Engineering Enterprise Architecture: Call to Action

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

April 13, 2011
Missions of the DoD

Warfighter Mission Area  Business Mission Area  Intel Mission Area

Enterprise Information Environment Mission Area

SECDEF

DEPSECDEF

CMO

DCMO

ASD(HD)

ASD (NII)/CIO

USD (G)

USD (P&R)

USD (AT&L)

USD ()

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

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

Past
(BMA Federation Strategy version 2.4a)

Present
(BOE Execution Roadmap)

Future
(BMA Technical Transition Plan version 1)

**Vision & Strategy**

**Planning & Roadmap**

**Infrastructure**

**Governance**

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

**Version 2.4a**

**BEA 3.0**

**Initial BOE Experience**

**DoD Strategic Mgmt. Plan (SMP)**

**Performance Measures**

**Semantic Information**

**Data Integration**

**Business Intelligence**

**Common Vocabulary (Ontologies)**

**Rules/Workflow**

**Security**

**BEA 8.x & Beyond**

**Data Sharing and BI Enablement**

**Enterprise Stds.**

**RDF OWL other**

**A More Reasoned Approach**

**DBSMC/IRBs**

**DCMO/DCIO; EGB; BECCM**

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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 solution architectures

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

The Journey
Enabling Strategic Management

4.0 Preserve and Enhance the All-Volunteer Force

2.0 Support Contingency Business Operations

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

DoD Personnel Management E2E

Army Dwell Time E2E

USMC Dwell Time E2E

Strategic Objectives

BEA Ontology Semantic Description

Enterprise E2E and OSD Policies

Operational Process and Service Policies

ADS

4/13/2011

Dwell Time

CII

ODSE
A Vision for DoD Solution Architectures

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

User executes BP

Business Enterprise Architecture: BEA

Acq Domain Vocabulary
Real Prop Domain Vocabulary
Log Domain Vocabulary
Fin Domain Vocabulary
HR Domain Vocabulary
Svc Member
OUID

OMG Primitives Conformance class 2.0
BP models uniformly described

W3C Open Standards Legend:
- Data described in RDF
- Relationship described in OWL
- DoD Authoritative Data Source

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Ontology – Based Information Integration & Analytics

What Pay Grade is Col. Blatt?

An Aha Moment
How much Dwell Time does Col. Blatt have?

Graph2

Deployment History

hasName

person

hasDwellTimeStatus

Dwell Time

Col. E.J. Blatt

hasValue

24 months
Who has a Pay Grade of “O6” and has at least 24 months of Dwell Time?
57% of DoD I.T. Costs are in Infrastructure

<table>
<thead>
<tr>
<th>OMB Budget Grouping</th>
<th>Number of Programs</th>
<th>FY2010 IT Spending - $ Billions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communications and Computing Infrastructure</td>
<td>1,547</td>
<td>$16.3</td>
</tr>
<tr>
<td>Information Assurance Activities</td>
<td>353</td>
<td>$3.2</td>
</tr>
<tr>
<td>Functional Area Applications</td>
<td>3,244</td>
<td>$13.2</td>
</tr>
<tr>
<td>Related Technical Activities</td>
<td>156</td>
<td>$1.0</td>
</tr>
<tr>
<td>Total DoD IT Spending</td>
<td>5,300</td>
<td>$33.7</td>
</tr>
</tbody>
</table>

SOURCE: http://www.whitehouse.gov/omb/e-gov/

Issue: Infrastructure

DoD Contractors Build Separate Infrastructures & Dictionaries

Issue: Redundancy

DoD Projects Have Own Data

<table>
<thead>
<tr>
<th>Projects</th>
<th>07 Budget $ Millions</th>
<th>Number of Projects</th>
<th>% of Total Budget $</th>
<th>% of Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project - &gt; $100 Million</td>
<td>$10,301</td>
<td>43</td>
<td>33.9%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Projects - &gt; $10 Million</td>
<td>$15,013</td>
<td>525</td>
<td>49.4%</td>
<td>15.4%</td>
</tr>
<tr>
<td>Projects - &lt; $10 Million</td>
<td>$5,066</td>
<td>2,832</td>
<td>16.7%</td>
<td>83.3%</td>
</tr>
<tr>
<td>Total</td>
<td>$30,380</td>
<td>3,400</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Issue: Data

There is an Economic Imperative!

<table>
<thead>
<tr>
<th></th>
<th>FY05</th>
<th>FY06</th>
<th>FY07</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total DoD I.T. Spending</td>
<td>$28.7</td>
<td>$29.9</td>
<td>$30.4</td>
</tr>
<tr>
<td>DoD Spending on Contractors</td>
<td>$21.1</td>
<td>$22.6</td>
<td>$24.1</td>
</tr>
<tr>
<td>% of I.T. Spending Contracted Out</td>
<td>73.5%</td>
<td>75.6%</td>
<td>79.3%</td>
</tr>
</tbody>
</table>
Standards-based Architecture - Primitives

Style Guide
Standard Symbols

Engineering Language and Symbols:
- Resistor symbol
- Capacitor symbol

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

PriMo
Modeling Guide

Architecture Primitives

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

New Way of Thinking & Game Changing Innovations

Standards Best Practices

Influences

PriMo

PrOnto
Ontology (Lexicon)

Different Frameworks

Other Disciplines can do it!

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

This agreed upon representation of music allows a common understanding…

Standard Language (terms and definitions)

Dictionary

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Primitives to Patterns

- Provides basic definitions of the architecture model semantics
- Provides elementary rules for the connectivity of primitive constructs
- Provides foundation building blocks for constructing architecture products
- Caveat: A common vocabulary by itself does not guarantee high quality products

A style guide provides subjective advice that will ensure the design of high quality products

- A style guide advises on
  - Choice of words
    - Which constructs are appropriate in a given situation
  - Choice of grammar
    - How to combine constructs to maximum effect
NEWS FLASH!!

DoD Primitives in the DISR!!

March 2011, The DoD Information Technology Standards Registry (DISR) working group unanimously voted to include DoD Primitives – BPMN 2.0, as a mandated standard focused on DoDAF and all systems that interact with Defense Business Systems.
We Are Underway!

And that’s not all
End-to-End (E2E) Business Models in the DoD Business Architecture

- DBSMC endorsed using and extending the E2E framework to evolve the BEA
- BEA captures the following:
  - Enterprise capabilities
  - Performance metrics aligned to the DoD Strategic Management Plan (SMP)
  - Processes, data standards and rules for interoperability
- BEA will be a tool to drive portfolio management and Business Process Reengineering (BPR)
- BEA 8.0 Release captured and defined the Department’s 15 E2E Business Lifecycle models
- BEA 8.0 further provided a detailed level business process models for the Procure to Pay E2E to include information exchanges

DCMO Memo signed 4 April 2011
Subject: End-to-End (E2E) Business Models in the DoD Business Architecture

Clear and Unambiguous Guidance
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 Memo signed 4 April 2011
Subject: End-to-End (E2E) Business Models in the DoD Business Architecture
Architecture Primitives Series

DoD Architecture Framework Processes Best-Practice


Clear and Unambiguous Instructions
Common Vocabulary is Common Sense

- Identify information to communicate
- Agree on terms and contextual use
- Communicate

“Now! That should clear up a few things around here!”
Common Ways to Build Architectures

What is the architecture supposed to achieve?
- Capability Vocabulary
  - Items: Objectives, Features, Services

Which processes/activities will provide the capabilities?
- Activity Vocabulary
  - Items: Verbs

Which data/resources will be consumed or produced?
- Resource Vocabulary
  - Items: Nouns

Who/What will be involved?
- Performer Vocabulary
  - Items: Roles, Systems, Actors

Capability Vocabulary
Activity Vocabulary
Resource Vocabulary
Performer Vocabulary

Capability View
Process View
Data & Rule View
Process View
Department of Defense Enterprise Information Web (EIW)

Leading by Example
The 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.
EIW History

Problem: Personnel visibility (PV), accurate and timely pay
Alternative: Build an enterprise ERP for HR functionality across DoD

<table>
<thead>
<tr>
<th>Measure</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agility</td>
<td>10 year program, system did not pass Integration Testing and Acceptance Testing</td>
</tr>
<tr>
<td>Interoperability</td>
<td>100+ planned point-to-point interfaces to legacy systems; 1/3 successfully built and tested</td>
</tr>
<tr>
<td>Savings</td>
<td>&gt;$$$$$$$$ spent, system not fielded</td>
</tr>
</tbody>
</table>

Post-DIMHRS Personnel Visibility Problem Persists

<table>
<thead>
<tr>
<th>Personnel Visibility</th>
<th>Interoperability/Federation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DoD currently lacks the enterprise level capability to quickly and accurately account for personnel, manage troop strength, and plan</td>
<td>• Standards &amp; transactional systems in constant state of change</td>
</tr>
<tr>
<td></td>
<td>• Relationally-based architectures expensive to change/maintain</td>
</tr>
</tbody>
</table>

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# Alternatives Considered

<table>
<thead>
<tr>
<th>COA</th>
<th>Description</th>
<th>Pro</th>
<th>Con</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status quo</td>
<td>Manual aggregation and gathering of information in disparate systems</td>
<td>Process known</td>
<td>Labor intensive (e.g., daily JPERSTAT report consumes 70 person-hrs); uncertain data lineage</td>
</tr>
<tr>
<td>DIMHRS</td>
<td>Single military personnel and pay system</td>
<td>Efficient; accurate</td>
<td>DIMHRS not fielded; Political change curve substantial</td>
</tr>
<tr>
<td>Traditional Warehouse</td>
<td>Set up a traditional network of data stores to pull and store personnel and pay related information</td>
<td>Known model and technology stack</td>
<td>Duplicates data; costly to develop &amp; to maintain; very costly to modify</td>
</tr>
<tr>
<td>Semantic Approach</td>
<td>Semantically describe personnel and pay information assets, pull, aggregate and display (vice store)</td>
<td>Federated data = data lineage; powerful analytics; virtual data (no duplication); easier to modify and maintain; highly extensible</td>
<td>Maturing technology; Technology change curve exists</td>
</tr>
</tbody>
</table>

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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
• **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
EIW Roadmap: Phased Approach

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

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Operations – Country View: User Defined Query

Pod 3 Dashboard

Dialog

Real World Example
Machine readable policy with automated lineage to the supporting source data.
BPM Methodology

Goal: Develop correct, consistent, human and machine readable, high quality business process models

Approach:

Benefits:
- Consistent, semantically aligned (end-to-end HR) business processes
- Communicate effectively with the Services
- Machine readable (queryable) business processes
- Perform gap analysis
- Standards based models result in fewer errors during implementation

CARP from the Top-Down
Community Workspace: www.Common Vocabulary.army.mil
https://www.commonvocabulary.army.mil/ui/groups/HR_EIW
HR EIW and H2R E2E

Personnel Visibility not possible if DoD doesn’t understand the Enterprise H2R E2E processes, information flows, data sources, integration points, standards and exceptions.

Eg: how does the “Pay” process work across DoD in the E2E?

Need to know: where in E2E, which ADS, semantics (meaning) of data, and access.

The E2E Informs the the Ontology
Semantic Development Approach

Upper Ontology
(Common Vocabulary)

Domain Specific/External Ontology

Source System Data

Ontology Aliases

Col 1 Alias 1
Col 2 Alias 2
Col 3 Alias 3
Col 4 Alias 4

Business Rules (Source System A, B, or C)

Semantic Layer Output
(Semantics Data Store)

User Interface (UI)

System Exposed Data

Extraction of Data/Linked Common Content

Application Dev. Steps:
1. Identify Data to be exposed
2. Identify sources and SME’s (Subject Matter Experts)
3. Relate system data to ontology/SFIS Business & Rules
4. Systems provide query to expose their data
5. Apply business rules and assign domain aliases, and populate the semantic store.
6. Apply User Interface (i.e. Google Gadgets) to access multiple federated source data into comprehensive enterprise views.

CARP from the Bottom-Up

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Financial Management Domain

Authoritative Data Stores

Virtual Common Server

FM Domain Vocabulary (Ontologies) and rules for machine reasoning

Described Data (RDF Triple Stores)

Metrics

OCO

Budget Execution

Legacy Systems

DCD

DCW

DDRS

EBI

Transform

SQL

SQL

SQL

Metrics

OCO

Budget Execution

DoD-Wide Enterprise Business Intelligence

Data Sharing

Reporting

Ad Hoc Query

Knowledge Exploration

EIW from the FM Perspective

Acquisition Domain

Logistics Domain

Human Rsrs Domain

Real Property Domain
Agile, Architecture-Driven, DoD Business Capability Delivery

Governance
Policy, Processes, Tiered Accountability

Model-Data-Implement

Model
Common Architecture Methodology
Common Vocabulary
Standard Representation and Composition
Primitives and Design Patterns

Data
Authoritative Data Sources
Semantic Technologies

Implement
Phased Implementations
Agile Business Services Delivery

Model to Guide Transformation
Data to Improve Performance
Implement to Deliver Capabilities
For the rest of the story!

http://www.commondefensequarterly.com/
Save the Dates: July 13-14, 2011
3rd Annual SOA & Semantic Technology Symposium

More information to come. To be added to the mailing list please contact: Jessica.Zucal.ctr@bta.mil

Waterford at Springfield
6715 Commerce Street
Springfield, VA 22150

See You In July!
Thank you!

Questions?
Dennis.Wisnosky@osd.mil
DoD Semantic Technology 
e-learning modules

Making it easier to find, share, and combine information across DOD Enterprises!!

Business Operations Applications Educational Resources

- Service Oriented Architecture
  - Reviews IT infrastructure in today’s DoD and explains the challenge which SOA addresses, defines SOA, and provides applicable tutorials.

- Semantic Web Technologies
  - Included lessons on Business Enterprise Common Vocabulary, provides general knowledge about Semantic Web capabilities, defines common semantic terminology and identifies key elements necessary for implementation.

DoD Architecture Framework Processes Best-Practice


Coming in 2011

- Demonstrates how ontologies are generated and published.

Courses are developed by the CTO Stakeholder Education team in the
Office of the BMA Chief Architect & CTO
AKO/DKO  CTO Stakeholder Education Community Site

Courses are also available under the
Business Transformation Agency Products and Services