN PLATFORM
- Customer unique
- Fleet aware
- Tailored services
- Real-time
- Engineering, simulation & visualization platform
- Cognitive services & business intelligence
- Enterprise intelligence & system integration

DIGITAL TWIN SERVICES
- Cloud connected
- Tailored services
- Real-time
- Design and innovation insights, actions
- Integrated customer support and field service
- Manufacturing, supply chain and quality performance

Digital thread
Digital Twin System Architecture

Device Connectivity
- IP capable devices
- Existing IoT devices
- Resource constrained devices

Data Processing, Compute, Analytics and Management
- Stream Processing and Analytics
- Device Provisioning and Management
- Application Business Logic
- Vision, Speech, Language & Knowledge
- Simulation & Visualization Compute

Business Connectivity, Presentation & Interaction
- Solution UX
- Business Integration Connectors and Gateway(s)

© 2017 Microsoft Corporation. All Rights Reserved
**PLCS and the Digital Twin**

**Product Life Cycle Support (PLCS) ISO 10303-239**
- Structured data for data analytics
- Information as a service
- Cross enterprise interoperability
- Information-centric, agnostic

**When combined with device data:**
- An explicit representation of the “Thing”
- Observations on the “Things”
  - Location, activity, states, properties,
- Known configuration status of the “Thing”
- Histories

---

© 2017 Microsoft Corporation. All Rights Reserved
Role of Artificial Intelligence.
The role of AI: unique recommendations & actions

1. Unique (condition based) recommendations
2. Autonomous task execution, self healing or preservation
3. Learning and behaviors; task modification
4. Human interaction; question/answer/action (speech, text)
5. Vision; face recognition & emotion
Summary
Unlock benefits across the entire business

- Provide engineers unprecedented insight
- Optimize manufacturing floor processes
- Improve supplier accountability and product quality
- Equip sales and marketing teams with advanced insights
- Optimize efficiency, availability and service
Microsoft can help develop your Digital Twin strategy, business model and solution

Microsoft offerings for the Digital Twin

**Software and hardware capabilities**

- Azure
- Azure IoT Suite
- Azure Machine Learning
- High Performance Computing
- HoloLens
- Cortana Intelligent Suite
- Azure Blockchain
- Trusted Cloud

**Preconfigured solutions**

- Remote Monitoring
- Predictive Maintenance
- Connected Field Service
- Connected Factory

Most comprehensive portfolio  Open platform  Industry-leading security  Extensive IoT partner ecosystem  Scalable cloud solutions
Simon Floyd @floydinovation

HOME PAGE

WHITEPAPER

BLOG
• http://aka.ms/mfgblog