A capability based enterprise architecture unlocks the value of the Model Based Enterprise.

PDT Europe 2017
Kenneth Swope
Enterprise Business Architecture
Agenda

1: Introduction to Boeing
2: Digitization of the Enterprise: Opportunity
3: Digitization of the Enterprise: Reality
4: Roadmap with Business Architecture
5: Standards
6: Key Take Aways
HISTORY

The First 100 Years

Founded in 1916 in the Puget Sound region of Washington state

Became a LEADING PRODUCER of military and commercial aircraft

Completed a series of strategic mergers and acquisitions to become the WORLD’S LEADING AEROSPACE COMPANY

A heritage that mirrors the history of flight
WHAT WE DO TODAY / The Next 100 Years

COMMERCIAL AIRPLANES
Boeing 7-series family of airplanes leads the industry

DEFENSE, SPACE & SECURITY
World's largest manufacturer of military aircraft and satellites and major service provider to NASA
Large-scale systems integration, networking technology and solutions provider

GLOBAL SERVICES
A dedicated services business focused on the needs of global defense, space and commercial customers

Connect and protect people globally
# A Business Transformation Opportunity

Cultural shift unlocking the value of digital

<table>
<thead>
<tr>
<th>What’s out there?</th>
<th>Boeing’s enablement</th>
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<tr>
<td>✓ Voice recognition and natural language processing</td>
<td>✓ 2nd Century Enterprise Systems</td>
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<td>✓ Social media platforms and content platforms</td>
<td>✓ Boeing enterprise digitalization</td>
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<td>✓ Artificial Intelligence – applying the data to solve problems through analytics AI/ML</td>
<td>✓ Enterprise function defined through business architecture</td>
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<td>✓ Computers are making a generation design transition</td>
<td>✓ IOT system everywhere</td>
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<td>✓ Massive service provider function emerging</td>
<td>✓ Digital Transformation Environments for Dev/OPs</td>
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<td>✓ Reduced development time through next generation Dev/Ops</td>
<td>✓ Mobility</td>
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<td>✓ Next generation of computing</td>
<td>✓ AnalytX and analytic fabric everywhere</td>
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<td>✓ Next generation of systems</td>
<td>✓ Cloud and SaaS</td>
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<td>✓ New and better data systems</td>
<td>✓ Microservices and API interconnected fabrics for automated OSS controls</td>
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<td>✓ Emerging technologies like BlockChain and others moved to central service delivery</td>
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Service Oriented Architecture
A transformation journey template for business?

Service-Oriented Architecture (SOA) is not a technology – it is a design methodology.

Microservices are a specialized implementation of SOA for building flexible, independently deployable (DevOps) systems.

A microservices architecture puts each element of functionality into a separate service...

... and scales by distributing these services across servers, replicating as needed.
# PLM Evolution at Boeing Commercial Airplanes

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<td><strong>Design</strong></td>
<td>2D Drawings</td>
<td>3D Model + 2D Drawings</td>
<td>Persistent Digital Twin</td>
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<td><strong>Change</strong></td>
<td>Paper</td>
<td>Textual based, Boeing built</td>
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<td><strong>Validation</strong></td>
<td>Physical Mockup</td>
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<td>Spatial, Functional, Build &amp; Support Pre-assembly</td>
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<td><strong>Bill of Material</strong></td>
<td>Paper / Forms on Mainframe</td>
<td>Teamcenter Enterprise + Specialty PDMs</td>
<td>ENOVIA LCA / Teamcenter Enterprise + Specialty PDMs</td>
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<td><strong>Configuration</strong></td>
<td>Explicit airplane effectivity</td>
<td>Option driven quantity based</td>
<td>Option driven instance based</td>
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<td><strong>Applications</strong></td>
<td>Boeing Computing Services</td>
<td>Customized COTS + Boeing IT</td>
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<td><strong>Technology</strong></td>
<td>Mainframe</td>
<td>Unix + Windows, Thick &amp; Thin</td>
<td>Windows, Thick &amp; Thin</td>
</tr>
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</table>

## Technology
- **Mainframe**
- **Unix + Windows, Thick & Thin**
- **Cloud, SAAS**
As-Is Architecture
A System of Systems at incredible scale

Comprised of
~3,400 Processes with
~4,100 Applications
On
~5,000 Servers using
~14,000 Integrations
Affected by
~ 900 changes annually
Impacting
~ 100,000 Users
With
~ 12 copies of the data
And maintaining
~ 20 PB of data
Across
7 Countries
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Leveraging Business Architecture to align our business

One Boeing: Systems Engineering Principles of the Business

Today

Tomorrow
Business Architecture

- **Integrated model of the business**
  - Aligns strategy to tactics
- **Components**
  - Business capability,
  - Information,
  - Organization,
  - Process.
- **Describes**
  - Policies & procedures,
  - Business rules,
  - Requirements.
- **Enables**
  - Strategy development & planning
  - Performance assessment and improvement,
  - Integration analysis,
  - Reporting and analytics,
  - Business simulation.
The One Boeing Capability Map
A method to organize the business for digitization

Engaged 100+ Boeing SMEs
• Version 1 - September 2013
• Version 6 - August 2016

Decomposed to a maximum of 6 levels
• Level 1 9
• Level 2 41
• Level 3 - 6 389

Engagement increases with each revision
• Proposed changes v2 - v5 = 164
• Proposed changes for v6 = 328

Competitive Advantage Values assigned
There is ONE map for Boeing
Value Streams at Boeing

Definitions

Strategic value streams are…
An executive-level flow of business activities that provide differentiated value to external customers and stakeholders. Strategic value streams are forward-looking and used for direction-setting. Business capabilities enable value streams.

Operational value streams are…
An operational view of activities that will deliver value to an internal and external stakeholder. The operational value stream is used to optimize the sequence of activities and integrate through the information exchanged.
Strategic Value Stream
A tool to align the Boeing Enterprise at the business unit level

An executive-level flow of business activities that provide differentiated value to external customers and stakeholders. Strategic value streams are forward-looking and used for direction-setting. Business capabilities enable value streams.
Mapping Capabilities to Strategic Value Streams

- Capabilities are mapped to value stream stages
- Target level 3 capabilities
- Level 2 identified if all level 3 capabilities are used
- Common view enterprise wide
- One capability map for the enterprise
Operational Value Stream
Linking the business through services

An operational view of activities that will deliver value to an internal and external stakeholder. The operational value stream is used to optimize the sequence of activities and integrate through the information exchanged.

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**TACTICAL LEVEL**

- Operational Value Stream (OVS)
  - Multiple business services constitute an OVS
- Business Processes
  - Integrated to:
    1. SLA’s / Customer Agreements
    2. TPM’s / KPI’s
    3. Workflows
    4. RACI frameworks
    5. Information Products

**EXECUTION LEVEL**

- Strategic Value Stream (SVS)
  - Multiple capabilities enable a SVS
  - Which enables competitive advantage in the marketplace

**Capabilities**

- Capability A
- Capability B
- Capability C

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Operational Value Stream Example
Change Management

Every Business Service affords Enterprise reuse.
Standards View – Model Based Environment

Standards across the lifecycle

Standards across Nations and Standards Bodies

Work needed to capture the value of interoperable data standards.
A capability based enterprise architecture unlocks the value of the Model Based Enterprise.

Key Take Aways

Aerospace & Defense Industry: Long history, slow to change. Culture is rooted in old thinking.

Advanced concepts and data technologies enable new opportunities and disruptive events; new entrants are using these directly.

Roadmaps to a future state are notoriously difficult, yet required to maintain integration.

A structured approach to transforming an existing business is required; organic methods unlock partial value.

Your data has to be modeled, period.

A capability driven business takes value to the next level enabling enterprise reuse at scale.