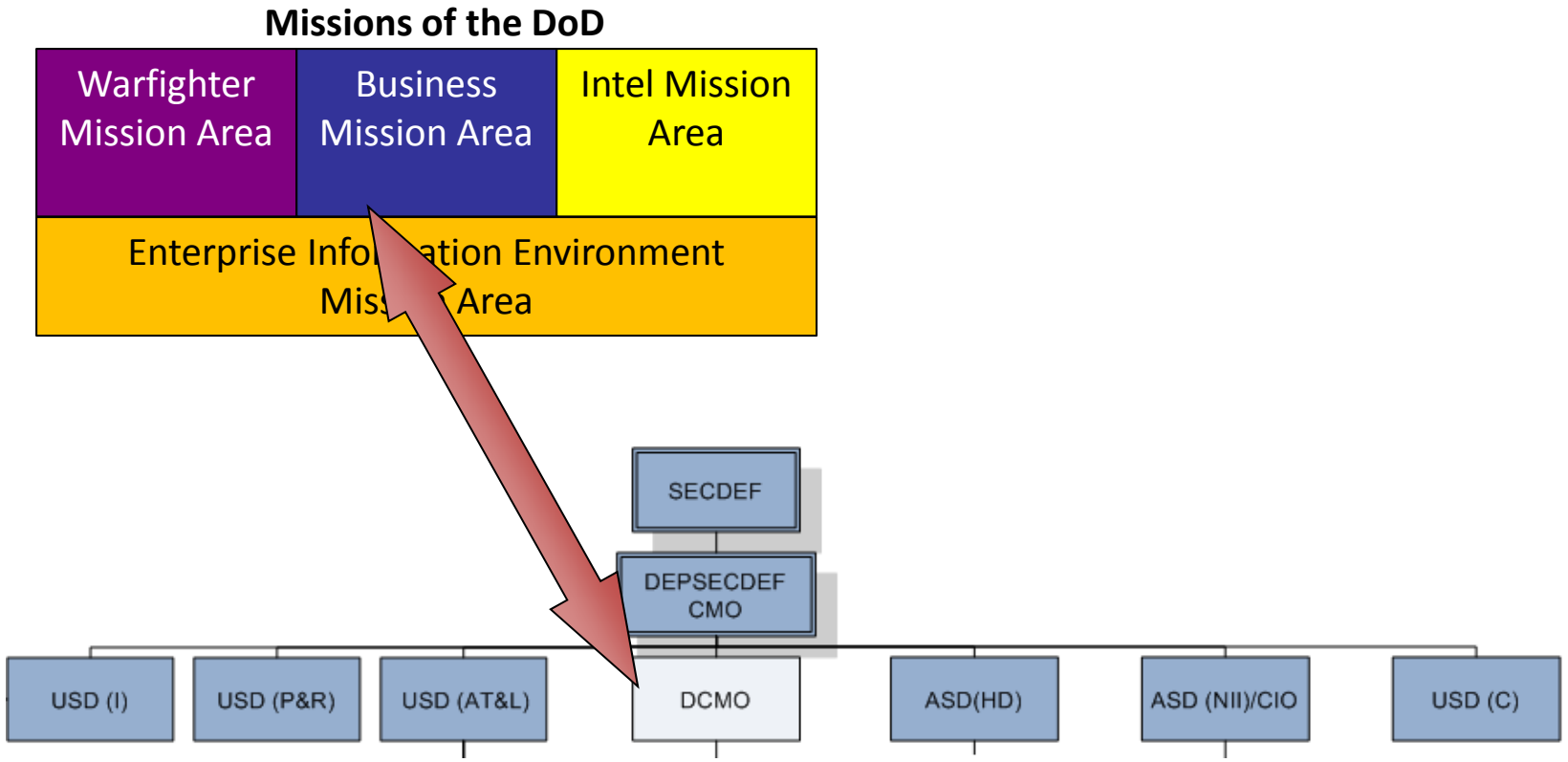
Engineering Enterprise Architecture: Call to Action

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

April 13, 2011

DCMO CTO/CA



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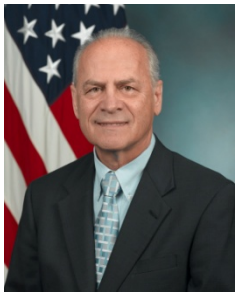
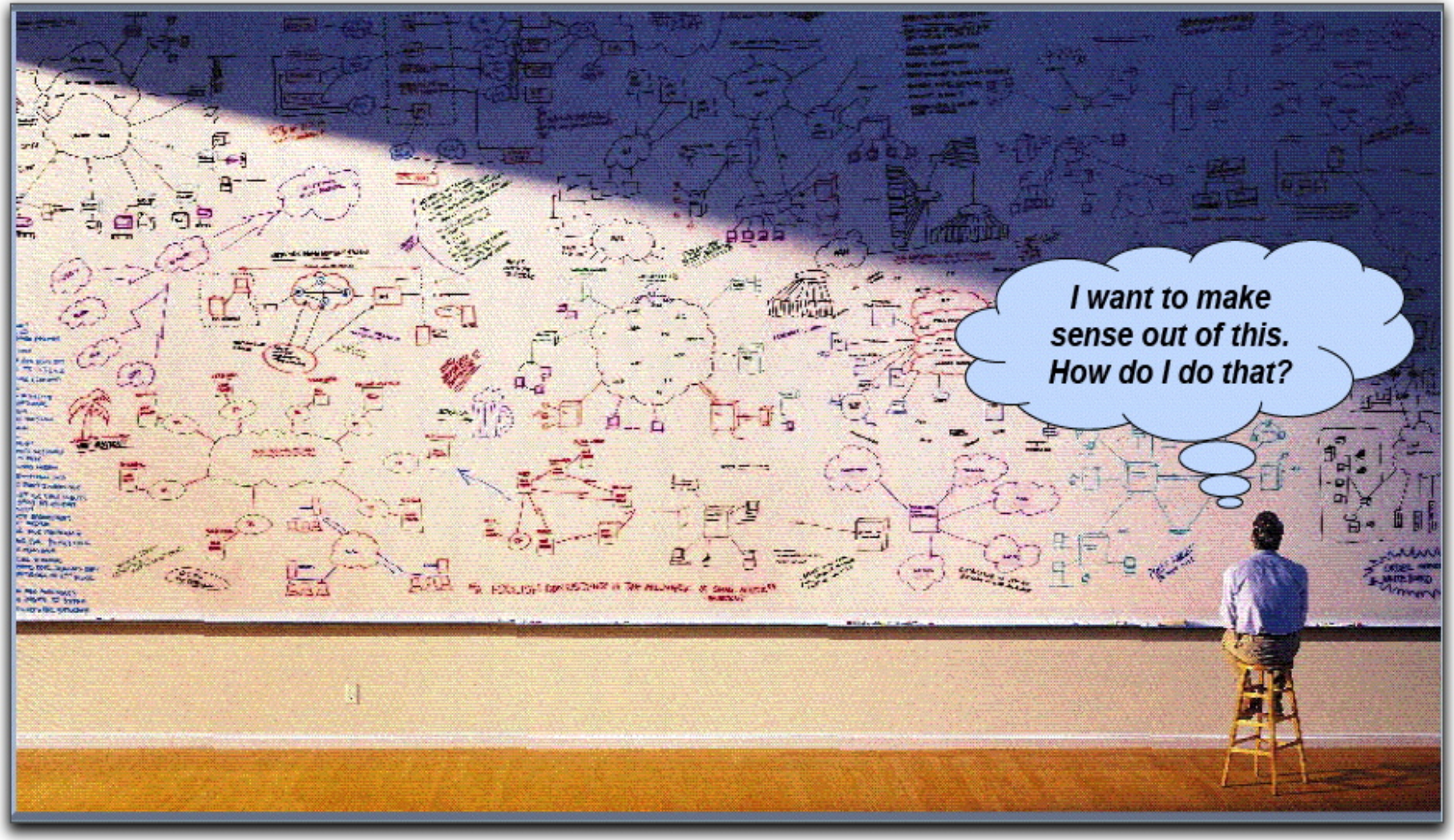
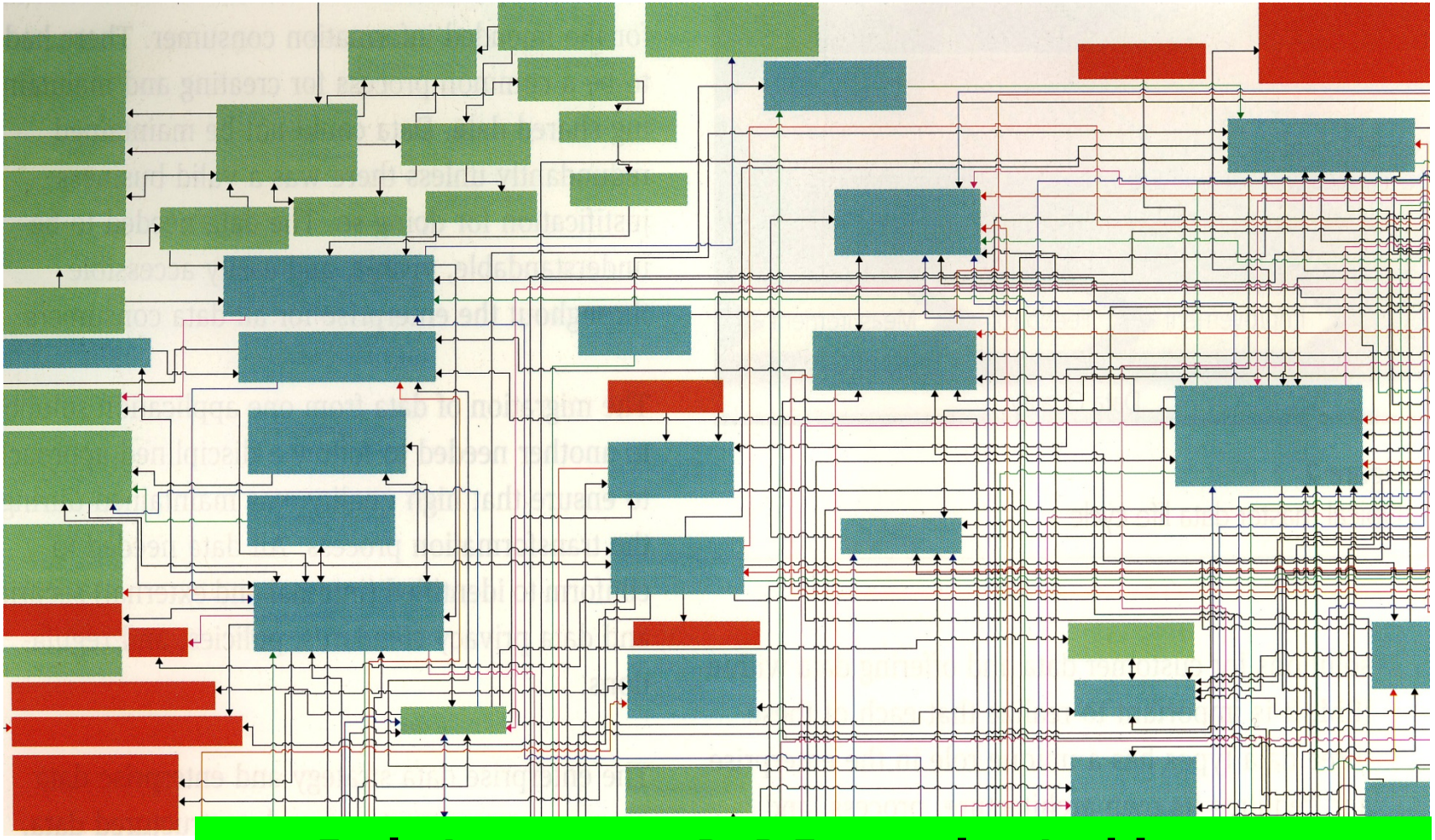


DoD Management Challenges

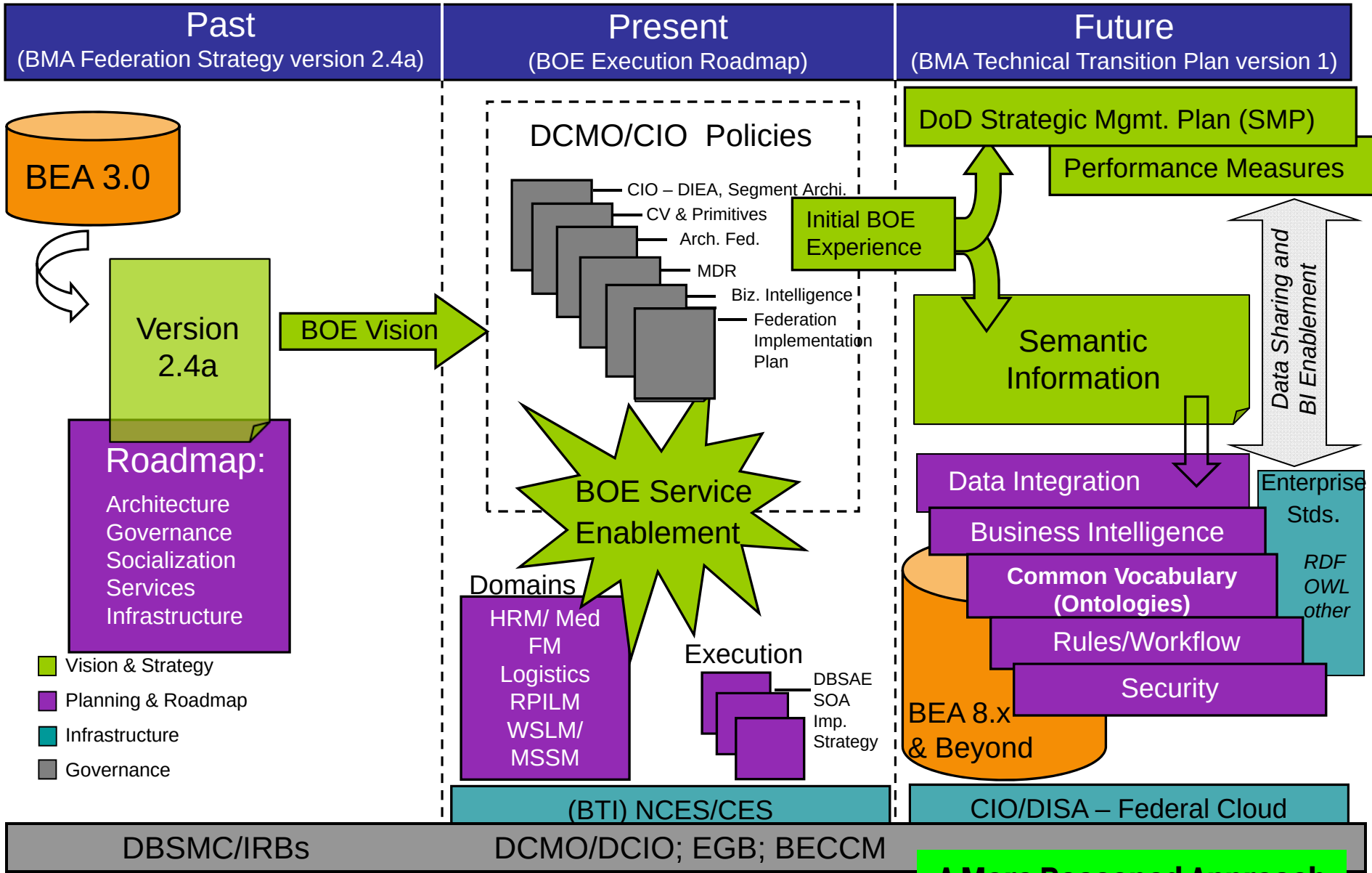


Another View



Early Attempts at DoD Enterprise Architecture

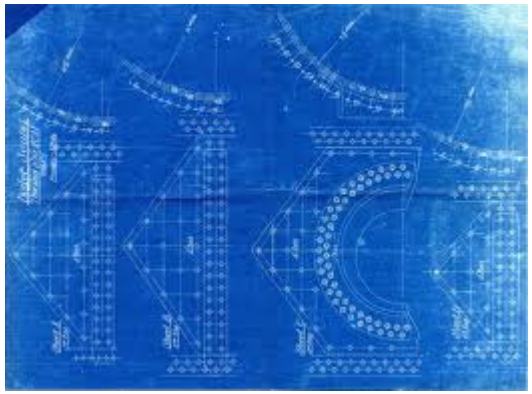
Strategy and Roadmap for DoD Business Operations Transformation

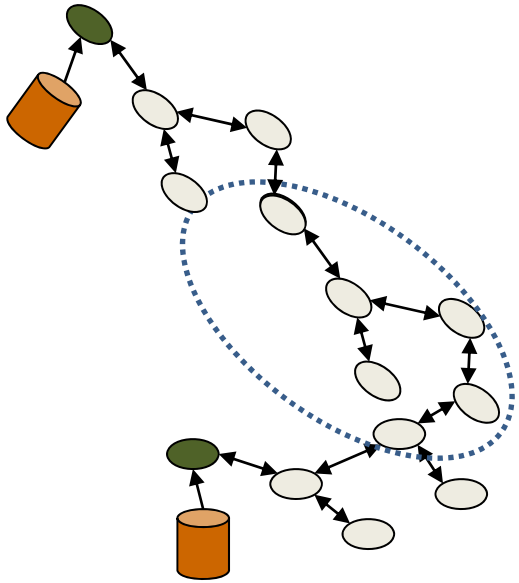


A More Reasoned Approach

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

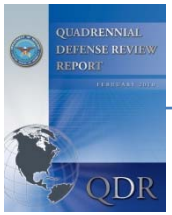
Strategic Objectives

BEA Ontology Semantic Description

Enterprise E2E and OSD Policies

Operational Process and Service Policies

ADS

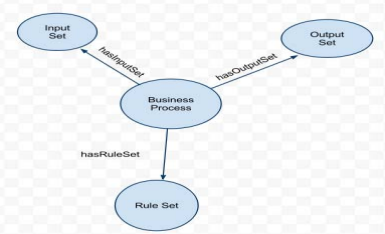


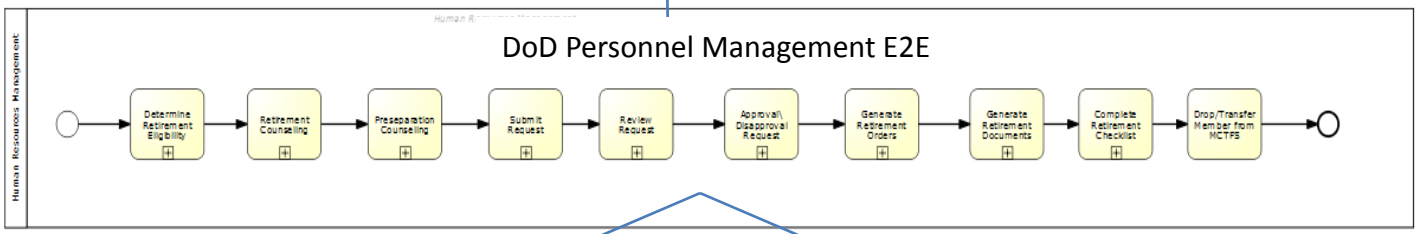
4.0 Preserve and Enhance the All-Volunteer Force

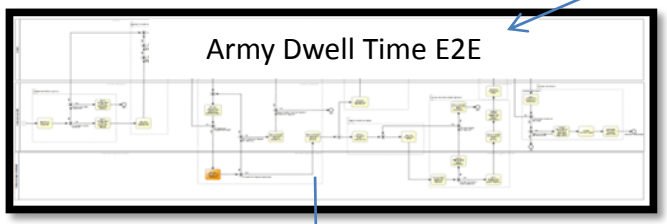
2.0 Support Contingency Business Operations

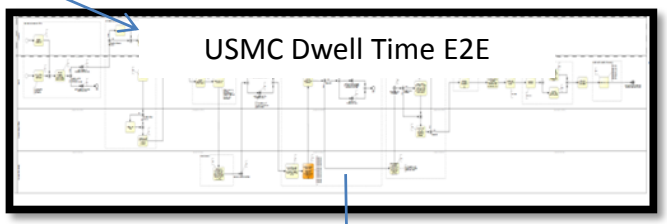
Dwell Time

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







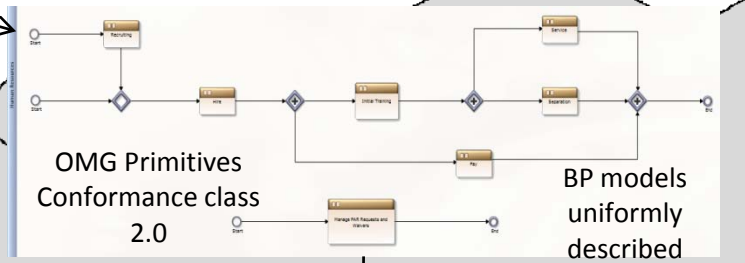


A Vision for DoD Solution Architectures

User executes BP

NCES

DoD EA



OMG Primitives Conformance class 2.0

BP models uniformly described

BP executes via BEA directly

Query BEA *directly*:

- Enterprise analytics
- Compliance
- IRB/portfolio management

Business Enterprise Architecture: BEA

Acq Domain Vocabulary

Real Prop Domain Vocabulary

Log Domain Vocabulary

Fin Domain Vocabulary

HR Domain Vocabulary

Warfighter Domain Vocabulary

SameAs

(EDIPI)

Svc Member

(GFMDI)

OUID

Airman

Sailor

position

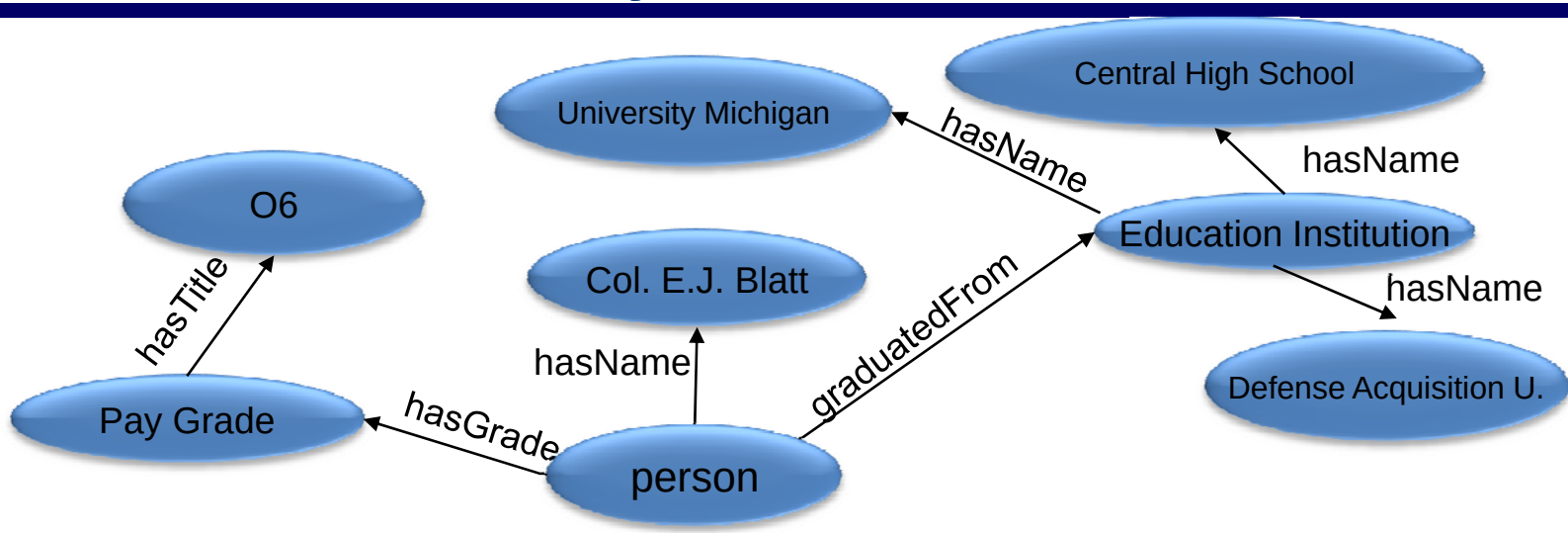
billet

dept

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

Ontology – Based Information Integration & Analytics

HR Dataset



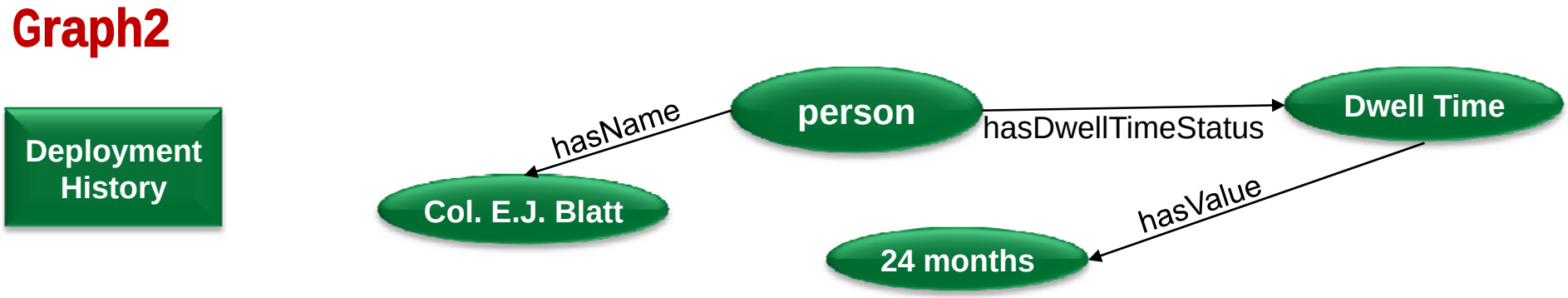
Graph1

What Pay Grade is Col. Blatt?

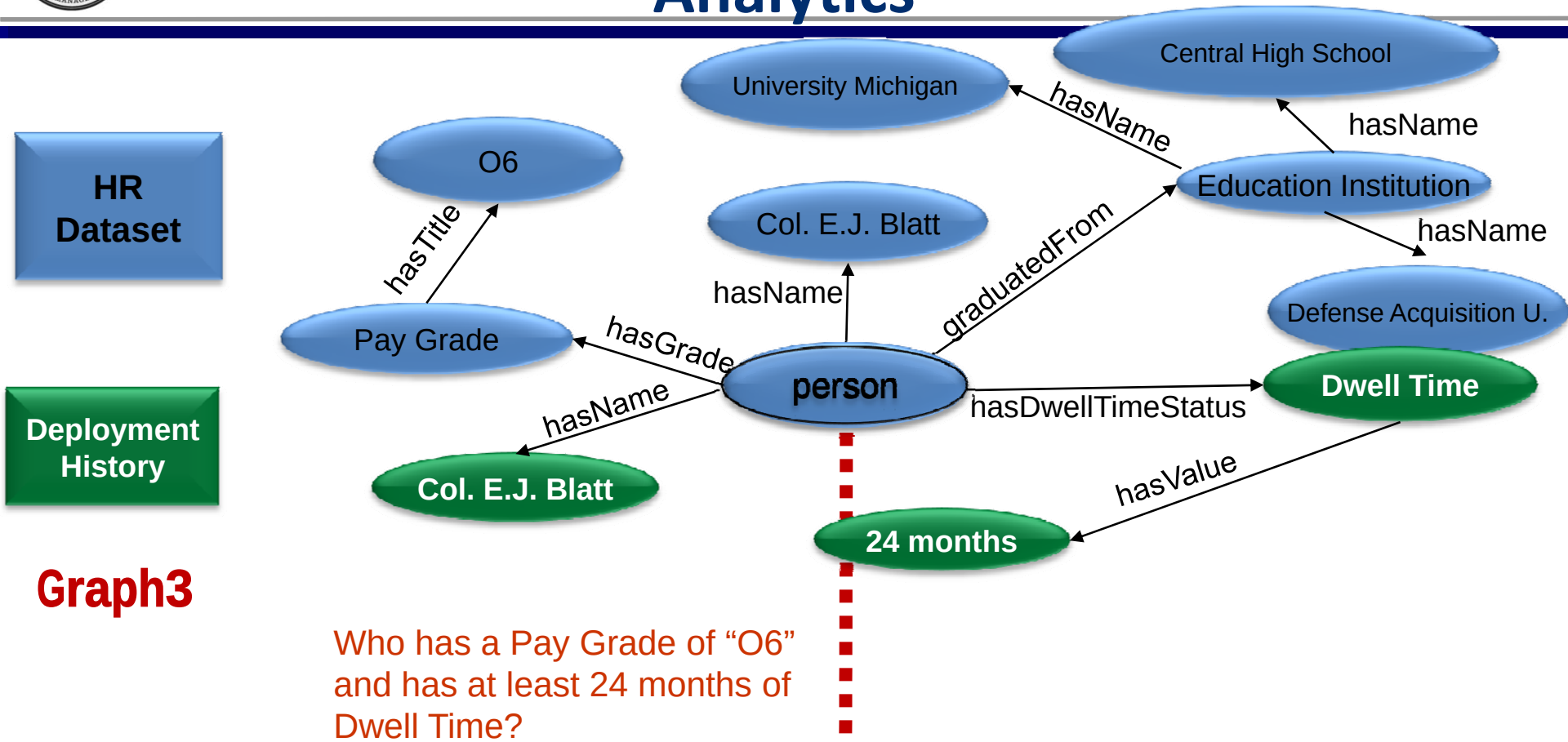
An Aha Moment

Ontology – Based Information Integration & Analytics

How much Dwell Time does Col. Blatt have?



Ontology – Based Information Integration & Analytics



57% of DoD I.T. Costs are in Infrastructure

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

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

Issue: Infrastructure

DoD Contractors Build Separate Infrastructures & Dictionaries

Issue: Redundancy

DoD Projects Have Own Data

Projects	07 Budget $ Millions	Number of Projects	% of Total Budget $	% of Projects
Project - > $100 Million	$10,301	43	33.9%	1.3%
Projects - > $10 Million	$15,013	525	49.4%	15.4%
Projects - < $10 Million	$5,066	2,832	16.7%	83.3%
Total	$30,380	3,400	100.0%	100.0%

$ Billions	FY05	FY06	FY07
Total DoD I.T. Spending	$28.7	$29.9	$30.4
DoD Spending on Contractors	$21.1	$22.6	$24.1
% of I.T. Spending Contracted Out	73.5%	75.6%	79.3%

Issue: Data

There is an Economic Imperative!

Standards-based Architecture - Primitives

Standard Symbols

Engineering Language and Symbols:

Resistor symbol

Capacitor symbol

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

- 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

Architecture Primitives

Standards
Best Practices

informed by

influences

PriMo
Modeling Guide

foundation for

PrOnto
Ontology (Lexicon)

input for

Different Frameworks

Architecture Primitives

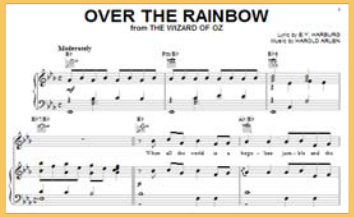
Other Disciplines can do it!

Music Language and Symbols:

Music Scale symbols

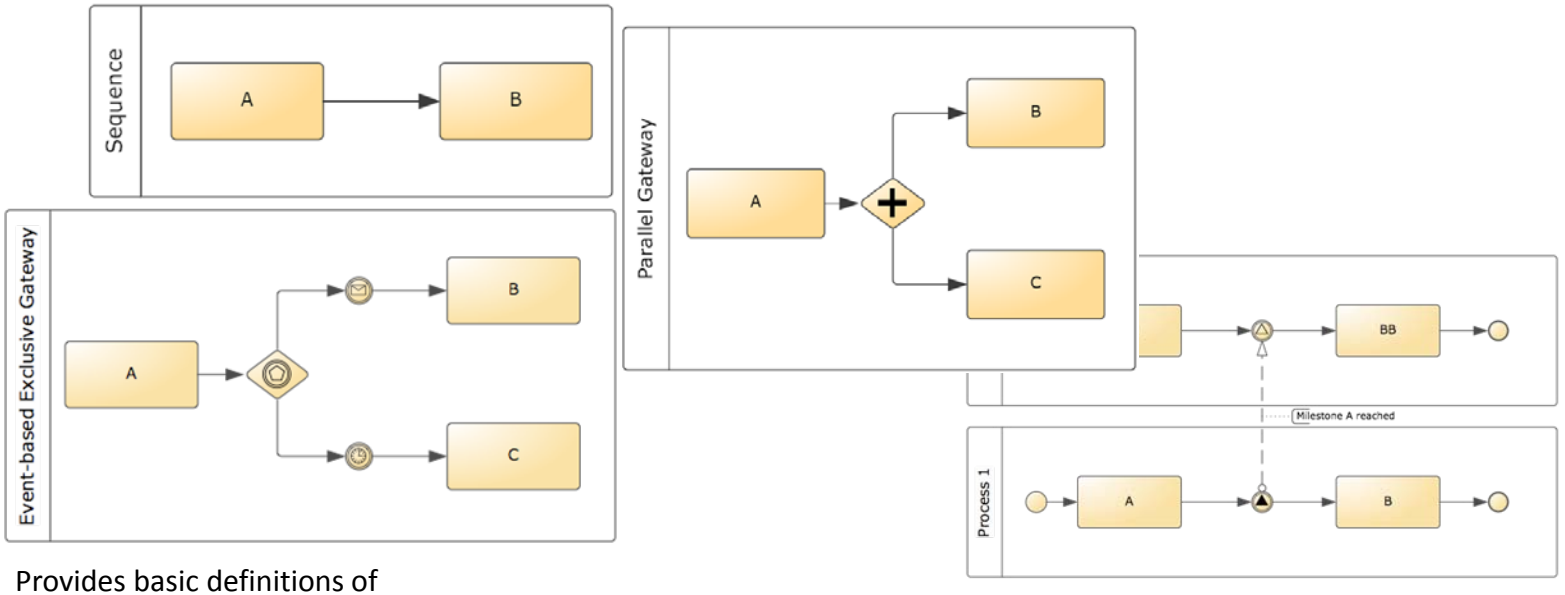
Notes symbols

This agreed upon representation of music allows a common understanding…



Standard Language (terms and definitions)

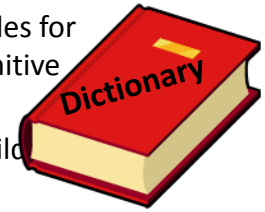
Primitives to Patterns

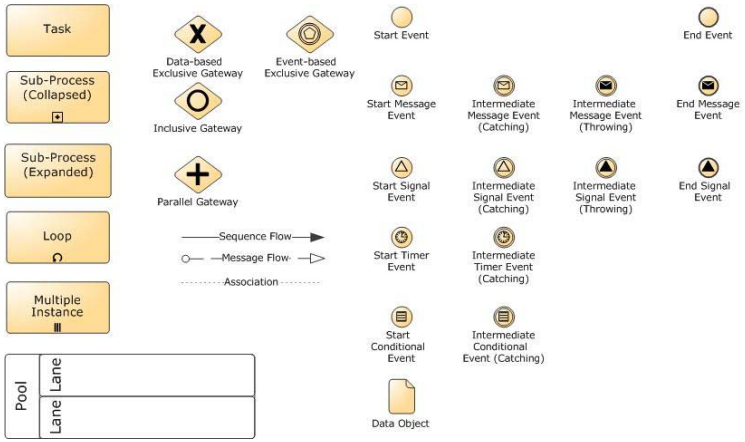


PriMo

- 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

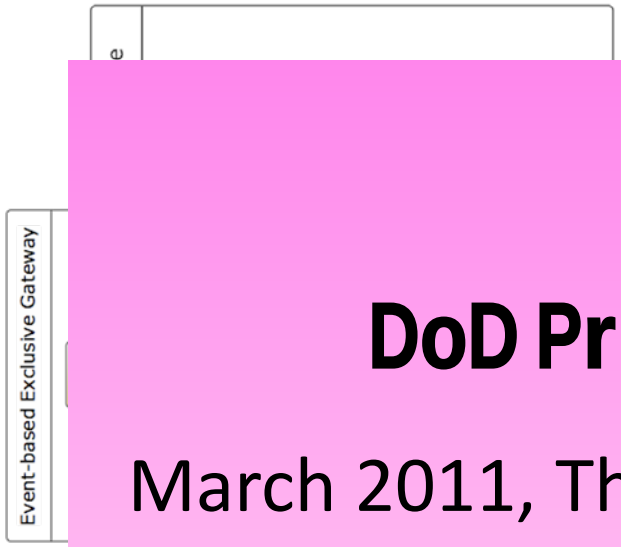
PrOnto





- 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

Primitives to Patterns



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.

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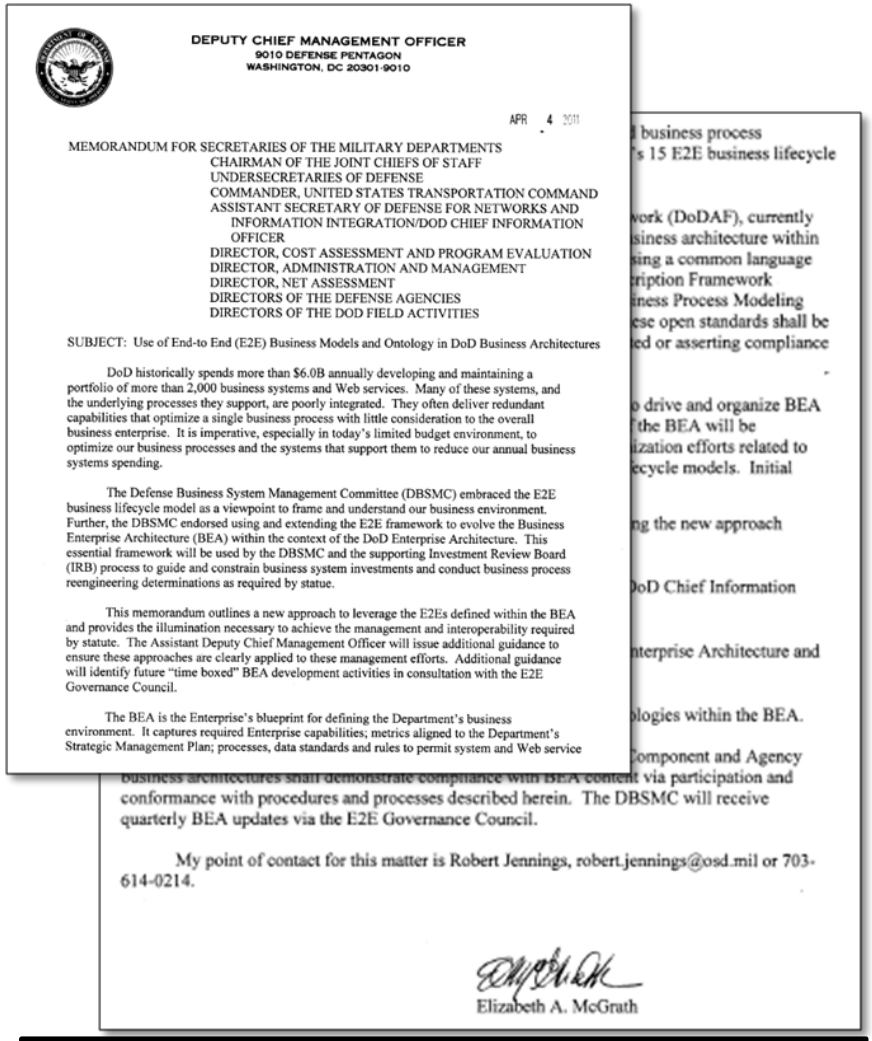
We Are Underway!

And that's not all

End-to-End (E2E) Business Models in the DoD Business Architecture



DEPUTY CHIEF MANAGEMENT OFFICER
9010 DEFENSE PENTAGON
WASHINGTON, DC 20301-9010

APR 4 2011

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS
CHAIRMAN OF THE JOINT CHIEFS OF STAFF
UNDERSECRETARIES OF DEFENSE
COMMANDER, UNITED STATES TRANSPORTATION COMMAND
ASSISTANT SECRETARY OF DEFENSE FOR NETWORKS AND INFORMATION INTEGRATION/DOD CHIEF INFORMATION OFFICER
DIRECTOR, COST ASSESSMENT AND PROGRAM EVALUATION
DIRECTOR, ADMINISTRATION AND MANAGEMENT
DIRECTOR, NET ASSESSMENT
DIRECTORS OF THE DEFENSE AGENCIES
DIRECTORS OF THE DOD FIELD ACTIVITIES

SUBJECT: Use of End-to End (E2E) Business Models and Ontology in DoD Business Architectures

DoD historically spends more than $6.0B annually developing and maintaining a portfolio of more than 2,000 business systems and Web services. Many of these systems, and the underlying processes they support, are poorly integrated. They often deliver redundant capabilities that optimize a single business process with little consideration to the overall business enterprise. It is imperative, especially in today's limited budget environment, to optimize our business processes and the systems that support them to reduce our annual business systems spending.

The Defense Business System Management Committee (DBSMC) embraced the E2E business lifecycle model as a viewpoint to frame and understand our business environment. Further, the DBSMC endorsed using and extending the E2E framework to evolve the Business Enterprise Architecture (BEA) within the context of the DoD Enterprise Architecture. This essential framework will be used by the DBSMC and the supporting Investment Review Board (IRB) process to guide and constrain business system investments and conduct business process reengineering determinations as required by statue.

This memorandum outlines a new approach to leverage the E2Es defined within the BEA and provides the illumination necessary to achieve the management and interoperability required by statute. The Assistant Deputy Chief Management Officer will issue additional guidance to ensure these approaches are clearly applied to these management efforts. Additional guidance will identify future "time boxed" BEA development activities in consultation with the E2E Governance Council.

The BEA is the Enterprise's blueprint for defining the Department's business environment. It captures required Enterprise capabilities; metrics aligned to the Department's Strategic Management Plan; processes, data standards and rules to permit system and Web service

business process
's 15 E2E business lifecycle

work (DoDAF), currently
siness architecture within
sing a common language
ription Framework
ness Process Modeling
ese open standards shall be
ed or asserting compliance

o drive and organize BEA
the BEA will be
ization efforts related to
ecycle models. Initial

ng the new approach

DoD Chief Information

nterprise Architecture and

logies within the BEA.

Component and Agency
via participation and
conformance with procedures and processes described herein. The DBSMC will receive quarterly BEA updates via the E2E Governance Council.

My point of contact for this matter is Robert Jennings, robert.jennings@osd.mil or 703-614-0214.

Elizabeth A. McGrath

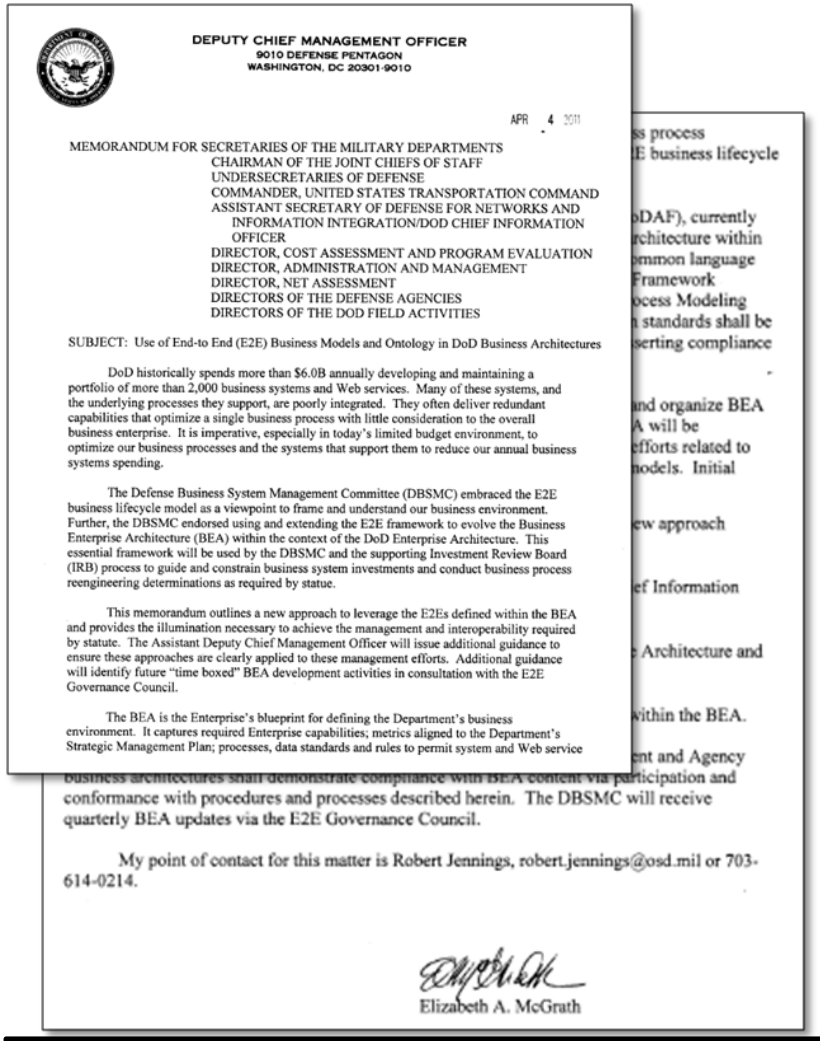
DCMO Memo signed 4 April 2011

Subject: 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

Clear and Unambiguous Guidance

End-to-End (E2E) Business Models in the DoD Business Architecture



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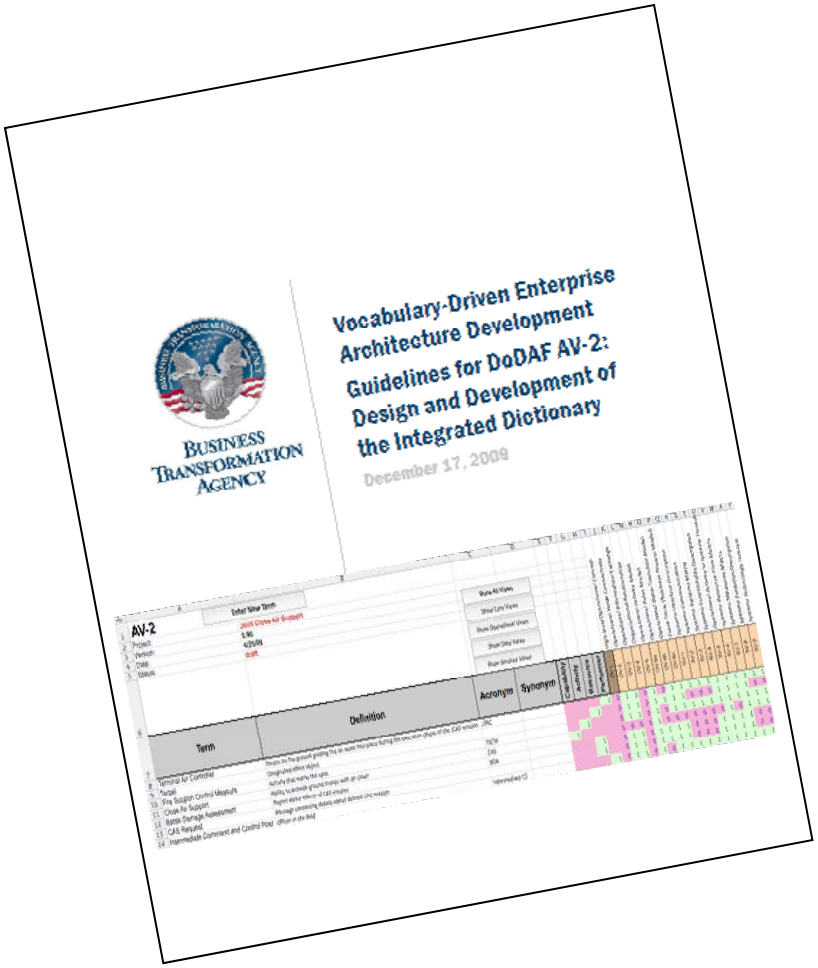
DCMO Memo signed 4 April 2011

Subject: 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

Architecture Primitives Series



DoD Architecture Framework Processes Best-Practice

http://cio-nii.defense.gov/sites/dodaf20/journal_exp3.html

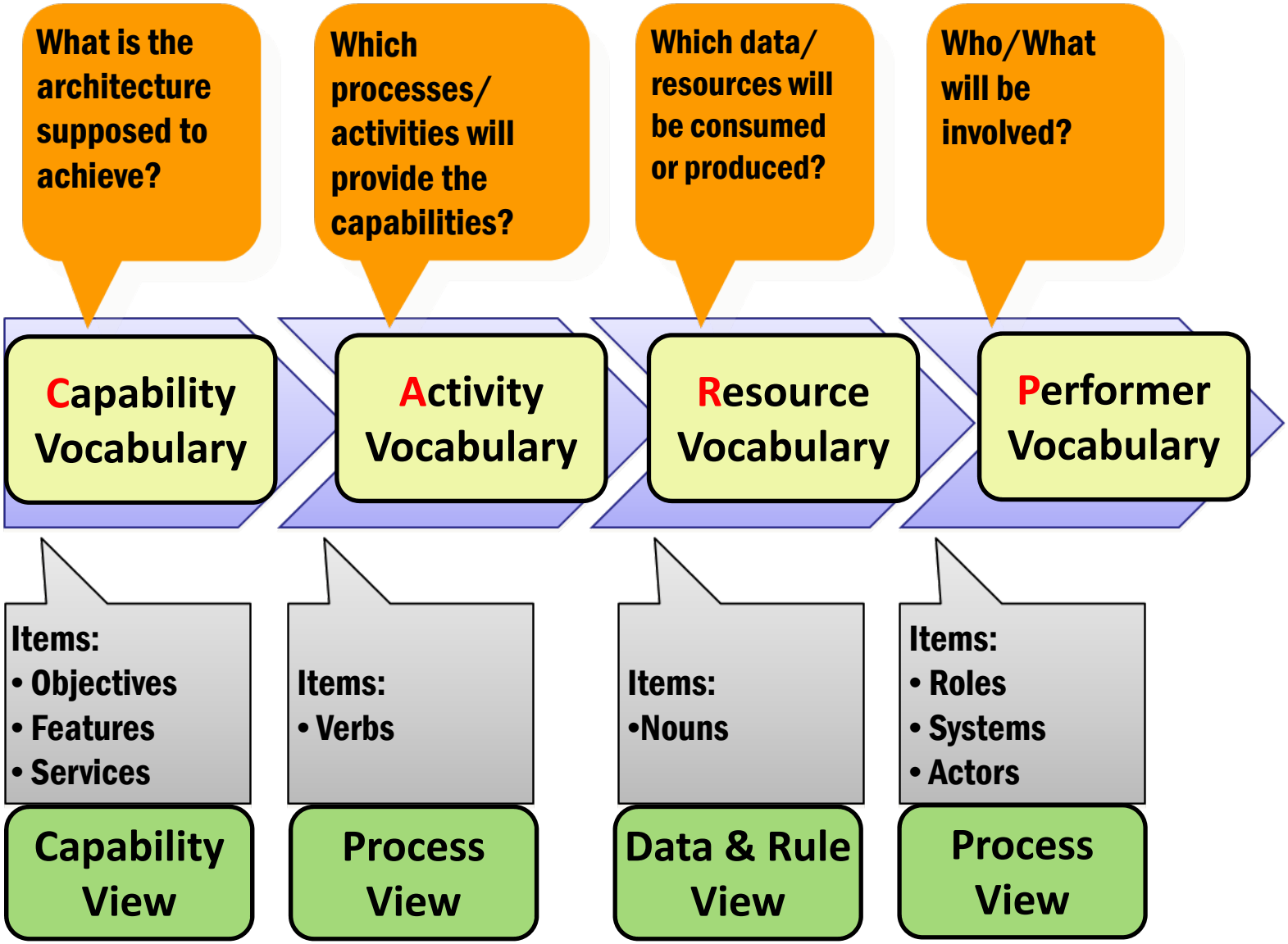
Clear and Unambiguous Instructions

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



Department of Defense Enterprise Information Web (EIW)

Leading by Example

Bottom Line Up-Front (BLUF)

- 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

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

Post-DIMHRS Personnel Visibility Problem Persists	
Personnel Visibility	**Interoperability/Federation**
DoD currently lacks the enterprise level capability to quickly and accurately account for personnel, manage troop strength, and plan	• **Standards & transactional systems in constant state of change** • **Relationally-based architectures expensive to change/maintain**

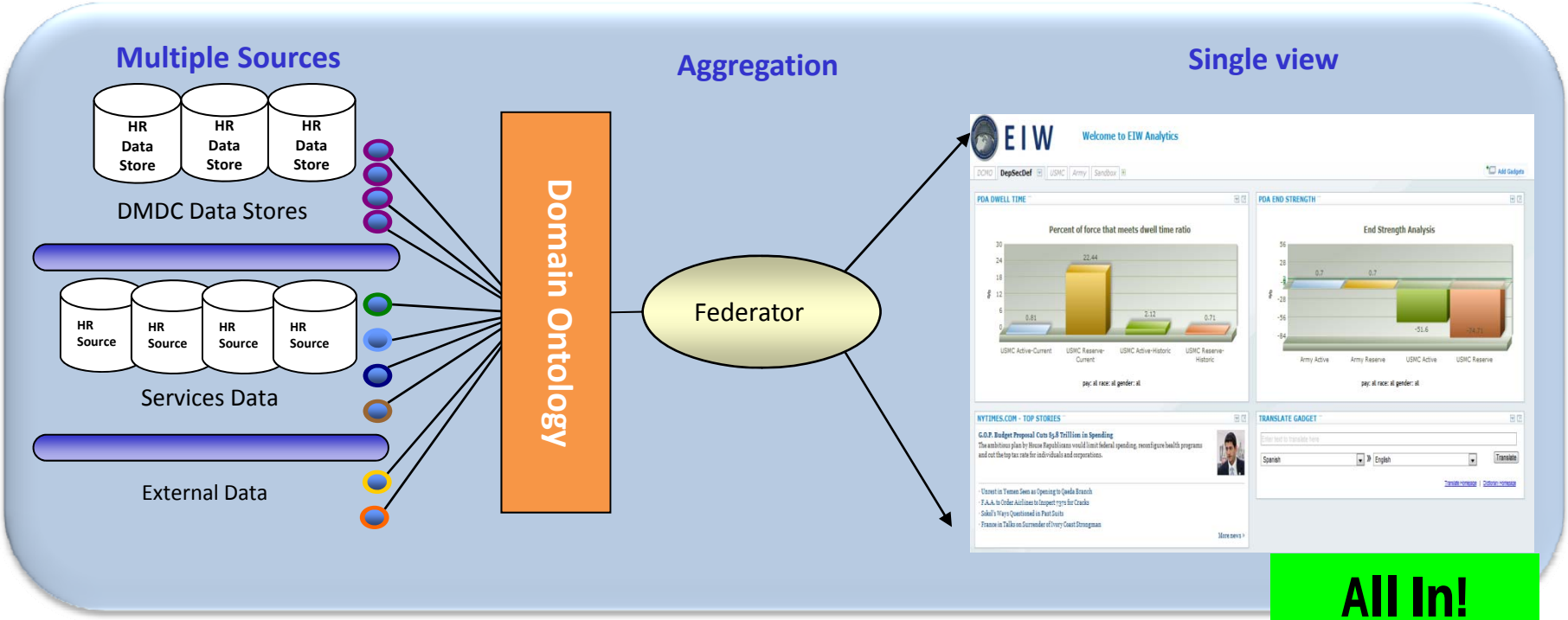
Alternatives Considered

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

New Approach to Personnel Visibility (PV)

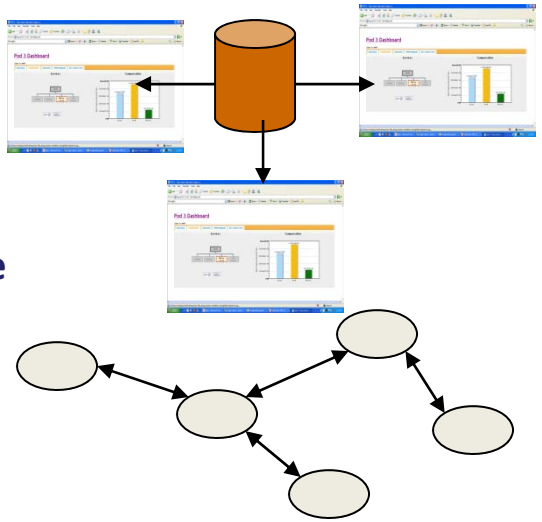
The HR Enterprise Information Web (EIW) is a mechanism for reaching into Authoritative Data Sources (ADS) to satisfy enterprise information needs. It accomplishes three things:

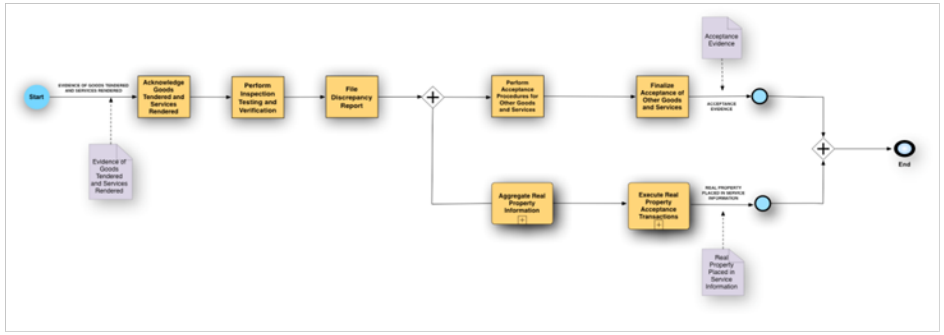
1. **Reports near real-time, authoritative information on-demand**
2. **Supports enterprise information standards (Open; HRM ES)**
3. **Supports IT flexibility/agility**



EIW Benefits

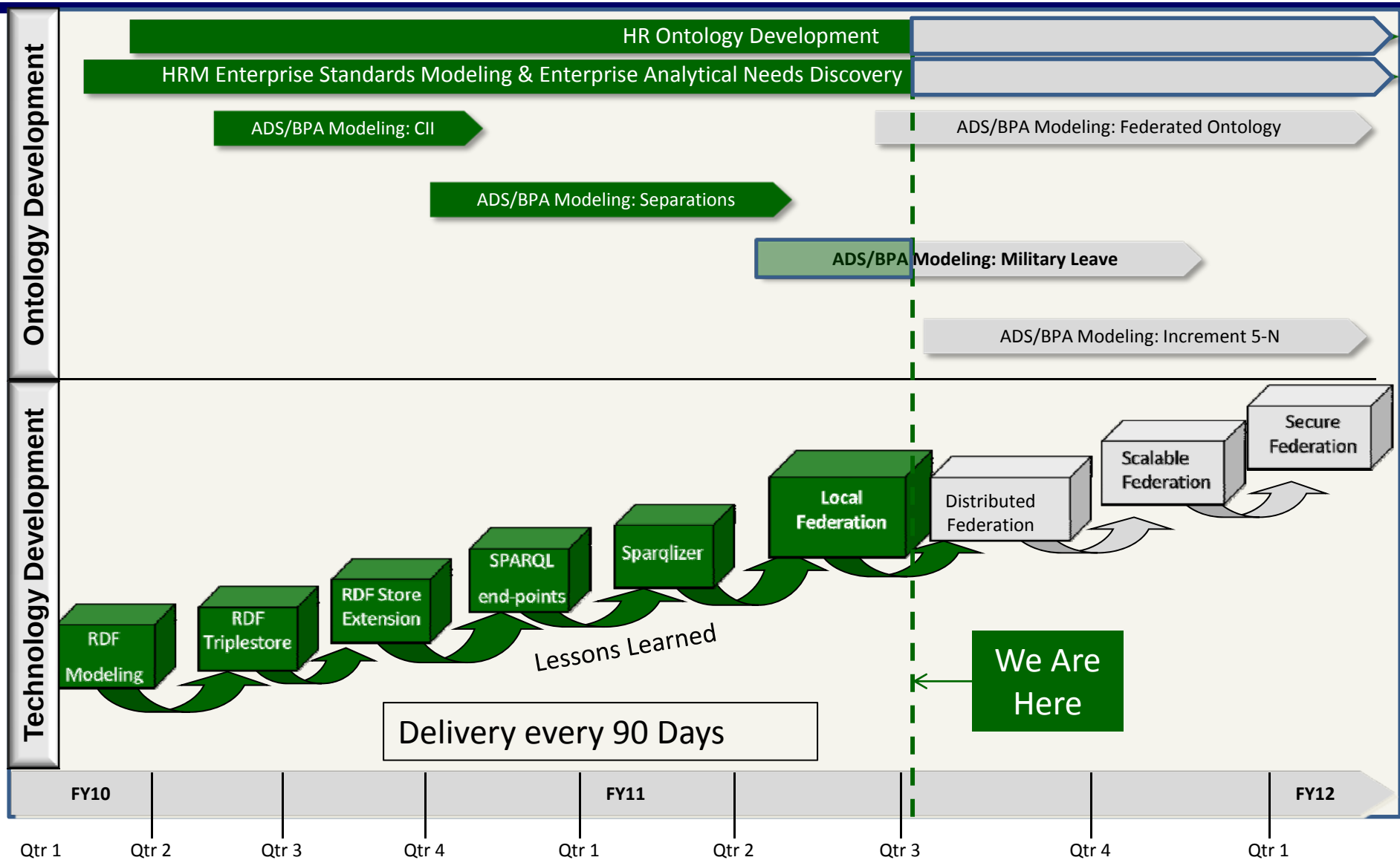
- **Visibility**: pull & display (vice store!) enterprise information directly from the authoritative data sources
- **Agility**: plug-and-play federated environment so new systems or analytical needs can come online and go offline without disrupting the overall environment
- **Access**: build federation 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





Dramatic Benefits

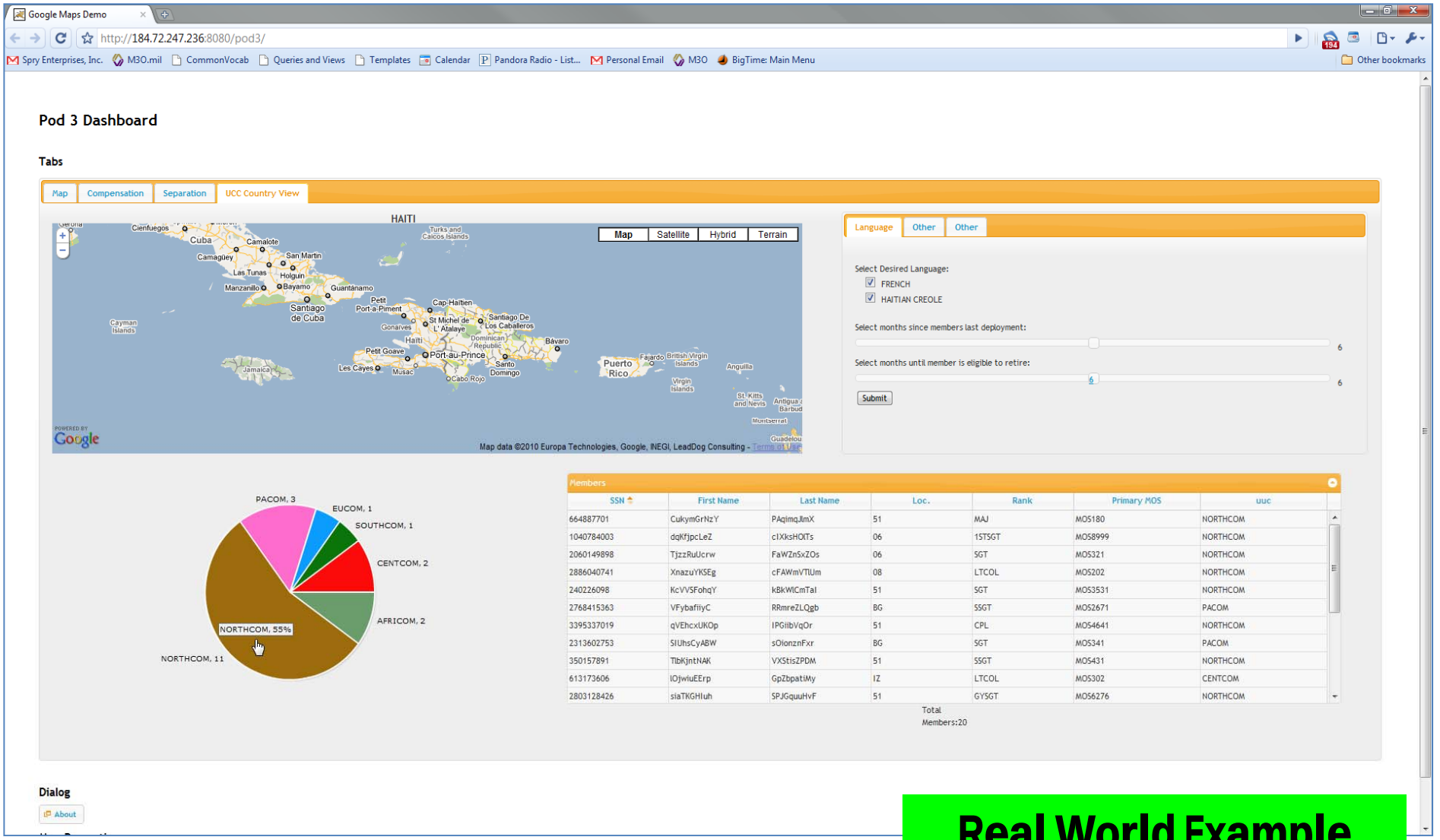
EIW Roadmap: Phased Approach



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

Crawl, Walk, Run

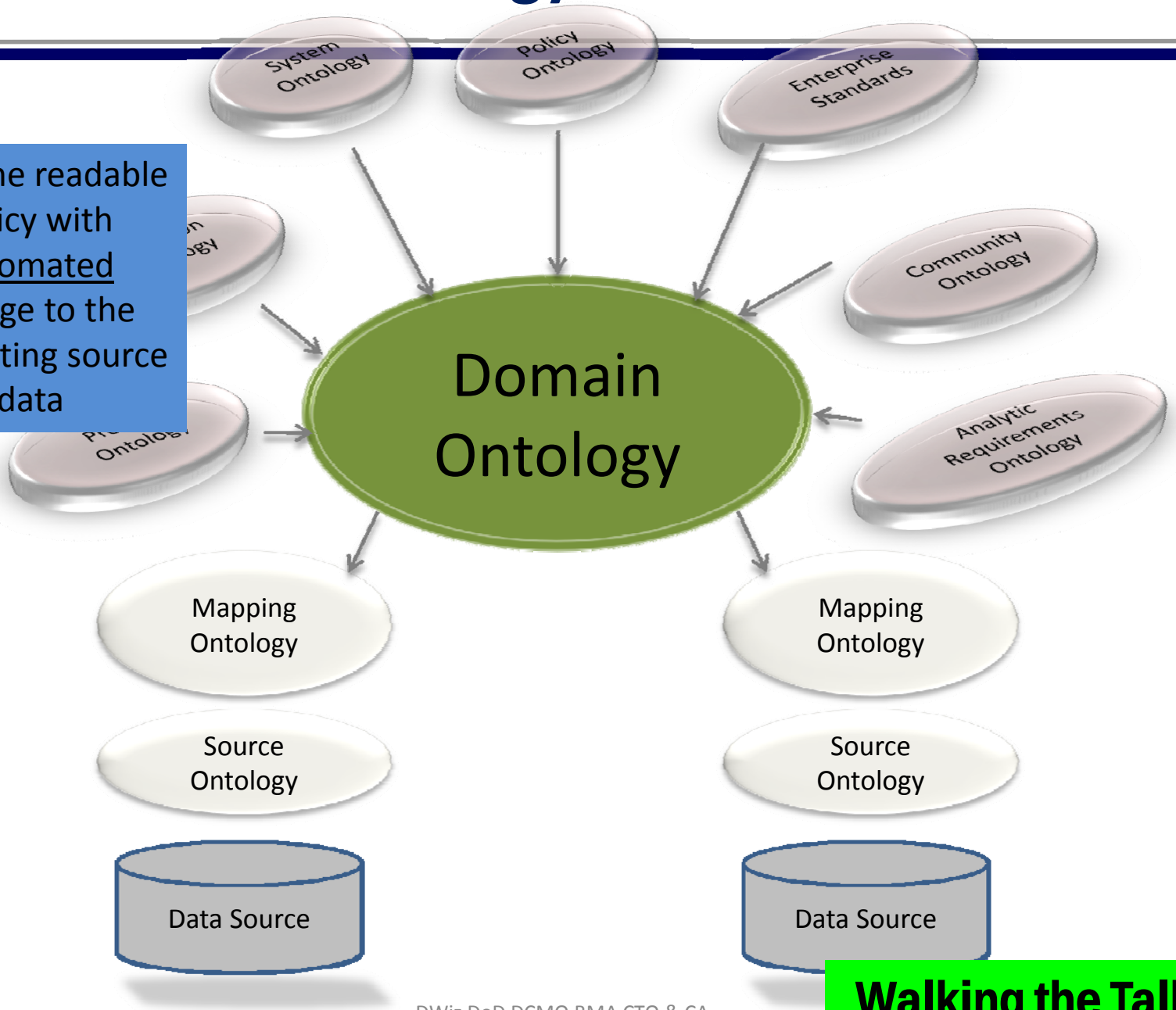
Operations – Country View: User Defined Query



Real World Example

EIW Ontology Architecture

Machine readable policy with <u>automated</u> lineage to the supporting source data

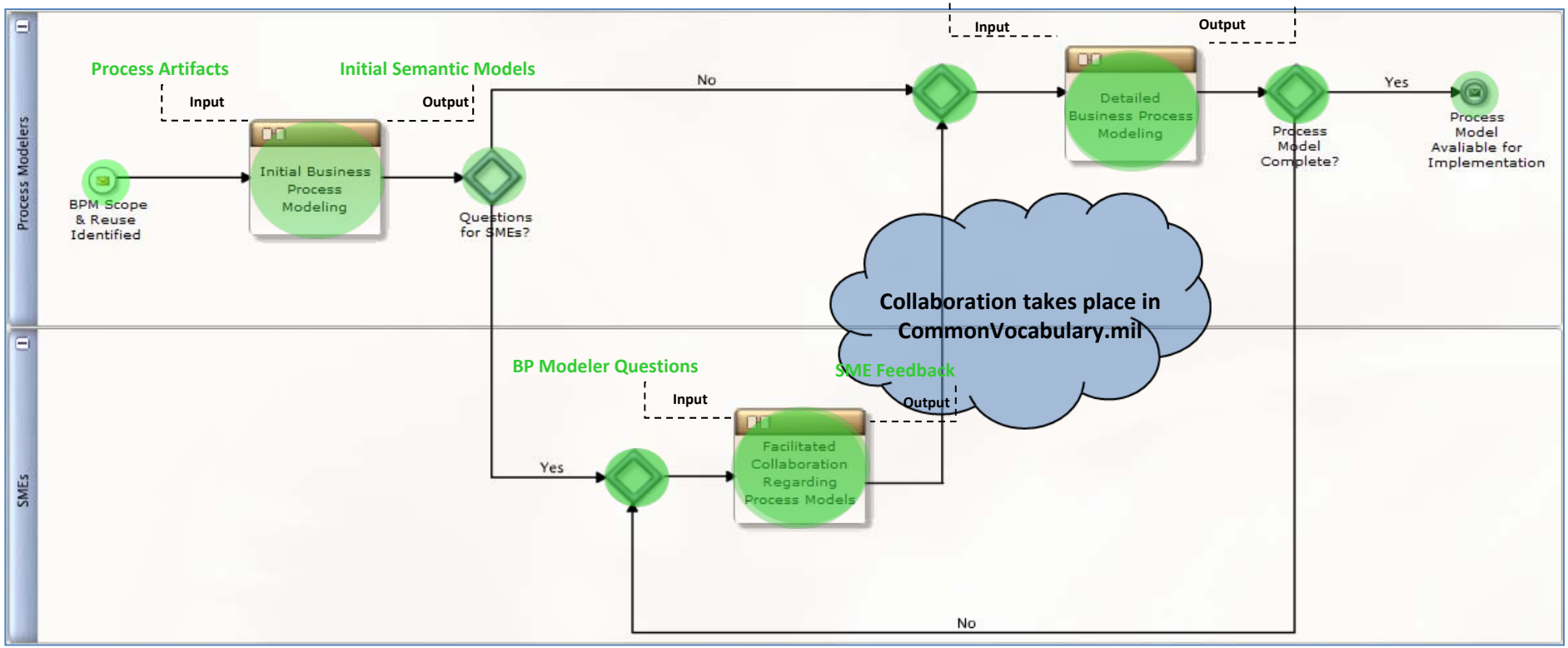


Walking the Talk

BPM Methodology

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

Approach:



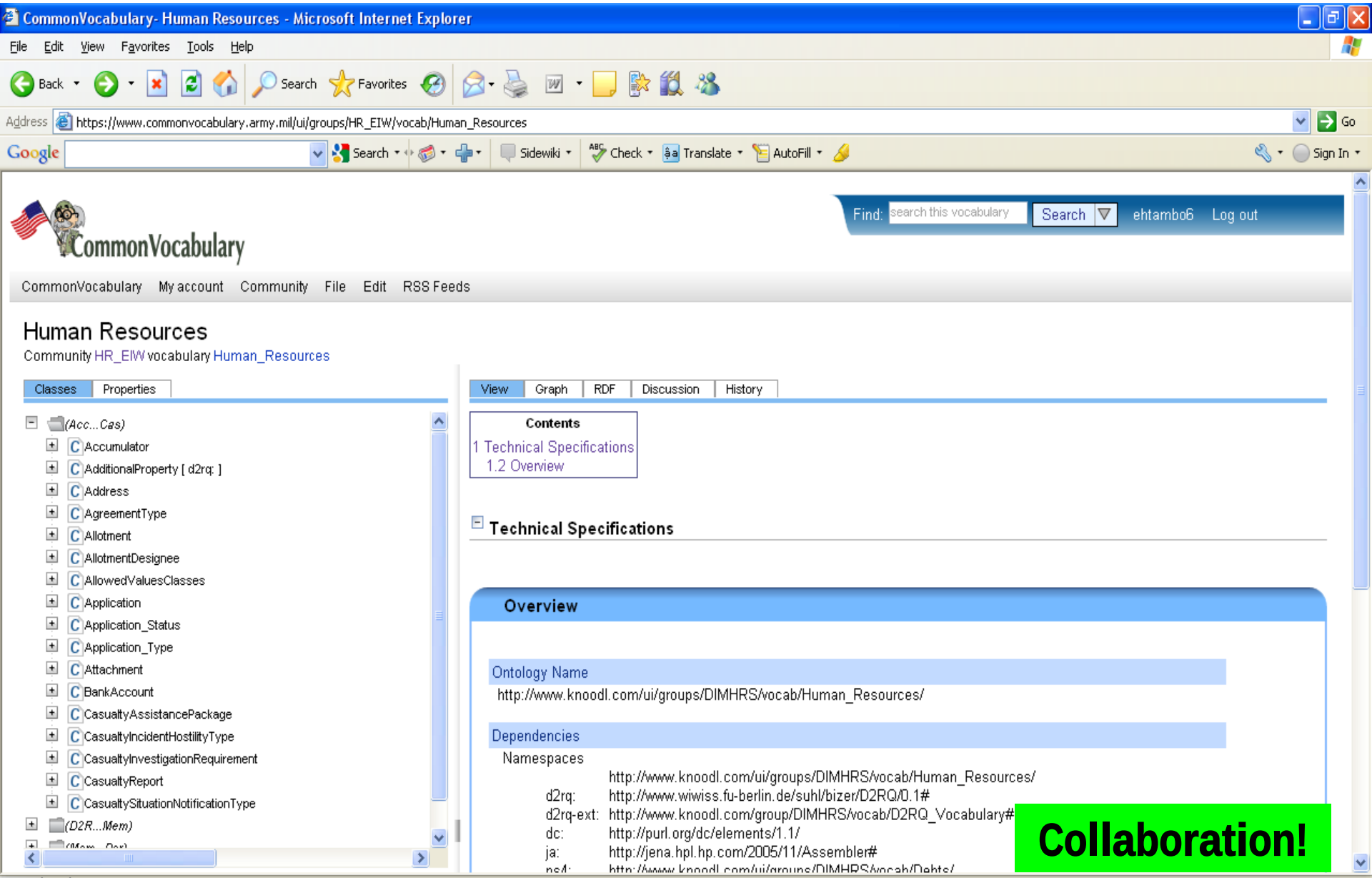
Benefits:

- 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

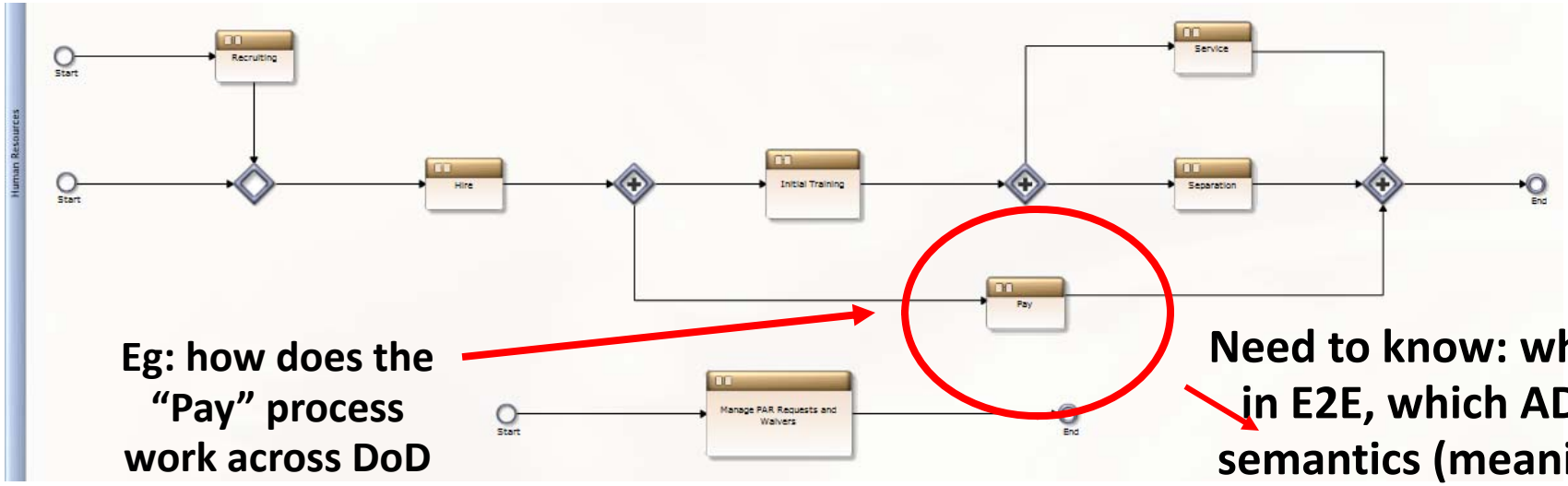
Community Workspace: www.Common Vocabulary.army.mil

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

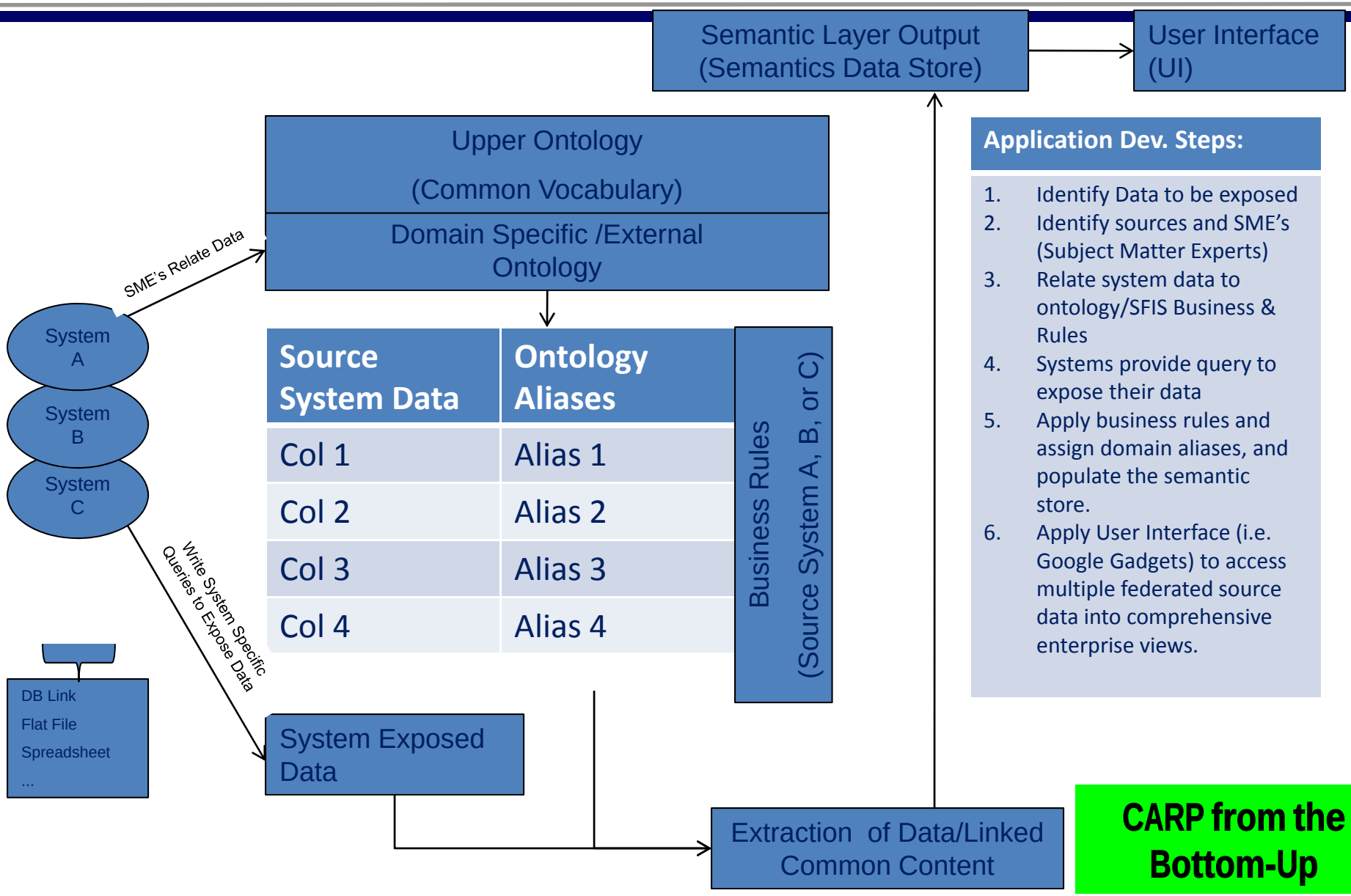


Eg: how does the "Pay" process work across DoD in the E2E?

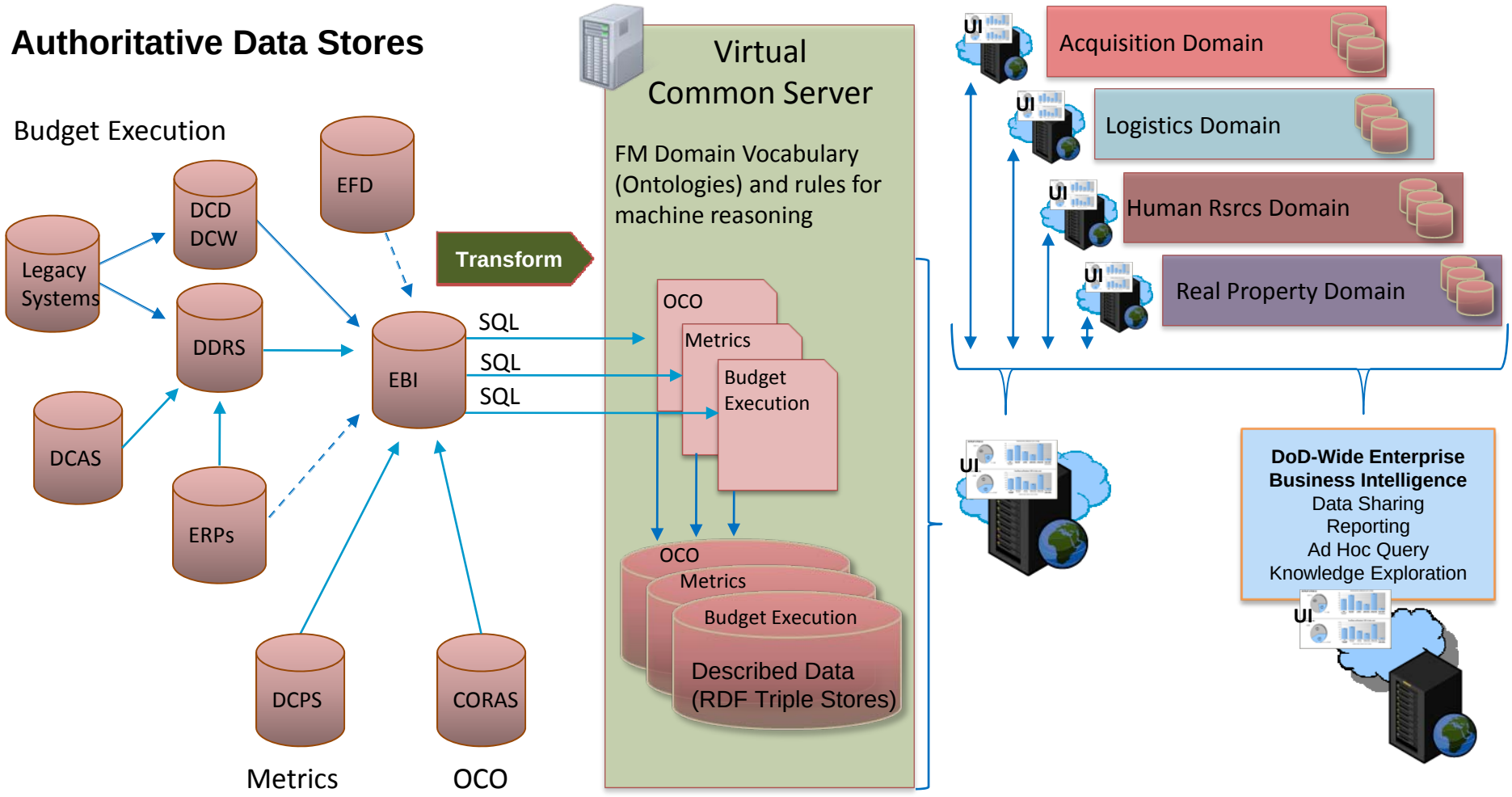
Need to know: where in E2E, which ADS, semantics (meaning) of data, and access

The E2E Informs the the Ontology

Semantic Development Approach

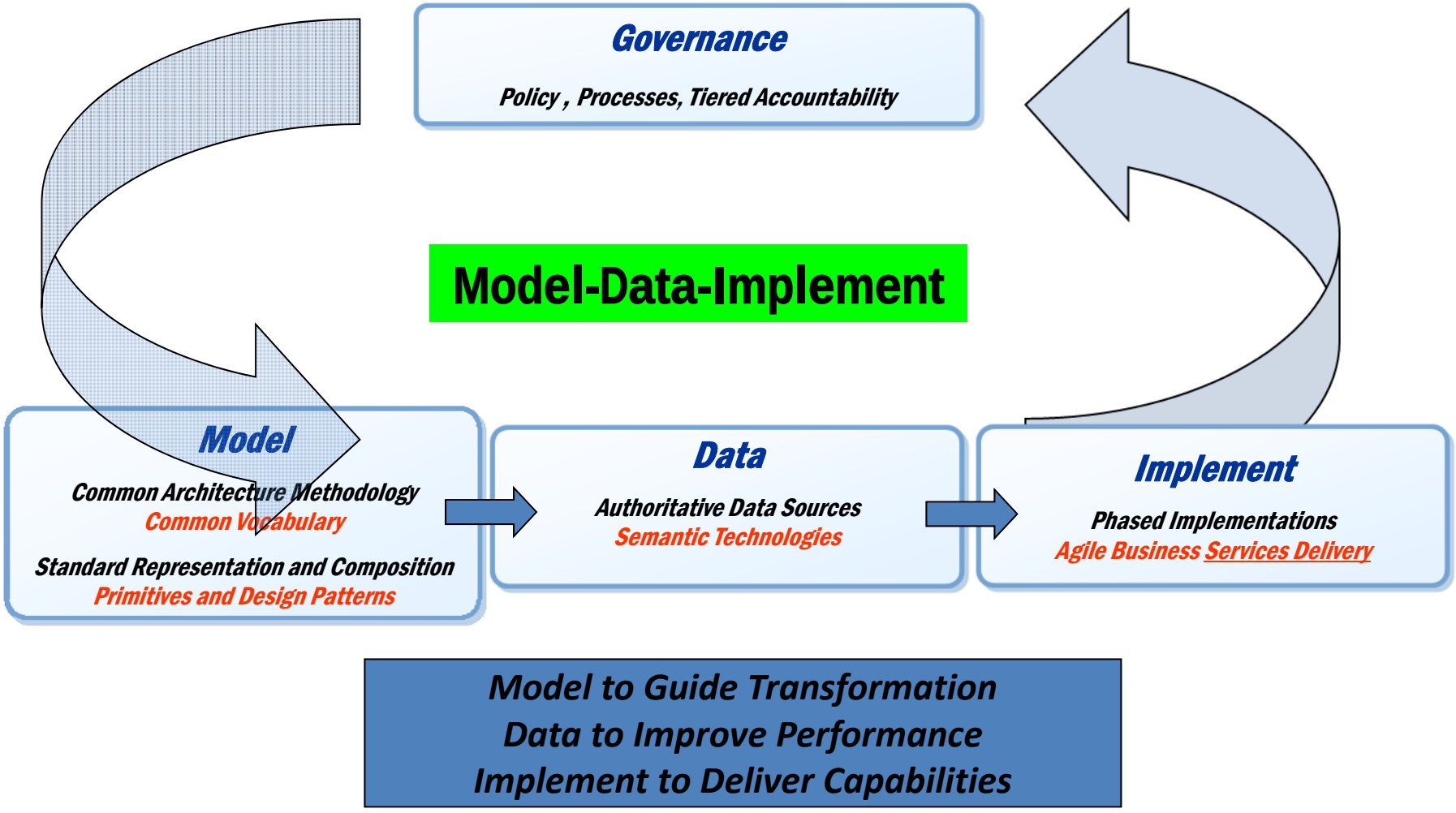


Financial Management Domain



EIW from the FM Perspective

Agile, Architecture-Driven, DoD Business Capability Delivery



For the rest of the story!

Spring 2011

Common Defense Quarterly Spring Issue Index

Policy

Engineering Enterprise Architecture: Call to Action

By Dennis Wisnosky

There are a plethora of Enterprise Architecture (EA) frameworks, methodologies, tools, views, languages, approaches and 'standards'. There are over thirty years of accumulated detritus with respect to how to build an EA, yet there are no accepted best practices. There is no underlying engineering discipline or mathematics. Instead, an EA is viscerally good or bad, useful or not. When two Architects cannot agree on a framework or a methodology, often a third one is born. When a community does reach agreement, the result is a stovepipe that itself is isolated from other communities.

Why would we not want every Enterprise Architect be able to read and understand the meaning of any Enterprise Architecture? Why would we not want computers to be able to execute the End to End Business Process Models that EA can represent?

Background: The DoD Business Enterprise Architecture (BEA) provides a blueprint for DoD business operations prescribed by the Department of Defense Architecture Framework (DoDAF). The purpose of the BEA is to provide defense business system owners and program managers with the information they need to make informed decisions in support of the Department; which in turn supports our Warfighter by ensuring that the right capabilities, resources and material are delivered to them when they need it, where they need it, anywhere in the world.

More specifically, the BEA guides and constrains implementation of interoperable defense business system solutions and guides information technology investment management to align with strategic business capabilities. The BEA outlines and defines the Department's business transformation priorities, the business capabilities required to support those priorities, and the combinations of enterprise systems and initiatives that enable those capabilities.

Point: The BEA is a big deal! It is significant in purpose, cost, man power and maintenance. It is also one of many architectures within the Department. The components, Army, Navy, Air Force, Marine Corps etc… have their own architectures, and these architectures must comply and federate with the BEA.

Issue: While the DoDAF provides the framework or views from which to build architecture, it does not prescribe a standard methodology of how to model the architecture within the views. This lack of a common standard means that the same work is being done over and over again. Certified Enterprise Architects cannot understand one another's work; and if enterprise architectures (EA's) cannot be read by anyone but the people and programs that created them, imagine the waste and cost associated with trying to integrate and/or federate. The cost in time and money within the DoD is substantial. But, it should not and does not need to be this way.

GERAM TOGAF IAF OBASHI CLEAR IFW TRAK ARCON DNDAF EABOK OMEGAF NISTEAM MoDAF PEAF AGATE NORA NAF DoDAF FDICEAF TEAF FEAF GEA

Figure 1.1: Just a few of the Enterprise Architecture frameworks utilized today

An EA is, or should be - a blueprint, a model, a schematic diagram, a recipe, or even a formula that will lead to a specific predetermined result. Sadly, sometimes even tragically, based upon the amount of time and money expended, many or perhaps most EA's, have no practical value. They are built and shelved.

It is time to change this paradigm. It is time to approach the building and use of EA within the context of an engineering, or at least a business discipline. The experience of the U.S. Department of Defense (DoD) over the last 2 years demonstrates that this can be done.

Figure 1.2: A standard EA representation that all can understand is a necessity!

Figure 1.3: Cost in time and money within the DoD is substantial

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http://www.commondefensequarterly.com/

Save the Dates: July 13-14, 2011

3rd Annual SOA & Semantic Technology Symposium

SOA 3.0

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Interoperable Business Operations Through Shared Understanding

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

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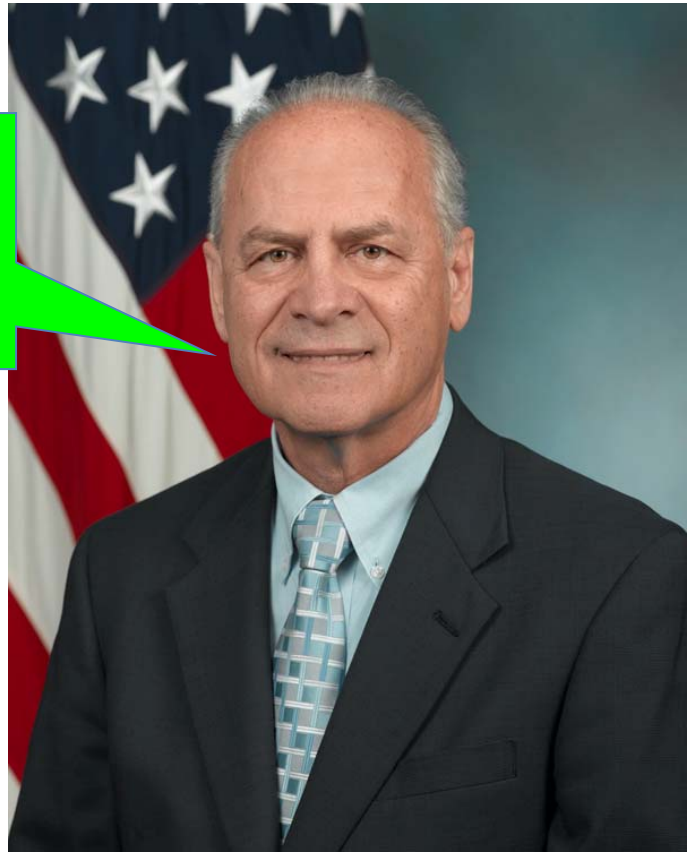
6715 Commerce Street
Springfield, VA 22150

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. Site: http://www.bta.mil/products/training/SOA/index.html
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. Site: http://www.bta.mil/products/training/SemanticWeb/index.html

DoD Architecture Framework Processes Best-Practice
Site: http://cio-nii.defense.gov/sites/dodaf20/journal_exp3.html

❖ Coming in 2011

Semantic Web Technologies	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
https://www.us.army.mil/suite/page/635133

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