Dennis E. Wisnosky, DoD BMA CTO & Chief Architect in the Office of the Deputy Chief Management Officer

Realizing Efficiency & Interoperability: SOA & Semantic Technology in the Business Mission Area (BMA), U.S. DoD

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DoD Semantic Technology Clip
http://www.youtube.com/watch?v=OzW3Gc_yA9A
Missions of the DoD

Warfighter Mission Area
Business Mission Area
Intel Mission Area
Enterprise Information Environment Mission Area

SECDEF
SEPCQ
CMO

DCMO
ASD(HD)
ASD (NII)/CIO
USD (C)
USD (P&R)
USD (AT&L)

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DoD Management Challenges
DoD Management Challenges

A More Reasoned Approach

I want to make sense out of this. How do I do that?
Strategy and Roadmap for DoD Business Operations Transformation

### Past
(BMA Federation Strategy version 2.4a)

- **Vision & Strategy**
  - Architecture
  - Governance
  - Socialization
  - Services
  - Infrastructure

- **Planning & Roadmap**
  - DBSMC/IRBs
  - DCMO/DCIO; EGB; BECCM

- **Domains**
  - HRM/ Med FM Logistics
  - RPILM
  - WSLM/
  - MSSM

### Present
(BOE Execution Roadmap)

- **DCMO/CIO Policies**
  - CIO – DIEA, Segment Archi.
  - CV & Primitives
  - Arch. Fed.
  - MDR
  - Biz. Intelligence
  - Federation Implementation Plan

- **Execution**
  - DBSAE
  - SOA
  - Imp. Strategy

- **Past (BMA Federation Strategy version 2.4a)**
  - Version 2.4a
  - BEA 3.0

- **BOE Vision**
  - Roadmap:
    - Architecture
    - Governance
    - Socialization
    - Services
    - Infrastructure

### Future
(BMA Technical Transition Plan version 1)

- **DoD Strategic Mgmt. Plan (SMP)**
- **Performance Measures**
- **Semantic Information**
- **Data Integration**
- **Business Intelligence**
- **Common Vocabulary (Ontologies)**
- **Rules/Workflow**
- **Security**
- **BEA 8.x & Beyond**

- **Initial BOE Experience**
- **Roadmap:**
  - Architecture
  - Governance
  - Socialization
  - Services
  - Infrastructure

- **Vision & Strategy**
- **Planning & Roadmap**
- **Infrastrcutre**
- **Governance**

- **DBSMC/IRBs**
- **DCMO/DCIO; EGB; BECCM**

- **Roadmap:**
  - Initial BOE Experience
  - Data Sharing and BI Enablement
  - Semantic Information
  - RDF
  - OWL
  - Other

- **Enterprise Stds.**
- **Vision & Strategy**
- **Planning & Roadmap**
- **Infrastructure**
- **Governance**

- **The Journey**
DoD Architecture Progression

Blueprinting  →  BEA - Stovepiped  →  BEA - Semantic

Branch office-based; readable but not analyzable; stovepiped

Business Mission-based; readable within a Business Mission; not analyzable; not integrated with architectures

End-to-End based; analyzable; executable; integrated with & consumable by solution architectures

Enabling Strategic Management
Enabling Strategic Management

Strategic Objectives

BEA Ontology Semantic Description

Enterprise E2E and OSD Policies

Operational Process and Service Policies

ADS

4.0 Preserve and Enhance the All-Volunteer Force

2.0 Support Contingency Business Operations

DoD Personnel Management E2E

Army Dwell Time E2E

USMC Dwell Time E2E

Vision for DoD Solution Architectures

Dwell Time

4.2.10 Percentage of the Dept. AD who meet objectives for time deployed vs time at home

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A Vision for DoD Solution Architectures

User executes BP

Query BEA directly:
- Enterprise analytics
- Compliance
- IRB/portfolio management

Business Enterprise Architecture: BEA

- Acq Domain Vocabulary
- Real Prop Domain Vocabulary
- HR Domain Vocabulary
- Log Domain Vocabulary
- Fin Domain Vocabulary

Auto-escalation

Warfighter Domain Vocabulary

Sailor

Svc Member

Employee

OUID

An Aha Moment

W3C Open Standards Legend:
- Data described in RDF
- Relationship described in OWL
- OMG Primitive Conformance class 2.0
- Position, billet, dept
Ontology – Based Information Integration & Analytics

What Pay Grade is Col. Blatt?

Graph 1

Central High School
hasName

Defense Acquisition U.
hasName

Education Institution

Col. E.J. Blatt
hasName

University Michigan

person

Pay Grade

hasGrade

O6

hasTitle
How much Dwell Time does Col. Blatt have?

Graph2

Deployment History

Col. E.J. Blatt

.person

24 months

Dwell Time

hasName

hasDwellTimeStatus

hasValue

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Who has a Pay Grade of “O6” and has at least 24 months of Dwell Time?
Standards-based Architecture - Primitives

- DoDAF 2.0 serves as the foundation for architecture primitives
- Use Cases being developed and used to drive pilots

**Engineering Language and Symbols:**
- **Resistor** symbol
- **Capacitor** symbol

This agreed upon representation of electrical engineering allows a common understanding...

**PrOnto**
Ontology (Lexicon)

This agreed upon representation of music allows a common understanding...

**Standards Best Practices**

**PriMo**
Modeling Guide

**Different Frameworks**

**Music Language and Symbols:**
- **Music Scale** symbols
- **Notes** symbols

**Other Disciplines can do it!**

**Standard Language (terms and definitions)**

**The Semantic BEA**

Style Guide

Dictionary

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The Semantic BEA

Written in a Common Language for Describing, Sharing, and Managing data, systems, processes, and relationships in System of Systems (SoS) environments

- System of systems: Processes, data, systems, interfaces, concepts, systems, and business relationships
- Leverage Business Process and Object Models (BPA) & Military Service & Agency-level

Example of RDF:

```xml
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:custom="http://mySite/mySchema">
  <custom:Person rdf:about="http://people/johnDoe">
    <custom:Name>John Doe</custom:Name>
  </custom:Person>
</rdf:RDF>
```
Semantic BEA Benefits

- **Visibility**: pull & display (vice store!) enterprise information directly from the authoritative data sources

- **Agility**: plug-and-play federated environment so new systems or analytical needs can come online and go offline without disrupting the overall environment

- **Access**: build federation into the solution

- **Standards**: leverage BPM and Semantic Web technology standards (RDF/OWL) developed by DARPA and approved by W3C and OMG

- **Savings**: People readable Architecture, Machine readable Architecture, Executable Architecture, Long-term re-use of authoritative data
End-to-End (E2E) Business Models in the DoD Business Architecture

- In order to facilitate integration of the systems and business architecture within the E2E lifecycle models, the BEA will be described in an ontology using a common language – {World-Wide Web Consortium (W3C) open standards Resource Description Framework (RDF)/Web Ontology Language (OWL) and modeling notation (Business Process Modeling Notation (BPMN) 2.0 Analytic Conformance Class (Primitives))}

- The E2E Framework shall be used to drive BEA content within the federated BEA ontology

- Future releases of the BEA will be synchronized with our highest priority system acquisition and modernization efforts related to critical activities within the Hire-to-Retire (H2R) and Procure-to-Pay (P2P) lifecycle models
DCMO DoD Business Operations Technical Transition Plan

• Today’s state is defined by point solutions, redundant technologies and duplicate capabilities that exist under management silos and compete for resources

• The purpose is to provide a plan — a set of initiatives beginning with the move to a dynamic BEA — to achieve a transition to a future state where SOA services and systems use enterprise services, share their information securely for appropriate use and provide enterprise capabilities in agile and cost-effective ways

• Systems and services then use the common or standard vocabularies set out in the architectures to express the data that they exchange in order to integrate
  • They use this vocabulary in accord with standard ontologies that define the semantics of the vocabulary, and which is published such that all recipients of the exchanged data can make reference to them so as to be able to determine the meaning of the data they receive when needed

• Systems and services are built using the common set of standards and patterns for integration defined in the architectures and related guidance for interconnection so they can make effective use of capabilities provided by other systems and services, eliminating ad hoc, costly and laborious interface development to adapt one to the other

This Changes Everything
Interoperability requires Data Interfaces

• Alternative 1: Proprietary Point-to-Point interfaces
  – Scaling: \( n \times (n-1) \) interfaces for \( n \) fully connected systems
  – System changes/upgrades potentially affect \( n-1 \) systems

✗ Alternative 2: Interface Standards
  – Scaling: \( n \) interfaces for \( n \) fully connected systems
  – Standard as least common denominator may lead to gaps

✓ Alternative 3: Semantic Data standards
  – Scaling: \( n \) data descriptions for \( n \) fully connected systems
  – Standard description allows for specialized capabilities

And Process Interfaces!
Interoperability requires Process Interfaces

Alternative 1: **Proprietary Point-to-Point interfaces**
- Scaling: $n \times (n-1)$ interfaces for $n$ fully connected systems
- System changes/upgrades potentially affect $n-1$ systems

Alternative 2: **Standard Process Protocols**
- Scaling: 1 Protocol for all process invocations (e.g. HTTP)
- Functionality-agnostic protocol puts burden on data

Alternative 3: **Semantic Process Services**
- Each process represents a service
- Scaling: $n$ service descriptions for $n$ available processes

Interoperability!
Semantic Data Strategy

Current State
System of Systems

(near) Exponential Integration problem ($n^2 - n$)  
Inflexible Data model  
Total interoperability for 100 systems > $4B*$  
Promotes operational silos  
Promotes data duplication

Target State
Semantic BEA

(near) Linear Integration problem (2n-1)  
Infinitely extensible data model  
Total interoperability for 100 systems < $40M*$  
Promotes cross-domain reasoning  
Encourages data reduction

* Assumes $400K/interface

Our Toolbox Must Change!
Our Technology Toolbox is Evolving

WILL EVOLVE TO TOOLS THAT…

PRODUCE & USE NON-PROPRIETARY, OPEN STANDARDS & PROTOCOLS

Walking the Talk - EIW
Department of Defense Enterprise Information Web (EIW)

Jonathan Underly – EIW PM
The DoD Enterprise Information Web (EIW) is pioneering the adoption of Semantic Technology and approaches that can be the way forward for enterprise business intelligence and solution architectures in the DoD.
A New Approach to Personnel Visibility (PV)

The HR Enterprise Information Web (EIW) is a mechanism for reaching into Authoritative Data Sources (ADS) to satisfy enterprise information needs. It accomplishes three things:

1. Reports near real-time, authoritative information on-demand
2. Supports enterprise information standards (Open; HRM ES)
3. Supports IT flexibility/agility

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Proof of Delivery (PoDs) Every 90 Days
EIW Roadmap – Phased Approach

Legend: ADS/BPA = Authoritative Data Source/Business Process Area

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Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | FY11 | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | FY12

RDF Modeling | RDF Triplestore | RDF Store Extension | SPARQL end-points | Sparqlizer | Local Federation | Distributed Federation | Scaleable Federation |

Lessons Learned

Delivery every 90 Days

ADS/BPA Modeling:
- CII
- Separations
- Military Leave
- Increment 5-N
- “Member Profile”
- Federated Ontology

Secure Federation

We Are Here
PoD Progression

**Dashboard**

- **Gadget**
- **Gadget**
- **Gadget**
- **Gadget**

**Federator**

- **Source Ontology**
- **SPARQLizer**
- **SPARQLizer**

**Triple Store**

**Common Vocabulary**

- **Domain Ontology**
- **Mapping Ontology**

**External Data Source(s)**

- **SPARQLizer**
- **SQL**

**Web Service Call**

**HTTP Port 443 for web traffic**

**DMZ**

**Firewall**

**SQL**

**PDA Metrics**

**Web/App Server**

**Triple Store Load (Semantic Mapping)**

**PoD1:**

- Models inform the location and extraction of data

**Composite App Srvr**

**Ab Ini So App Srvr**

**Triple Store**

**PoD2:**

- Model Driven AnalyScs
- Model Driven ETL
- Triple Store

**Data Source:**

- MCTFS (USMC)

**PoD3:**

- Store and query multiple test data sets in a triple store

**PoD4:**

- Access data from relational store at run time using semantic query engine
- SPARQLizer alpha release with D2RQ mappings

**PoD5:**

- Access data from relational store at run time
- SPARQLizer 1.0 release, support SQL equivalent comments
- Add more demographic reports
- More extensibility and reuse

- PDA Metrics Added
- USMC MCTFS Mappings reused

**Long Term Roadmap**

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We are Expecting Enormous Benefits
Semantic BEA Roadmap

BEA

3QFY11
- Final BDM
- Draft BDM
- 1st Draft BEA Transition Plan (BTP)
- BEA Baseline Ontology

4QFY11
- Final BTP
- 2nd Draft BTP
- 1st Draft BEA Transition Plan
- BEA 8.1

1QFY12
- PPM Ontology
- HR EIW Mapping Ontology
- DiTPR & SNaPIT Mapping Ontologies

2QFY12
- BEA 8.2
- BEA Graphical Model GUI Phase I
- BEA Threads/Compare RDF Data Layer
- BEA Federated Secure SPARQL Module

3QFY12
- BEA 9.0
- BEA Reusable Semantic Toolkit
- REA eTools 2.0 Hosting Solution (wRDF Store)

4QFY12
- Mapping Ontology 8
- Mapping Ontology 9
- Mapping Ontology 10

1QFY13
- BEA Reusable Semantic Toolkit
- POD 1

2QFY13
- BEA COOP Architecture Enterprise Failover/Scalability

Tools

Model Driven Implementation

Equipping the Workforce

Course Catalogue Complete

BEA Technical Architecture Design (TAD)

Finalized Course Materials

Semantic Training Platform Stood up

BPMN Training Platform Stood up

DoD Business Operations Technical Transition Plan v0.99

Use of E2E Business Models & Ontology Memo

Model Driven Implementation

Guidance

DoDI 8321 – Semantic Web Application Across the BMA
DoDI 8330 – BPMN Primitives Application Across the BMA

DoDI Business Enterprise Services Development and Implementation

These capabilities will adjust based on collaborative efforts

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Model Driven Implementation

Model
- Common Architecture Methodology
  - Use CARP & CPRR and Begin Vocabulary
- Standard Representation and Composition
  - Primitives and Design Patterns

Data
- Authoritative Data Sources
- Extend the Vocabulary with Semantics

Implement
- Phased Implementations
  - Agile Business Services Delivery

And, if this logic does not Work
Flight Deck Management Challenges

http://www.youtube.com/watch?v=qh42k3Kvxck

Thank you!
Thank you!

Questions?
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For the rest of the story!