Enterprise Architecture Approach to Developing OAGIS as a Standard Message Format at Boeing

OAGIS Plenary Meeting Nov 13 2014

Kevin Himka, Enterprise Architecture, The Boeing Company
Jeff Rice, Application Architect Gold, The Boeing Company
Canonical Strategy

• Overview of Boeing
• Enterprise POC for OAGIS
• Message Strategy
• GS&S Implementation of Message format
• OAGIS Governance
Boeing Overview
What We Do Today

• Design, assemble and support commercial jetliners
  – Boeing 7-series family of airplanes leads the industry
  – Commercial Aviation Services offers broad range of services to passenger and freight carriers

• Design, assemble and support defense systems
  – World’s largest designer and manufacturer of military transport, tankers, fighters and rotorcraft
  – Global Services & Support provides services to government customers worldwide

• Design and assemble satellites and launch vehicles
  – World’s largest provider of commercial and military satellites; major service provider to NASA and prime contractor for the International Space Station

• Integrate and support large-scale systems; develop networking technology and network-centric solutions

• Provide financing solutions focused on customer requirements
• Develop advanced systems and technology to meet future customer needs

Connect and protect people globally
Global Boeing

- Products and services support to customers in 150 countries
  - Total revenue in 2013: $86.6 billion
  - 70 percent of commercial airplane revenue historically from customers outside the United States
- Manufacturing, service and technology partnerships with companies around the world
  - Contracts with 21,800 suppliers and partners globally
- Research, design and technology-development centers and programs in multiple countries
- More than 169,000 Boeing employees across the United States and in more than 65 countries

Partnering worldwide for mutual growth and prosperity
Boeing Defense, Space & Security

- Designing, building and supporting net-enabled platforms and systems for government and commercial customers
- Formed in 2002 integrating Boeing’s defense, space, intelligence and communications capabilities
  - Headquartered in St. Louis, Mo., with global operations in four countries and 21 states
- Approximately 58,000 employees
- 2013 revenues of $33.2 billion
- Balanced backlog across all markets including a strong mix of development, production and support contracts

Delivering the future
Boeing Commercial Airplanes

- 2013 revenues of $53.0 billion
- Headquartered in the Puget Sound region of Washington state
- Approximately 80,000 employees

- Offering a family of airplanes and a broad portfolio of aviation services for passenger and cargo carriers worldwide
  - Boeing airplanes represent three quarters of the world’s fleet, with nearly 12,000 jetliners in service
  - Approximately 70 percent of Boeing Commercial Airplane sales (by value) go to customers outside the United States

The industry’s source for customer-focused solutions
Drivers and Challenges

- Technology Refresh
- International
- Cloud on-premise and off-premise
- Shrinking Defense budgets
- MoD demand to have SOA supply chain
- Integration concerns with system-to-system applications, business partners/suppliers.
Target Strategy

▪ Comprehensive Integration to help to run a healthy core business
  ▪ Enhance Integration across Functions, Process, Data, & Systems
  ▪ Establish Integration Governance for strategy compliance

▪ Standard and secure integration to enable international growth and supply chain efficiency
  ▪ Leverage industry standards bodies for neutral data exchange
  ▪ Combine security measure with integration solution
  ▪ Determine Integration technologies and architecture patterns for future Global business opportunities

▪ Support the use of industry standards for integration
Target Enablers

- **Flexible Integration as enabler for quick response to market change and enable programs and service growth**
  - Improve integration agility & flexibility by using loosely coupled integration
  - Deploy SOA service centric integrations using web services
  - Use canonical format OAGIS for message payloads

- **Common/reusable integration solution/pattern to reduce product development and deployment cost and cycle time**
  - Reduce start-up/investigation time by providing use of Standard Integration (patterns)
  - Cycle time reduction from requirements through design and implementation
Canonical Strategy

- Overview of Boeing
- Enterprise POC for OAGIS
- Message Strategy
- GS&S Implementation of Message format
- OAGIS Governance
Hybrid solution for Canonical

Current

- Requester 1
  - Model R1
- Model R1
- Map
- Service Requester
- Common Message Model
- ESB
- Service Provider
- Model P1
- Provider 1

Governance Tool

CentraSite Service Repository
- Design Time Registry
  - Publish
  - Search
  - Governance
  - Life-cycle

Applications
Hybrid solution for Canonical

Phase 1 begins with Canonical in the Box contract Last Service

Current

- Requester 1
  - Model R1
- Model R1

Phase 1

- Requester 2
  - Model R2
- Map
- OAGIS R2
- Model P2
- Provider 2
- Model P2

Service Requester

Common Message Model

ESB

Service Provider

Model P1
- Provider 1
- OAGIS P2
- Map

Governance Tool

CentraSite Service Repository

Design Time Registry

Publish
Search
Governance
Life-cycle

Applications
Hybrid solution for Canonical

**Current**
- Requester 1
  - Model R1
- Service Requester
  - Map
- OAGIS R2

**Phase 1**
- Requester 2
  - Model R2
  - Map
- Service Provider
  - Model P1
  - Provider 1

**Phase 2**
- Requester N
  - Model R3
  - API
  - OAGIS
- Service Provider
  - Model P2
  - Provider 2
  - Model P3
  - Provider N

**ESB**
- Common Message Model

**Governance Tool**
- Publish
- Search
- Governance
- Life-cycle

**CentraSite Service Repository**
- Design Time Registry

**Phase 1** begins with Canonical in the Box contract Last Service

**Phase 2** begins with ADM’s updating interface to support CMM & Contract First Service
Hybrid solution for Canonical

Current
- Requester 1: Model R1
- Requester 2: Model R2
- Model R1
- OAGIS R2
- Map

Phase 1
- Requester 2
- Model P2
- Provider 1
- Model P1
- OAGIS P2
- Map

Phase 2
- Requester N: Model P3
- Provider N: OAGIS
- Map

Phase 3
- Requester N: Model P4
- Provider N: OAGIS

Common Message Model

ESB

Governance Tool

CentraSite Service Repository

Publish
Search
Governance
Life-cycle
Applications

Moving right is better…

Phase 1 begins with Canonical in the Box contract Last Service
Phase 2 begins with ADM’s updating interface to support CMM & Contract First Service
Phase 3 ADM’s full native support for CMM Contract first Web Service
Proof of Concept

1. Evaluate interface needs for 3 sites
2. Interfaces that are common create OAGIS objects depending upon the domain
3. Interfaces that are not common leave in API format
4. Use an ESB layer
5. Leave existing interfaces as is until funding is available.
Canonical Strategy

• Overview of Boeing
• Enterprise POC for OAGIS
• Message Strategy
• GS&S Implementation of Message format
• OAGIS Governance
Why are Messaging standards important?

- Application Integration is very expensive as each new interface is a custom solution.
- Infrastructure area costly having too many point to point interfaces between applications.
- Business Processes are difficult to modify as every process change requires interface customization.

A possible solution

- Develop an Enterprise messaging architecture around OAGIS and standardize message vocabulary that can be used across the business units.
Example Message Layout

- Noun is used to represent one Instance of an Item, ItemInstance, Party or other message business content
- Current reflects the existing applications condition prior to this request or notification
- Future indicates the desired or requested or post-processing status.
- Submit back to Standards Body

**NOTE:**
Only one header and one line will be accepted
Receiving systems will need to Error if their current status is not matching
Canonical Strategy

- Overview of Boeing
- Enterprise POC for OAGIS
- Message Strategy
- GS&S Implementation of Message format
- OAGIS Governance
GOLD Overview

**Description:**
GOLD, Commercial of the Shelf Software (COTS), provides a wide range of scalable functionalities that allow for implementations in support of a variety of business environments. From a simple warehouse operation, to a full depot level maintenance and modification facility.

In addition, using published Application Program Interfaces and Web Services, GOLD can be tightly integrated with other enterprise systems to provide seamless data flow between operations and business management functions. GOLDespTM is the current version.

**Supply Support Functional Area:** Enabling high performance and total lifecycle Product Support – Providing businesses with an integrated suite of common processes and applications systems for managing Assets, Maintenance and Modification, Upgrade, Repair, Overhaul, Supply Chain and Logistics Operations.

**Capabilities:**
- **Material Management** - Processes and primary functions include: demand & replenishment based acquisition planning, parts ordering & integration with procurement systems, warehousing, physical inventory (ABC), cost tracking, handling alternate / substitute parts, real time inventory status, automated material allocation, & kitting.
- **Asset Management** - Primary functions include: asset identifications, disposition, scheduling, photo ID & storage, preventive maintenance tracking, real-time asset status, location / condition / custodian tracking, asset structure definition, asset management APIs & Web services.
- **Work Recording** - Provides the ability to author, store, revise, track & / or execute maintenance programs, Technical Directives, TCTOs, Service Bulletins, other work plans, wo’s/steps & associated bills of material.
- **Enterprise Management** - Customizable data structures and user-configurable business rules define the users’ operating environment.
- **Maintenance Program Management** - Provides the functionality to author maintenance tasks, organize them into maintenance plans and apply them to fleets of operational end items.
- **Data Distribution** - Provides the algorithms needed to port a subset of the data base to another platform being deployed.
- **MILS – Military Standard Logistics System** - Provides all the data structures, elements, transactions, and printable documents needed by business operations that exchange supply information with DoD organizations ( USAF, USMC, USN, USA, DLA, ICP…).
GOLD Environment

- There are 10 Unique Instances of the Gold running
- There is a total of 117 Applications Involved
- There are 7 Different Integration Types
- We have over 200 + integrations between systems
MRP (Material Requirements Planning)
The Story Begins on PO and Work Order

Unique Middleware & 13 Unique Messages to support one application at one Site

- Process Requisition
- Process Work Request
- Acknowledge Requisition
- Cancel Requisition
- Change Requisition
- Notify Purchase Order
- Change Purchase Order
- Cancel Purchase Order
- Acknowledge Work Request
- Cancel Work Request
- Change Work Request
- Notify Work Order
- Change Work Order

PO & Requisition
- OUT BOUND

Work Order
- OUT BOUND

PO & Requisition
- IN BOUND

Work Order
- IN BOUND

P1 INBOUND
- Outbound

P2 INBOUND
- Outbound

P3 INBOUND
- Outbound
MRP (Material Requirements Planning)

PO and Work Order Current State

Unique Middleware & 39 Unique Messages
to support 3 Applications (Example IG3)
MRP (Material Requirements Planning)

PO and Work Order Future State OAGIS Messages

- Only the Messages and some of the Middleware logic needs to be changed.
- MRP and Shipping end points stay the same.
- The Messages will be built Program independent
- Once coded the OAGiS BODs can be sent anywhere.

Common Middleware & 7 Common Messages to support Three application

- ProcessRequisition BOD
- AcknowledgeRequisition BOD
- CancelRequisition BOD
- ChangeRequisition BOD
- NotifyPurchaseOrder BOD
- ChangePurchaseOrder BOD
- CancelPurchaseOrder BOD

PO & Requisition OUT BOUND

Work Order OUT BOUND

PO & Requisition IN BOUND

Work Order IN BOUND

P1
INBOUND
Outbound

P2
INBOUND
Outbound

P3
INBOUND
Outbound
Value of Common Conical OAGIS Messages

The Current Provisioning, Requisition and Purchase Order and Messages are nearly Identical to the Work Order Messages. By leveraging the OAGIS standard we are able to obtain a 3 to one reduction in our supported integration message base. As other applications begin to use the BODS in place of there one-one strategy we achieve even greater re-use and business value.
Current Supply Chain Management

1. Decompose Business Applications Processes into Functions

2. Decompose Business Functions into Capability’s

3. Decompose the Business Capabilities into Services into BODs
MRP (Material Requirements Planning)

Centric View Messages

OAGiS BODs by Service

- ShipmentSchedule
  - GetShipmentSchedule
  - ShowShipmentSchedule
  - SyncShipmentSchedule
  - NotifyShipmentSchedule

- Shipment
  - GetShipment
  - ShowShipment
  - ProcessShipment
  - AcknowledgeShipment
  - SyncShipment
  - NotifyShipment
  - ConfirmBOD

These OAGiS “like” messages will be built from the “Standard” OAGiS web service.
The messages will be built “Program” independent.
Canonical Strategy

• Overview of Boeing
• Enterprise POC for OAGIS
• Message Strategy
• GS&S Implementation of Message format
• OAGIS Governance
Governance

GEFEG:

- Imports the OAGIS model into a database for augmentation
- Permits simpler creation of XSD subsets for easier creation of focused web services
- Enables reuse of subset selections (guidelines)
- Offers ability to document Guidelines individually
- Offers documentation to a level of granularity not available any other way
- Offers documentation of xsd and guidelines in Excel, HTML and Word to enhance education and governance
- Validates back to the Standard release
Service Registry Repository

- Provides a single point of reference for information about all the services available to the Enterprise for visibility, discovery, and information exchange

- It supplies a single point of control for managing services and metadata

- Promotes the use of Service Design Standards both functional expression and data representation for service contract:
  - Entity service will follow this naming standard
  - XML schemas must exist in separate files and linked to WSDL
  - Facilitates content validation and workflow support
  - Manage & Tracks the life-cycle, characteristics of services and usage profile
Moving forward

• Areas that Boeing contributed/supported Oagis 10.1 release:
  • Added the Financial Account and References Groups to Party Master, Supplier Party Master, and Customer Party Master
  • Added Receipt Discrepancy capability to describe the issue to Receive Delivery Item Type
  • Add an OAGIS Test Request on the Inspect Delivery Line
  • Added Storage Location to Facility to enable more finely grained specification for example, Aisle, Row, Bin, etc.
  • Made enhancements to the Schedule Component in the Meta-Model to support more of document line–like capability in the Meta Model
  • Added the Schedule Component to Sub-Lines throughout OAGIS
  • Added more inheritance to the Sub-Line Component from the Document Line Component in the Meta Model
  • Added several Data Elements to Inspect Delivery Noun
• Boeing is looking to work as closely as possible in implementing and adhering to the standard languages like OAGIS/PLCS.
• COTS vendors need to support and provide out-of-box OAGIS support going forward
• Suppliers and Vendors need to implement OAGIS business language