The Industrial Internet of Things and How It is Driving New Ways to Gain Value

Ben Blanchette
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TAKING ADVANTAGE OF NEW TECHNOLOGIES:
The Industrial Internet of Things and How It is Driving New Ways to Gain Value
An evolution is happening in the way that major industrial companies are leveraging the Industrial Internet of Things (IIoT) to solve problems previously thought unsolvable.

The Future Has Arrived, It’s Just Not Evenly Distributed Yet

-William Gibson
Industrial Internet of Things
Solving problems that were thought unsolvable

Production Efficiency
Process Reliability
Supply Chain Optimization
Enterprise-wide Safety and Security
How Does IIoT Work?

Smart and Secure Collaboration

Advanced Analytics

Data Management and Onsite Control

Smart & Connected Assets and Devices

Connect process intelligence to business KPIs

Apply powerful analytics to detect and predict issues

Organize and visualize data in asset context

Capture real-time process and event data

Visualization Across Entire Enterprise

KPIs Mgmt
Supply Chain
Alarm Mgmt
Predictive Mtnce.

Collaboration Across Entire Ecosystem

Driven via instant notifications

Finance & Planning
OEMs
Operations Ldr
CEO

Enterprise

Plant Mgr
Maintenance Mgr
Operator
Central Engineering

System Integrators
Enterprise SMEs
Process Licensors
Consultants

Plant

Ecosystem

Operator

OEMs

Operations Ldr

System Integrators

Enterprise SMEs

Process Licensors

Consultants

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IloT by Honeywell Ecosystem

Honeywell Sentience enabling solutions from a broad ecosystem

Smart and Secure Collaboration

Advanced Analytics

Data Management and Onsite Control

Smart & Connected Assets and Devices

INspire™ (Joint Innovation Program)

Honeywell App Store

External App Developers

Knowledge Vendors
- EPCs
- OEMs
- SIs
- Process Licensors

Data Scientists

Honeywell HUB

Cloud Analytics

Honeywell Sentience™

Cloud Data Consolidation

Equipment Vendors
- e.g. Flow Serve, MHI, etc.

DCS Process Data

Ancillary System Data
- e.g. SAP, ERP, LIMS, Maximo, etc.

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IIoT by Honeywell Infrastructure

IIoT is driven by devices that are:

- Smarter
- More Connected
- More Controllable
- Easier to service

Key Structural Elements:

- Plant Gateway
- Unit Gateway
- WiFi or Cellular

Building off elements that you already have to enable IIoT
Addressing Core Industry Problems

Enterprise Intelligence Management

Production Efficiency
- Operator Effectiveness
- Reduce Off-Spec
- Optimize Process

Process Reliability
- Asset Surveillance
- Predictive Maintenance
- Expert Guidance

Supply Chain Optimization
- Planning & Scheduling
- Inventory and WIP Reduction
- Enterprise-Wide Real Time Supply Chain Execution

Gains not possible with conventional methods used today

Benefits from fully-deployed IIoT solution for typical 150k barrel / day refinery on the West Coast:

- Proven impact $14-$18M per site per year
- Typical savings of $25-$26M per year
- Cost savings $26-$28M per site per year

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### Production Efficiency

**Operator Effectiveness**

<table>
<thead>
<tr>
<th>Solution</th>
<th>Benefit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote Ops Support</td>
<td>0.25% Improved Yield</td>
<td>$4.8M Benefit</td>
</tr>
<tr>
<td>Competency building</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobility Tools</td>
<td></td>
<td></td>
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<tr>
<td>Alarm management</td>
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</tbody>
</table>

**Reduce Off - Spec**

<table>
<thead>
<tr>
<th>Solution</th>
<th>Benefit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>APC</td>
<td>0.5% Improved Yield</td>
<td>$4.8M Benefit</td>
</tr>
<tr>
<td>Blending mgmt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connected Performance Services</td>
<td></td>
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</tbody>
</table>

**Optimize Process**

<table>
<thead>
<tr>
<th>Solution</th>
<th>Benefit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connected Performance Services</td>
<td>Increased Profit (via smarter/ faster decision making)</td>
<td>$4-8M per site/yr</td>
</tr>
<tr>
<td>Collaboration with Process Experts &amp; Internal SMEs</td>
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</table>

### Process Reliability

**Predictive Maintenance**

<table>
<thead>
<tr>
<th>Solution</th>
<th>Benefit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>OEM equipment analytics</td>
<td>0.5% OEE</td>
<td>$10M Benefit</td>
</tr>
<tr>
<td>Connected Performance Services</td>
<td></td>
<td></td>
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<tr>
<td>Corrosion Prediction</td>
<td></td>
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</tbody>
</table>

**Asset Surveillance**

<table>
<thead>
<tr>
<th>Solution</th>
<th>Benefit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated Ops &amp; Maintenance Tools</td>
<td>0.5% OEE</td>
<td>$10M Benefit</td>
</tr>
<tr>
<td>Safe System Performance</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Expert Guidance**

<table>
<thead>
<tr>
<th>Solution</th>
<th>Benefit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connected Performance Services</td>
<td>Increased Profit (via smarter/ faster decision making)</td>
<td>$5-6M per site/yr</td>
</tr>
<tr>
<td>Collaboration with Process Experts &amp; Internal SMEs</td>
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### Supply Chain Optimization

**Planning & Scheduling**

<table>
<thead>
<tr>
<th>Solution</th>
<th>Benefit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing Execution System</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production Scheduling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operations Management</td>
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</tbody>
</table>

**Inventory & WIP Reduction**

<table>
<thead>
<tr>
<th>Solution</th>
<th>Benefit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warehouse/Storage Optimization</td>
<td>0.5% Inventory Optimization</td>
<td>$8M Benefit</td>
</tr>
<tr>
<td>Inventory Mgmt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production Accounting &amp; Reconciliation</td>
<td></td>
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**Enterprise-Wide Real Time Supply Chain Execution**

<table>
<thead>
<tr>
<th>Solution</th>
<th>Benefit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production &amp; Distribution Planner</td>
<td>Increased Profit (via smarter/ faster decision making)</td>
<td>$7-9M per site/yr</td>
</tr>
<tr>
<td>Supply Chain Visualization &amp; Control</td>
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**Key Area of Vertical Need**

- Increased Profit (via smarter/ faster decision making)

Benefits based on 150k BOE/day Refinery on the Gulf Coast

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IioT by Honeywell – Driving Value at Every Phase of Implementation

1. Disparate Information Systems across Customer Enterprise
   - Federate siloed information from "data swamps" within individual plants or functions
   - Leverage smart sensors, connected devices to be able to better monitor/ control real time

2. Enterprise Intelligence Management
   - Actions
   - Local Service Enablement
   - Insights & Recommendations
   - Collecting across systems
   - Visualize & Contextualize
   - Alarm Mgmt & Mobile Notification

3. Data Insight
   - Advanced Analytics via Machine Learning & Data Science
   - Iterative Optimization
   - Enables enterprise wide fact based decision support & KPI benchmarking

4. Expert Support
   - Insight
     - Advanced algorithms & models to uncover insights from real-time & historical data
     - Incremental improvements previously unseen thru conventional analysis
   - Insight Plus
     - External support beyond enterprise
     - Enabling collaboration/ secure data exchange with specialized experts (OEMs, Process Licensors, EPCs, etc.)
     - Facilitated by common platform
   - Richer insights, improved asset performance, faster service time

Connected Plant
- Cloud Intelligence
  - Secure data transfer & aggregation in cloud
  - Single version of truth cross enterprise/ functions
  - Tools to contextualize/ share data & deliver insights to stakeholders
  - Enables enterprise wide fact based decision support & KPI benchmarking

Ecosystem Domain Expertise
- Advanced Analytics
- Collaboration & Visualization
- KPI & Calculation engine
- Enterprise Historian
- Plant Gateway
- Asset Edge Connector
- Sensors

IioT Framework
Fact based decision support system & Collaboration Solution

Multi Site Enterprise with 7 Refinery/ Petrochem Assets

Opportunity

- Customers demand fact based decision based support system to enable real time decisions for improved business performance

Solution

1. Disparate Information Systems across Customer Enterprise

- Collecting across various systems
- Visualizing & Contextualizing
- Iterative Optimization

2. Enterprise Intelligence Management

- Intuition Executive
- Unformance
- Pulse/Target
- Suite of Solutions for KPI mgmt, analytics, notification & collaboration

3. Advanced Customer Analytics

- Honeywell Or Customer SME
- SECURED DATA
- Insights & Recommendations
- Known as KPI Mgmt.
- Uniformance
- Executable Analytics

4. Local Service Enablement

- Uniformance Pulse/Target
- Suite of Solutions for KPI mgmt, analytics, notification & collaboration

Value

- Customer is able to maximize Enterprise performance by:
  - Consistent, role based views of KPIs
  - Near real time performance monitoring
  - Integration and visibility across functions
  - Standardization of KPI definitions
  - Collaborative platform for review and monitoring by subject matter experts

- Reduced downtime & operational costs
- Improved staff time efficiency

$30 M improvements/yr
Production Efficiency Offering

Predictive Maintenance – Refining Use Case
150k BOE/day Refinery on the Gulf Coast

Opportunity:
- Customers need better insight on how to manage their equipment to maximize performance and lifespan
- Vendors need to benchmark equip data & tools performance & offer advisory services to their customers

Solution

1. Customer Site
   - High Speed Single Asset Model

2. Cloud based multi-asset Model “digital twin”
   - Customer SME
   - Iterative Optimization

3. Expert Support

4. Local Service Enablement
   - Insights & Recommendations

Value:
- **Customer** gets better performance and/or lifecycle out of their equipment
  - More production, less downtime
  - Lower maintenance cost, reduced capital cost for replacement and spares
- **Vendor** gets increased customer satisfaction | Subscription revenue for enhanced support services | Product improvement feedback

Optimizing operational efficiency:
- 0.5% OEE increase
- $10M savings/ site/ yr
Supply Chain Optimization Offering

Inventory & WIP Reduction – Chemicals Use Case
Mid-size Chemical Manufacturer

Opportunity

• Customers need solutions to better track/ensure the quality of their product up to the transfer of ownership
• Working capital reduction – properly enforce late fees
• Better understand customer usage rates & potentially anticipate needs

Solution

1. Valuable Supply Chain Assets Tracking
   - Fleet of +36 Trucks, worth +$400K per truck
   - +1,000 Iso Containers, worth +$5K per unit
   - +160 Railcars, worth $1M per car

2. Enterprise Historian
   - Secure data
   - Insights & Recommendations

3. Fleet Optimization
   - Advanced analytics
   - Increased data visibility & collaboration across all phases of supply chain

4. Optimized Logistic Scheduling

Value

• Compliance & Safety – accurately track assets & ensure proper transfer of ownership
• Fleet Optimization – analysis to confidently reduce unnecessary working capital
• Increased Sales/Customer Satisfaction – Better track & anticipate customers usage & predict needs

Optimizing enterprise operations:

$11M savings/site/yr
Opportunity

Customers demand continual improvements in process efficiency & reduction in off-spec production

Solution

1. Customer Site
2. Cloud based Process Unit Model “digital twin”
3. Expert Support
4. Local Service Enablement

Value

Customer is able to maximize plant performance by:
- Optimizing process yields
- Maximizing mix of feeds to convert
- Lowering energy utilization
- Extending useful catalyst lifetime
- Benchmarking site-to-site operations

Optimizing plant operations: $8M savings/site/year
Vendor-Specific IIoT Framework

Vendor “A” Analytics

Vendor “A” Data Lake

Vendor “A” Secure Data Transfer

Data Aggregation “A”

DAQ “A”

Process Equipment Vendor “A”

Analysis Dashboard Vendor “A”

Maintenance Management Platform

Vendor “A” Prevention/Resolution Workflow

Vendor Spend – High
Customer Spend – Low

Process Data DCS

Process Data PLC

Process Data Asynchronous Data
Multiple Vendor-Specific IIoT Frameworks

Vendor “A” Analytics
Prevention/Resolution Workflow

Vendor “B” Analytics
Prevention/Resolution Workflow

Vendor “C” Analytics
Prevention/Resolution Workflow

Data Aggregation “A”
Analysis Dashboard Vendor “A”
DAQ “A”
Maintenance Management Platform
Process Equipment Vendor “A”

Data Aggregation “B”
Analysis Dashboard Vendor “A”
DAQ “B”
Process Equipment Vendor “B”

Data Aggregation “C”
Analysis Dashboard Vendor “A”
DAQ “C”
Process Equipment Vendor “C”

Vendor “A” Data Lake

Vendor “B” Data Lake

Vendor “C” Data Lake

Vendor “A” Secure Data Transfer
Vendor “B” Secure Data Transfer
Vendor “C” Secure Data Transfer

Vendor(s) Spend – High
Customer Spend – High

Vendor “A”  Vendor “B”  Vendor “C”
Unified Honeywell IIoT Framework

- **Customer or Sentience Cloud**
  - **Vendor “A” Module**
    - Analytics & Prevention/Resolution Workflow
  - **Vendor “B” Module**
    - Analytics & Prevention/Resolution Workflow
  - **Vendor “C” Module**
    - Analytics & Prevention/Resolution Workflow

  - **Vendor Spend** – Low
  - **Customer Spend** – Medium

- **Analytics & Prevention/Resolution Workflow**
  - **Maintenance Management Platform**
    - **Data Aggregation Honeywell**
      - **Analysis Dashboard Honeywell**

- **Honeywell Secure Data Transfer**
  - **Process Data**
    - DCS
    - PLC
    - Asynchronous Data

- **Process Equipment**
  - **Vendor “A”**
  - **Vendor “B”**
  - **Vendor “C”**

- **Maintenance Management Platform**
  - **Common Data Lake**
  - **Single secure data transport path**
  - **Single dashboard (Experion HMI Integration)**
  - **Single data aggregation module shares common DCS/PLS/etc. data links**
  - **Common edge device (by Honeywell)**
  - **Simplified collaboration between site, remote SMEs, vendors**

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New EDGE devices developed to meet data collection, transport and analytics needs.

Edge Devices – Consolidate Asset + Process IIoT Data

Cloud Applications
- Asset Analytics
- Cloud Historian
- KPI Dashboard
- Visual Analysis
- Collaboration Environment
- Process Analytics

Secure Data Transport
- Plant Gateway

Advanced Analytics (New)
- Edge Gateway

Data Aggregation
- DCS Server
- Historian
- SCADA

Basic Analytics (New)
- Stranded Asset Data Acquisition Edge Device

Data Collection
- Edge Gateway
- DCS Controller
- PLC
- RTU

Full Capability Edge Devices
- Traditional Control System

System to System Data flow
- Valued Assets
- Process Data
- Ancillary/ Environmental Data

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Infrastructure – Asset Data Flow

High-Value Asset

Assets

Sensor

Analog Sensors & Digital Smart Transmitters

Multiplexed?

Edge

Asset Edge Connector

High-Speed Data Acquisition and Basic Analytics
#10s per project

Wired/Wireless Ethernet

Asset Edge Connector

High-Speed Data Acquisition and Basic Analytics
# 10s per project

Gateway

Unit Gateway

Data Aggregation & Analytics
# 10s per project

Plant Gateway

Secure data transport to Cloud
# 1 per project

Cellular

App Store for Ecosystem *
HON Apps

Sentience Cloud

Analytics Platform

Data Platform

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Scalable & Secure IIoT Data Flow - Integrate, Transport, and Analyze Data
Sentience IIoT Platform Framework Across All Honeywell Businesses

- **L6** Consumption
- **L5** Insight
- **L4** Cloud
- **L3** Gateway
- **L2** Edge
- **L1** Sensor

Differentiated

Common & Leveraged

Domain Specific
Sentience IIoT Platform Details

Insight Delivery
- Dashboards
- Reporting
- API

Predictive Science
- Predictive Modeling
- Correlation
- Clustering

Data Science
- Data Discovery
- Data Modeling
- Data Analysis

Decision Science
- Math
- Stat
- Optimization

Analytic Platform: Algorithm & Analytic Deployment and Delivery
- Batch
- Stream
- Math
- Stat
- Analytic Life Cycle Management
- Algorithm Implementation
- Algorithm Run Time

Asset Platform
- Connect
- Provision
- Manage
- Control
- Monitor

Data Platform
- Aggregate
- Integrate
- Prepare
- Store
- Query
- Protect

Data Management
- Data Lake
- Data Unification
- MDM

Cloud Infrastructure
- Compute
- Network
- Storage

Communications
- Web API
- Mobile API
- Cloud API
- Notification API

Edge Applications
- Edge Analytics
- Alarms
- Actions
- Backup / Recovery

Device
- Hardware
- Firmware

Security & Encryption
Why Honeywell?

Process & asset understanding not just asset

Security as top priority – proven track record of handling process data

Existing position at heart of facility/operations center - minimal disruption

Proven results not just at asset or plant, but at enterprise level

Proven Expertise – Global Reach

- 40 years of process data management
- 90 million connected products and solutions
- 10 thousand plants with installed Honeywell control systems