Smart Factory
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Executive Overview

Key trends in industry and use case introduction
The Internet of Things (LOT) Landscape

- **24BN** Connected "things" by 2020 (Gartner 2017)
- **27%** IoT market will grow CAGR in the next 5 years (Markets & Markets 2017)
- **62%** IoT spans industries representing 62% of GDP among G20 nations (Oxford Economics 2014)
- **82%** of companies say they are unable to identify all of the devices connected to their network (ForeScout 2017)
- **94%** of businesses will be using IoT by the end of 2021 (Microsoft 2019)
- **$440+BN** will be spent by consumers and businesses on IoT in 2020
- **$570BN** Revenue that managed services for IoT devices will earn in 2020

### MARKET
Fast growing global IoT market – customers still in discovery phase

### GROWTH
IoT is becoming a major driver of economic value

### CLIENTS
Strong need for consulting guidance when implementing IoT

- **93%** of companies believe that digital technologies will change their business models disruptively within the next 12 months
- **15%** of companies believe that they have the right resources & know-how for the implementation

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Why Should You Care About “Smart Manufacturing?”

**CAPABILITIES**

- Increased process efficiency and output through **data/insight driven process optimization and visibility**
- Reduced downtime and increased asset utilization through **real-time monitoring of assets and predictive maintenance analytics**
- Increased agility of supply chain planning processes by providing **real time visibility of equipment status and disruptive events** in manufacturing
- Increased accuracy and reliability of production processes through **real-time process control and automation**
- Reduced time to market through **real-time scheduling of processes**
- Improve worker safety by **automating dangerous processes and monitoring the environment** in real-time

**EXAMPLE BENEFITS**

**Cost Reduction**
- 10% reduction in maintenance costs
- 20% downtime reduction

**Enhanced Yield**
- 30% reduction in scrap

**Improved Productivity**
- 50% increase in quality testing productivity using cameras, sensors, and AI
- 90% improvement in defect detection
## The Typical Challenges to Address with New Smart Capabilities

<table>
<thead>
<tr>
<th>CHALLENGES</th>
<th>IMPACT</th>
<th>OPPORTUNITY</th>
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<tbody>
<tr>
<td>Outdated data ingestion tools</td>
<td>Unable to monitor and analyze large amounts of data in real-time</td>
<td><strong>OPPORTUNITY</strong> Adopt high-performing and scalable ingestion approach for leading analytics</td>
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<td>Rigid existing data structures</td>
<td>No flexibility to incorporate new changes in the overall environment</td>
<td>Stand up agile innovation approach that can rapidly translate data to value for continuous improvement</td>
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<td>Data complexity due to manufacturing machine turnover</td>
<td>Ingestion and assessment processes are <strong>difficult to navigate</strong>, causing siloes</td>
<td><strong>OPPORTUNITY</strong> Enhance data models to enable synchronous data flows between industrial infrastructure</td>
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<tr>
<td>Unanticipated machinery breakdowns leading to increased downtime</td>
<td>Production losses and delays leading to <strong>increased maintenance costs</strong></td>
<td><strong>OPPORTUNITY</strong> ML and advanced analytics to predict and forecast maintenance</td>
</tr>
<tr>
<td>Lack of visibility into causes of breakdowns and repair requests</td>
<td>Limited root cause analysis or predictive methods to foresee product failures earlier</td>
<td><strong>OPPORTUNITY</strong> Multi-variate predictive methods to optimize production processes in real time</td>
</tr>
<tr>
<td>Inefficient testing to assess inadequate production quality levels</td>
<td>Increased root cause detection time, which prevents optimal utilization</td>
<td><strong>OPPORTUNITY</strong> Targeted insight-based testing to optimize quality operations</td>
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The Case Study: Building The “Smartest” Factory On Planet Earth

THE SITUATION
- Gemstone and crystal manufacturer with global multi billion business
- Looking to reduce production waste by improving the quality and accuracy of its end-to-end monitoring capabilities
- Facing heterogenous machine park, out-of-date ingestion tools and complicated data structures unable to monitor and analyze large amounts of data in real-time

THE CHALLENGE
- A “Smart Manufacturing” initiative shall deliver a data driven end-to-end manufacturing process enabling the full value potential of IoT in manufacturing
- Technical requirements were immense – beyond any boundaries seen so far:

THE DATA (NON-EXHAUSTIVE)
- Order number
- Material
- Original Geometry
- Machine Measurements
- Cutting Program
- Geometry Corrections
- Machine Corrections

Knowledge Capture
- Root cause analysis automation
- Rule-based recommendation

Digital Twin – Data Driven Services
- Visibility of Machine Data
- New service levers for customers
- New revenues

R&D Feedback Loop
- Closed loop manufacturing
- Indirect R&D time reduction
- Simulation capability

Smart Crystal Factory

Predictive Quality
- Defect detection
- QA process efficiency
- Optimize polishing time
- Brand impact
- Traceability / Compliance

Reduce Yield Loss
- Waste reduction avoiding scrap
- Reduce handling fees for warranty claims

Predictive Maintenance
- Smart Maintenance
- Scheduling of Repair
- Avoid downtime
- Reduce maintenance Opex

Highlighted = Quick Win

OT Security

- Process Triggering
- Data Lake Integration
- Alerting
- OPC Integration – Open Platform Communications
- Real-time Data Ingestion

- Condition-based monitoring
- Real-time Data Analysis
- Data Visualization
- On-demand Self Diagnostics
- User-defined Reports / Views (Plan vs. Asset (worker))
Our IIoT Taxonomy: “Smart Manufacturing” Architecture

Industrial internet of things (IIOT) and the smart factory

**L0**
**Physical Production Process**
Process Manufacturing/Discreet Manufacturing

**L1**
**Basic Process Monitoring**
I/O Devices, Sensors

**L2**
**Monitoring & Control**
HMI, SCADA, PLC, DCS

**L3**
**Manufacturing & Business Planning**
MES, EMI, LIMS, SQC, SPC, Historian, EBR, DHR, PLM

**L4**
**Enterprise Applications**
ERP, CRM, SRM, PLM, Asset Management

**Monitor/Predict**
Mobile Solutions

**Manage**
Cloud Solutions

**Control**
The Approach: Accenture and Splunk Partnering for Next Level IoT Analytics

Operating Model
- Combined Splunk / Accenture Team in an engineering partnership approach
- Leveraging onshore / nearshore IoT factory
- Highly integrated team with client’s engineering, data science and IT departments

Methodology
- Agile delivery approach
- MVP approach to achieve tangible results early
- Joint engineering to stretch boundaries of product performance and scalability
Technical Implementation

Using Splunk for Industrial IoT and external tools
Primer: Introduction to Splunk for Industrial IoT

Splunk’s Premium Offering for Industrial IoT

Bundle consisting of:
- Splunk Enterprise
- Machine Learning Toolkit
- OPC TA: Emerging industry standard to onboard data from industrial equipment supported by new Splunk TA
- Industrial Asset Intelligence (IAI): Powerful self-service app integrating glass tables / monitor views with customized metrics workbench functionalities
Technical Building Blocks
3 Focus Areas for Technical Implementation

1. Data Ingestion and Predictive Model Refresh
   - Analyze machine data based on a real-time data ingestion of all production data and forwarding of data to corporate data lake
   - Build and update predictive models

2. Real Time Data Visualization and Scoring
   - Use Splunk as an intermediate layer for real-time dashboards
   - Trigger predictive model execution leveraging existing advanced analytics technologies and not MLTK

3. Self-Service Monitoring and Diagnostics
   - Analyze machine data based on a predefined asset hierarchy
   - Provide drag and drop access and functionalities for non-IT personnel
Data Ingestion and Predictive Model Refresh

Data Flow

1) Subscribe to OPC data using OPC TA
2) Enrich with information from PDA
3) Batch import of raw data into data lake
4) Raw data storage in Data Lake
5) Create and refresh predictive R models
Splunk OPC TA
Core Component for High Volume Data Ingestion

Key Achievements and Benefits
• Subscribe to huge amount of variables
• Achieve sampling intervals down to 8 ms
Data Ingestion and Predictive Model Refresh

Technical summary

Integrate with Existing Data Lake
Integrate with Existing Data Lake
Import OPC data using GUI or scripts
Export Data using Pipelines
Use External Languages (R or Python)
Real Time Data Visualization and Scoring

Data Flow

1a) Subscribe to OPC data using OPC TA
1b) Enrich with information from PDA
2) Visualize force data
3) Provide data for scoring via R Analytics App
4) Execute R model and return score
5) Visualize score on dashboard
Splunk Search and Reporting App

Provide real-time and historical insights

Key Achievements and Benefits

• Single dashboard showing near real-time sensor data alongside machine corrections

• Enrich with key prediction results like predictive polishing time and predicted quality
Real-time Data Visualization and Scoring

Technical summary

Create Comprehensive, Near Real-time Dashboards

Leverage External Advanced Analytics Frameworks

Combine Sensor Data with Scoring Results

Gain Access to Contextual Information Using Interactivity

Understand Impact of Historical Machine Settings
Self-service Monitoring and Diagnostics

Data Flow

1) Ingest of OPC metric data into Splunk metric store
2) Selected signals and messages available for self-service analytics
Key Achievements and Benefits

- Benchmark different assets of the same type
- Identify any discrepancies with regards to operational aspects
Self-service Monitoring and Diagnostics

Technical summary

Create a High Level Representation of Your Assets

Drill-down Multiple Levels to Narrow Down Issues

Compare Several Machines Against Each Other

Use Drag and Drop Interface for In-depth Time-series Analysis

Visually Correlate Information from Different Sources
Wrap-up

Summary and lessons learned
1. Leverage your existing Splunk investments in infrastructure and people

2. Leverage Splunk’s investments in emerging technologies like OPC UA and its open architecture

3. Avoid the need for complex IoT architectures and extend the use of Splunk to IoT Analytics

4. Achieve fast results and time to value using Splunk’s platform capabilities
Lessons Learned

Finding the Right Approach

1. Connect with your counterparts from manufacturing or electronics early

2. Understand the capabilities of your OPC infrastructure and closely monitor server capacity and performance

3. Properly plan, align and test your OPC configuration settings according to your Advanced Analytics requirements

4. Adjust your Splunk architecture and configuration if needed
Thank You!

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