Internet of Things

Digital Business Transformation

Executive Briefing

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Industrial Internet Consortium
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Internet of Things: enabling Digital Business

The Internet of Things is the technological approach to transforming business into Digital Business. The digital definition and awareness of "things" enables greater value and service by exchanging information, awareness and knowledge with the machine, consumer, operator, manufacturer, and supplier. The Internet of Things (IoT) is not a futuristic technology trend: it’s a persistent business and IT opportunity, and has taken the center stage of IT and Business considerations.
## Boeing IoT Principles

<table>
<thead>
<tr>
<th><strong>Intelligent Experiences</strong></th>
<th>Simplify and enrich human experiences by connecting Boeing to the people and data that enables better customer outcomes.</th>
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<tbody>
<tr>
<td><strong>Smarter Machines</strong></td>
<td>Promote M2M communication and predictive analytics to create a new class of actors – the machine.</td>
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<tr>
<td><strong>Higher Confidence</strong></td>
<td>Safeguard privacy and security to protect our IP and preserve the confidence of our customers and regulators.</td>
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<tr>
<td><strong>Flexible Infrastructure</strong></td>
<td>Empower people to harness data-driven insights with location-agnostic infrastructure that is flexible and transparent.</td>
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<td><strong>Enhanced Harmony</strong></td>
<td>Harmonize technology innovations, business processes, and organizational culture for maximum scale and customer impact.</td>
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IoT Characteristics - Differentiation

Micro
- Cell/Zone Construct (intra/inter)
- Gateway Utilization (cell/zone access, intra-zone)
- API/Service Construct
- Taxonomies Unique (sensor)/Shared (data, network)
- Domain Unification (East/West)
- OT/IT Convergence
- Hierarchical Taxonomy Communications Model
- Real time awareness/insight/response

Macro
- Enhanced business value contribution
- Intra-enterprise/Inter-enterprise collaboration/partnerships
- Convergence of services (partner/competitor/customer model)
Defining the Internet of Things - Effect

The Internet of Things (IoT) transforms Boeing’s supply chains, factories, and operational environments. The proliferation of low-cost devices, abundant compute power, and ubiquitous connectivity (between Boeing’s equipment, supplies, products, devices, systems and services) is enabling new business models born of advanced analytics.
Boeing’s IoT Vision
Boeing’s IoT Vision
Industry Standards Adoption

Internet of Things Reference Model

1. Physical Devices & Controllers
2. Connectivity
3. Edge (Fog) Computing
4. Data Accumulation
5. Data Abstraction
6. Application
7. Collaboration & Processes

Levels

- Center
  - Identity Management (software)
  - Authentication/Authorization (software)
  - Secure Storage (hardware & software)
  - Tamper Resistant (software)
  - Secure Communications (protocols and encryption)
  - Secure Network Access (hardware & protocols)
  - Secure Content (silicon)

Security

Edge

Industrial Internet Consortium Reference Model

Industry Collaboration
**Figure 3. The Digital Business Development Path**

<table>
<thead>
<tr>
<th>Before the Web</th>
<th>Before the Nexus of Forces</th>
<th>After the Nexus of Forces</th>
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</thead>
<tbody>
<tr>
<td><strong>Focus</strong></td>
<td><strong>Digital Business</strong></td>
<td><strong>Autonomous</strong></td>
</tr>
<tr>
<td>Analog</td>
<td>Analog</td>
<td>Analog</td>
</tr>
<tr>
<td>Build relationships that drive business or lower cost</td>
<td>Extend relationships into new markets or geographies</td>
<td>Exploit the nexus to drive greater efficiency</td>
</tr>
<tr>
<td><strong>Outcomes</strong></td>
<td><strong>Digital Business</strong></td>
<td><strong>Autonomous</strong></td>
</tr>
<tr>
<td>Optimize relationships</td>
<td>Optimize channels</td>
<td>Smart, semi-autonomous things become the primary &quot;customer&quot;</td>
</tr>
<tr>
<td><strong>Entities</strong></td>
<td><strong>Digital Business</strong></td>
<td><strong>Autonomous</strong></td>
</tr>
<tr>
<td>People</td>
<td>People</td>
<td>People</td>
</tr>
<tr>
<td>Business</td>
<td>Business</td>
<td>Business</td>
</tr>
<tr>
<td><strong>Disruptions</strong></td>
<td><strong>Digital Business</strong></td>
<td><strong>Autonomous</strong></td>
</tr>
<tr>
<td>Emerging technologies</td>
<td>Internet and digital technologies</td>
<td>Creation of new value and new nonhuman customers</td>
</tr>
<tr>
<td><strong>Technologies</strong></td>
<td><strong>Digital Business</strong></td>
<td><strong>Autonomous</strong></td>
</tr>
<tr>
<td>ERP, CRM</td>
<td>CRM, Web</td>
<td>Robotics, smarter machines, automation</td>
</tr>
<tr>
<td>CRM, Web</td>
<td>EDI, BI, portals</td>
<td></td>
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<tr>
<td>Mobile, big data, social</td>
<td>Sensors, 3D printing, smart machines</td>
<td></td>
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</tbody>
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**Source:** Gartner (June 2014)


**Things become the customer**
What does this mean to Boeing?

- Enabled by Digital Aerospace & Digital Business Transformation
  - Smart Factories, Supply Chain, Digital Aviation
  - New Revenue Channels, new customer types
  - Expansion of existing Revenue Streams

- Integration of Information Technology and Operational Technology
  - Data Analytics moving to the edge and within the Network Stream
  - Integrated Manufacturing Fabric of People, Robotics, Product and Facilities

- Operational Areas: Finance, Human Resources, Facilities...

Propelled by our Passion and Legacy

It behooves no one to dismiss any novel idea with the statement “It can’t be done” – William Boeing

The Next 100 years: “the answer is innovation” – Jim McNerney
Concept Validation Opportunities

**Factory Automation - Final Assembly:**
- Status of Things, Lost Things, Wrong Thing
- Digital FOD

**Aviation Operations:**
- Flight Crew Biometrics
- Tool Inventory Tracking

**Supply Chain:**
- En-route Inventory Optimization

**Facilities:**
- Power Conversation

**Safety:**
- Machine Human Boundary Definition
What is Boeing’s Digital Focus?

- Digital Aerospace Ecosystem
- Advanced Manufacturing and Robotics
- Supply Chain Optimization
- Mobile Solution and Device Integration
- Collaborative Passive & Active Sensor Technology
- Advanced Analytics and Data Visualization
  - At the Core (Data at Rest)
  - At the Edge (Data in Stream)
Boeing IoT – Active Early Adopters

Future Factory Automation – Robotics / Aircraft Maintenance

In the International Track and Trace project, Bosch and its partners in the Industrial Internet Consortium are exploring the interconnection and management of industrial tools.

Tools send information about their position as well as measuring data to a central database. Software is then used to analyze this data. This analysis helps ensure manufacturing quality.

Depending on the specific location of each tool, the appropriate program for the task at hand is automatically deployed on the tool.

Source: Bosch

http://www.iiconsortium.org/images/TrackAndTrace_EN WL_800px.pdf

Future Value of Internet of Things

Key Opportunities

- Boost revenues by increasing production,
- Creating new hybrid business models,
- Exploit intelligent technologies to fuel innovation, and transform the workforce

Long Term Goals
- High Tech – High Touch
- Service becomes more important than the product
- Be the most valuable Information Provider

Mid Term Goals
- Become the Digital Service Company
- Convert products into product-service hybrids

Near Term Goals
- Improve Operational Efficiency
- Reduce overall maintenance
- Eliminate unscheduled disruption

Unconventional Value Opportunity
Machines become intelligent agents… Boeing builds the worlds most complex machines. **Now, the world’s smartest machines**
Questions?

Thank You…