Is DoDAF V2.0 mandatory?
Do I have to create all those DoDAF-described Models?
What must architecture tools do to comply with DoDAF V2.0?
Where can I see exemplars of each DoDAF-described model?
Is DoDAF useful outside DoD?
When developing the viewpoints, do we have to list or show processes controlled by software, such as "receive crew data", "transmit crew data", "render crew data" or "process crew data", "provide transmit data"?
How is server/workstation processing indicated in the architecture?
What does DoDAF 2 consider an "External Performer" and how does the DM2 handle it?
The DM2 appears very abstract. Is it just for guidance?
The mathematics of the DM2 are difficult to learn. Is this really necessary?
What is IDEAS?
Is there a scientific basis for the DM2 and IDEAS?
How do DM2 and IDEAS relate to OWL?
Are there tools for DM2?
IDEAS applies mathematics that are not normally taught in IT curriculums and so some learning is required. How do you learn IDEAS?

Why was UML used for the DM2 Logical Data Model instead of an ontology tool?

Why did this mathematics suddenly emerge as applicable?

Why is AS&I spearheading the introduction of ontologic mathematics in DM2?

What’s the difference between ontology and taxonomy?

I hear the word “ontology” used a lot nowadays. Is it just another IT fad?

Formal methods in computer science have been around for quite a while. They usually were too intractable and inaccessible. Why are we adopting them now?

Some of the IDEAS and DM2 mathematics seem to be esoteric – addressing issues below the 90% or good enough level. Is this degree of precision really necessary?

Who’s developing DM2 or IDEAS analysis tools?

Why are there so many DM2 open action items?

Is the DM2 done?

How can the DoDAF / DM2 Working Group be effective if anybody is allowed to join and participate? Doesn’t it just become chaotic?

Why didn’t DoD just adopt a commercial standard for EA data exchange?

Is there a way to represent metrics with DM2 and what kinds?

How are temporal models handled in DM2?

How are Services modeled in DM2?

How can I implement the DM2?

I don’t see how to model requirements vs. solutions in DM2. Is it possible?
Contact

The BORO Program

The Purpose
About the CEO Project
About the STPO Project
About the REV-ENG Methodology

Overview of the BORO Program

The Goal
The Focus
The Challenges Facing the BORO Program

Resources

BORO Working Papers
BORO Technical Reports, Articles and Papers
BORO - CEO Project reports
BORO Reference Ontologies
BOOK - Business Objects: Re-engineering for re-use

Links

The BORO Centre

About BORO Centre
Approach
Business Services

SBSI

Services

Enterprise Architecture
Methodology Development
Enterprise Architecture Data
EA Data Analysis

Data Fusion

Data and Information Fusion
Data-Driven Fusion
Knowledge-Assisted Fusion

Ontologies and Bayes Nets

Combat Systems and C4ISR

SeaPort™

Task Orders Received
Instructions Received
Team Members
Team Members Professional Support Experience

http://semanticommunity.info/Information_Sharing_Environment/DoDAF-DM2_Collaboration_Site
Updated: Wed, 23 Sep 2015 06:14:04 GMT
Powered by mindtouch™
Description of QA Program

1.1.1. Ability to monitor and maximize quality
1.1.2. Approach to guarantee responsiveness to and cooperation with customers
1.1.3. Approach to problem resolution

Points of Contact

Products/Downloads

Database Tree Tool Suite (DataTree / DataPhrase)

What
Why
How
Download Now

White Papers, Articles, Briefings

Demos

Ontologies and Bayes Nets

Careers

The SBSI Family
Current Opportunities

About

Why “Silver Bullet”?
Contract Vehicles
Corporate
Personnel
Current / Recent Projects
Office Locations
Contact Us

Slides

DoDAFDM2WG20120626

26 Jun 2012 DoDAF - DM2 WG Agenda
DM2 v2.03 OWL-DL Demonstration Working Group Meeting #2
Meeting Objectives
Outline
BEA Ontology Framework Release 1
DM2 v2.02 OWL-DL Approach Review
Migrating from DM2 v2.02 to DM2 v2.03
DM2 v2.03 vs. DM2 v2.02
Lessons Learned with DM2 v2.02 OWL
DM2 v2.03 OWL-DL Structural Adjustments
DM2 v2.03 OWL-DL Structure
DM2 v2.03 OWL-DL Structure Points
Usage Patterns for DM2 v2.03
Sample BEA Capability Taxonomy
Demonstration
Example 1
Example 2
Example Performer
Inferred Relationships
Next Steps
DCMO
Backup Slides
DM2 is Central Ontology to the BEA Ontology Framework (BEAOF)
BEA Ontology Architecture Vision
OWL based architecture data exchange
Why use OWL based Ontologies?
DCMO Federation via Semantic Standards
Hierarchy of Process Models
Discussion
15 Jun 2012 DoDAF - DM2 WG Agenda
DoDAF v2.03 Status and Plan Update
Agenda
Direction for Unified Defense Architecture Framework
Common Approach
MODEM: A Semantic Foundation For Enterprise Architecture
NATO Architecture Capability Team (A CaT)
IDEAS Layered Approach
Structure and contents of DoDAF v2.03
Revised Production Schedule
Office of the Chief Information Officer
Questions in JCS J6 DD C2I Architecture Federation Branch
DM2 OWL-DL Approach
Meeting Agenda
Objectives of the Meeting
DCMO Mandate - Standards Approach
DoD Federated/Net-centricty and DCMO Approach
Intended Use of the DM2 OWL-DL
DCMO Federation via Semantic Standards
Hierarchy of Process Models
Story

Semantic Analytics and Dynamic Case Management for the DoD DoDAF 2.0

I attended the recent DoDAF Version 2.02 Plenary 29 August 2012 which was renamed the DoD Architecture and Tools Forum to more accurately reflect its broader purpose. I prepared a background story DoDAF 2.0 Information Sharing and Federation and tutorial slides in preparation for that forum to help readers understand DoD Enterprise Architecture. There is also my previous story on the DoD CIO - NIEM PMO Pilot, with tutorial slides that shows how to scale NIEM, a key component of the DoD Enterprise Architecture, to big data.
During the Forum I made some comments based on my experience and Mr. McDaniel, DoDAF2.0 Team, DoD CIO, Architecture & Interoperability Directorate, and President and CEO of Silver Bullet Systems, Inc. (a DoD Contractor), invited me to join the DoD DM2 Working Group, to provide suggestions on semantic analytics and dynamic change management. The purpose of this story is to do that and two quotes from the DoD Enterprise Architecture knowledge base I built recently come to mind: DM2 is the DoDAF Data Model Version 2 and DoDAF is the DoD Architecture Framework.

“Speed equals innovation times simplicity – and 80% of the value comes from simplicity.” Geir Ramleth, CIO, Bechtel

“If you don’t like change, you’re going to like irrelevance even less.” - General Eric Shinseki, Chief of Staff, US Army

First some excerpts from the recent June 2012 WG meeting provide insight into their goals and methods:

- The goal is to describe DM2 completely in the OWL open specification based constructs
- DM2 contains a lot of different domain information in a single model; detailed OWL ontologies are better managed in distinct mid-level ontologies rather than grouped into a single ontology (this is a best practice)
- Interoperability achieved through dynamic SPARQL queries not PES file transfer
- A well defined DM2 OWL-DL Ontology Architecture provides a foundation for verticals to inherit consistent vocabulary

OWL is the Ontology Web Language SPARQL is the SPARQL Protocol and RDF Query Language, PES is Physical Exchange Specification, and DL is Description Logic, a type of reasoning and inference with OWL.

One of their key conclusions is: We have a lot more technical questions, but will hold hem until we have thorough review of the OWL schema and can see a demonstrated capability in action.

This DoDAF work by the DoD CIO is being done in cooperation with the DoD DCMO (Deputy Chief Management Officer) whose goals and methods are:

- The semantic path to federation: A standards based semantic understanding between enterprise applications supports the shift from a stale data warehousing approach to federated dynamic retrieval of authoritative data sources approach.
- Process content in XML can be transformed to Semantic Standards for advanced analytics
- Design and create a BEA ontology that establishes and integrates BEA, DM2, BPMN 2.0, and other domain ontology OWL files
- Perform federated architecture data exchange via SPARQL queries

The combined work acknowledges and requires the following:

- DM2 is evolving and changes must be vetted via a long running process
- Communities build domain specific vertical ontologies that extend horizontals to represent their applications/systems
- Interoperability achieved through dynamic SPARQL queries not PES file transfer
- Two ways to use the BEA Ontology Framework:
  - Migrate your Architecture Data directly into a BEA Ontology Framework RDF repository, or
Use relational technologies proven by DCMO, such as R2RML mappings from your legacy architecture data.

My comments and questions on the above are:

- Is it true that process content in XML can be transformed to semantic standards for advanced analytics?
- How does a BEA ontology that integrates multiple domain ontologies help with actual applications?
- Why go to all the work performing federated architecture data exchange via SPARQL queries?
- Is having communities build domain specific vertical ontologies that extend horizontals to represent their applications/systems, a big leap of faith?
- Why not semantic tagging and federated search across all the DoDAF content to achieve interoperability?
- Why not use my five steps and four tools (MindTouch, Excel, Spotfire, and BeInformed) to do this?

So I can do this without building the ontology first, which has taken the DM2 WG 3+ years. I can semantically enhance their DM2 artifacts, make them data, fuse them together, visualize them with analytics, and do federated search without SPARQL Queries. Then I can build an actual Ontology-Rules driven applications using Be Informed.

My results are summarized in a knowledge base, spreadsheet, and dashboard as follows:

- DoDAF-DM2 WG Semantic Knowledge Base contains 203 rows by 11 columns of linked data for emails, wiki, SBSI, slides, Spotfire, and Web site content. Web site content accounts for 120 of the 203 rows of linked data.
- DoDAF-DM2 WG Attendance shows 823 rows of members by 7 columns of contact information and 120 columns of attendance at meetings during September 11, 2009, to June 26, 2012. Only 9 members have attended 20 or more of the 120 meetings.
- DoDAF DM2 WG Action Items shows 374 rows by 53 columns. For example the Data Group/Model/Other: IDEAS contributed 16 from the Source Organization: UPDM.
- Data Dictionary, Aliases, & Mappings shows 465 rows by 104 columns with Status: a. In Model with Associations: y 57, Y 47, and Empty 207. This means that less than a fourth (104) of the DM2 (465) are in the model with some semantic associations. There is lots of work yet to be done.
- Architecture Tools shows 58 rows by 22 columns with Primary Functionality of Analysis/M&S (12), Model Development (26), and Repository/Integration (20) with most of those being COTS (Commercial Off-The-Shelf). Obviously having one tool or suite of tools that does all of those three functions in a seamless and interoperable way is very desirable.
- Templates are the Template Legend and the PWP Refinement WS

So we are revolutionizing the FEA, DoDAF, OMG, etc. approaches to Enterprise Architecture by making it simpler with semantic analytics and dynamic change management.

Spotfire Dashboard

For Internet Explorer Users and Those Wanting Full Screen Display Use: Web Player Get Spotfire for iPad App

Media, iframe, embed and object tags are not supported inside of a PDF.
Welcome to the DoDAF-DM2 Working Group

Please download the New Member Orientation Package here (or from the bottom of the DoDAF-DM2 Working Group site login page):

DoDAF - DM2 WG Change Requests 2012-08-29.xls
DoDAF - DM2 WG Members 2012-08-29.xls
DoDAF - DM2 WG Notebook Spring 12 2012-06-26 FINAL.ppt
DoDAF-DM2 WG Welcome 2011-05-04.ppt

As a member of this working group, you will receive announcements with proposed agenda and read-aheads for the WG meetings.

Should you fail to receive these announcements, please send an email to:

DoDAF-DM2-WG@silverbulletinc.com

Current versions of DoDAF and DM2, documentation, CM, briefings and tutorials, models, reference materials, archives, and other DoDAF and DM2 resources are available at the DoDAF 2.xx website located at:


Link to the DoDAF-DM2 Working Group site:

http://www.silverbulletinc.com/dm2

Login information is as follows:

U/N:  DoDAF_MM  (Window's 7 users may be required to enter “silverbulletinc\DoDAF_MM”)
P/W:

Most login problems can be solved by adding http://silverbulletinc.com/dm2 as a Trusted site.

This is done by pressing the “Sites” button under the Security tab of Windows Internet Options.

If you also require a DoD Meta Data Registry account, your sponsor is: Michael.Wayson@osd.mil, (703) 607-0482.

Other relevant sites:
DoDAF Discussion Group: http://www.linkedin.com/groups?mostPopular=&gid=2585550&trk=myg_ugrp_ovr

IDEAS Discussion Group: http://www.linkedin.com/groups?mostPopular=&gid=3122051&trk=myg_ugrp_ovr

This message was sent to bniemann@cox.net from: David.McDaniel@silverbulletinc.com. David McDaniel | 1901 Ft. Myer Drive, Suite 501 | Arlington, VA 22209

DoDAF-DM2 Collaboration Site


Next Meeting

TBD

• Full Agenda / Readahead DoDAF - DM2 WG Notebook Spring 12 2012-06-26 FINAL.ppt
• This Week's Agenda / Readahead Do Architecture Methodology Tools Forum DoDAF Plenary Agenda 20120828 wjo(8).doc
• Change Request Tracker DoDAF - DM2 WG Change Requests 2012-08-29.xls
• Working Group Member List DoDAF - DM2 WG Members 2012-08-29.xls
• DoDAF-DM2 Configuration Management Plan DoDAF- DM2 CMP v1.0 FINAL.pdf

DoD Architecture Methodology & Tools Forum (Formerly - DoDAF Plenary)

29-August-2012 from 0730 to 1600 ET
MITRE Main Auditorium, McLean, Virginia
AgendaDoD Architecture Methodology Tools Forum DoDAF Plenary Agenda 20120828 wjo(8).doc
How to attend Forum, Collaboration, Attending the DoD Architecture Methodology20120829.docx
Directions Directions - MITRE McLean, mitre1_map (2).pdf

Sidebar

Upcoming Meeting MY NOTE: See Above

DoDAF-DM2 Working Copy

File Browser

Meeting Replays

Submit Change Request

Tools

Discussion Groups
# FAQs

## DoDAF-DM2 Working Copy

Source: [http://www.silverbulletinc.com/dm2/dm2workingcopy.htm](http://www.silverbulletinc.com/dm2/dm2workingcopy.htm)

### DoDAF-DM2 Working Copy files

#### FOR FORMAL COORDINATION

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#### WORKING GROUP USER FILES

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Powered by mindtouch

http://semanticommunity.info/Information_Sharing_Environment/DoDAF-DM2_Collaboration_Site

Updated: Wed, 23 Sep 2015 06:14:04 GMT
### Data Dictionary and Mappings

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**IDEAS Ontological Foundation**

http://www.ideasgroup.org

**OWL file**

TBS

**SQL Server Database Script**

TBS

**Oracle Database Script**

TBS

### File Browser


![File Browser Screenshot](image)

### Meeting Replays

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**DoDAF-DM2 Working Group Meeting Replays**

Select desired meeting:
<table>
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11-FEB-2011  Click to watch now  Click to download now  614,528 KB
04-FEB-2011  Click to watch now  Click to download now  324,552 KB

Note: Videos are encoded and you must download the GoToMeeting plugin to be able to view.

Submit Change Request

Source: http://www.silverbulletinc.com/dm2/ai.htm

Submit Change Request

* CR Title: 

* Detailed description of requested change:

Date: 

* Your name: 

* Organization: 

* Email: 

* Change Item:  
  -- Choose one --

Data Group / Model / Other: 

Level of Effort:  
  -- Choose one --
Priority: -- Choose one --

Core Process Category: -- Choose one --

Description of Core Process Requirement:

Submit Change Request

Tools

Source: http://www.silverbulletinc.com/dm2/tools.htm

Tools

- EALite (free read-only version of Enterprise Architect to read the DM2 EA Model) (37.4 MB EXE)
- IDEAS Plug-In (3.4 MB ZIP)
- Owl Editor OwlEditor.zip
- DM2.02 OWL Full DM2.02_OWL_Full.owl
- DM2.02 OWL DL DM2.02_OWL_DL.owl
- DM2.02 Oracle Database Script DM2.02_Oracle.SQL
- DM2.02 SQL Server Database Script DM2.02_SQL Server.SQL
- PES Examples PES examples.zip

Discussion Groups

Source: http://www.silverbulletinc.com/dm2/discussions.htm

Discussion Groups

- DoDAF Discussion Group
FAQs

Is DoDAF V2.0 mandatory?

While DoDAF is indeed prescribed for use in the development of architectural descriptions within the Department, DoDAF V2.0 currently serves as guidance. It is expected, however, that a growing number of commands and components will adopt V2.0. For such organizations, architectural descriptions they may have developed in accordance with prior versions of DoDAF should brought into compliance with V2.0 upon their next major release. In addition, architectural data should be stored in a data system – PowerPoint, Visio, Excel, etc. can only be used to present architectural information. For components within which the use of V2.0 is not mandated, it can still serve as an architecture best practices reference.

Do I have to create all those DoDAF-described Models?

No. DoDAF V2.0 does not prescribe any models – instead, it concentrates on data as the essential ingredients of any architecture development. It seeks to make architectural descriptions “Fit-for-Purpose”, based on decision-maker needs. Process owners may therefore prescribe a specific set of DoDAF-described Models to answer a particular purpose. For example, regulations and instructions issued by both DoD and the Chairman of the Joint Chiefs of Staff (CJCS) contain particular requirements with respect to Presentation Views. In general, whatever combination of views – both DoDAF-described and user-tailored – legitimately answers a need, aligns well with the intended use of the architecture as a whole, AND can be justified per common-sense professional practice in architecture, is acceptable. Consult the regulations and instructions issued by your component for specific model and view requirements.

What must architecture tools do to comply with DoDAF V2.0?

It is only necessary to implement the Physical Exchange Specification (PES). Note that while architecture teams may evaluate tool sets and recommend specific tools based upon their capabilities in a given architecture environment, DoD does not plan to formally endorse, adopt, certify, or mandate any tool.

Where can I see exemplars of each DoDAF-described model?

See the DoDAF Journal – a compendium of DoDAF V2.0 background information, implementation guidance, news, and other content useful to the DoDAF architect and decision-makers alike.
Is DoDAF useful outside DoD?

Yes! Given the unprecedented, growing, and mutual dependence between DoD, Intelligence Community (IC), and Coalition architectures, we both encourage and expect the early adoption of DoDAF V2.0 principles outside the Department. As a vital partner and contributor to our nation’s defense, the IC should continue to represent a significant portion of the DoDAF user base.

When developing the viewpoints, do we have to list or show processes controlled by software, such as "receive crew data", "transmit crew data", "render crew data" or "process crew data", "provide transmit data"?

The determination of whether to list the processes controlled by the software is reliant on the purpose of the architecture. If the purpose requires the processes controlled by the software, then it will be required. However, if it is not required at that level, it may be sufficient to indicate that "Provide Target Location" is the resource flow, rather than having multiple resource flows "Transmit Target Location data", "Receive Target Location Data", "Acknowledge Target Location Data", and "Receive Acknowledgement of Target Location Data".

How is server/workstation processing indicated in the architecture?

From a systems or services viewpoint, the server/workstation processes are Activities, but the related Performer is a System or Service (e.g., "CursorOnTarget Service").

What does DoDAF 2 consider an "External Performer" and how does the DM2 handle it?

In DM2, a Performer can be categorized as internal or external, based on specific need, although such categorization may not be standard across all organizations. External Performers do not need to be modeled, as DM2 does not require documentation of Activities other than acknowledgement that an unknown producing or consuming Activity does, in fact, exist (see UPDM SAR DM2 markup examples). However, although an OV-2 diagram need not show implied, external Activities, the DM2 PES XML must show them, even if only as placeholders for subsequent completion such as during OV-5 development. It is this precision that addresses the "over-specification" problem of earlier DoDAF OVs.

The DM2 appears very abstract. Is it just for guidance?

No, the DM2 can be used for simple to very detailed and complex architectural descriptions by combining its elements appropriately. It has few elements making it seem abstract because it is not language, but mathematically, based. The DM2 Physical Exchange Specification (PES) is the prescribed data exchange format and semantics for DoDAF 2.0 conformance.

The mathematics of the DM2 are difficult to learn. Is this really necessary?

The predecessor of the DM2, the CADM, was language-based. It was a state-of-the-art Entity-Relationship model at the time. E-R models have been very successful and useful throughout the business and government communities. However, the nature of Enterprise Architecture entails integration and analysis of multiple independently-developed...
architectural descriptions. The CADM and E-R models that were name and definition based did not work for this purpose. Hence, the DM2 has brought to bear additional science to help achieve these DoD EA goals.

What is IDEAS?

IDEAS is the International Defence Enterprise Architecture Specification. It is an international project of the US, UK, AU, SW, and CA for the past 5 years to develop a way to exchange EA data in support of Coalition operations. Early on in the project it was recognized that we needed more precise and unambiguous ways to label data so the science of formal ontologies was brought to bear. The IDEAS ontology is first-order, extensional, and 4-dimensional, employing the mathematics of set theory and 4-D mereotopology.

Is there a scientific basis for the DM2 and IDEAS?

Yes, the mathematics and science underpinning DM2 and IDEAS have been in development for many years, particularly with the development of set theory in the 19th century. What is new is the application of that science to IT data representations, specifications, and models.

How do DM2 and IDEAS relate to OWL?

DM2 and IDEAS data can be represented in RDFS and OWL. Pure OWL makes some commitments that are incompatible with IDEAS so a fallback to the less-committal RDFS was necessary in those areas. An RDFS/OWL generator for an early version of IDEAS was developed and will be updated and included in the ModelFutures' IDEAS Profile soon.

Are there tools for DM2?

A script for generating a DM2 database is available on CD at this conference and on the DM2 collaboration site – www.silverbulletinc.com/dm2. A bare-bones front-end (RDF triples generator) to the database will be available soon. Pilots and early adopters are building tools to generate and parse DM2. The UPDM Team is working on UPDM 2.0 which will be compatible with DM2. The AS&I team is working with other EA and M&S tool vendors to achieve DM2 compatibility. An RDFS/OWL generator is planned that will allow analysis by RDFS/OWL tools that comport with IDEAS ontology constructs.

IDEAS applies mathematics that are not normally taught in IT curriculums and so some learning is required. How do you learn IDEAS?

The DM2 collaboration site at http://www.silverbulletinc.com/dm2 has many resources, including DM2 description documents (CDM, LDM, PES / IDEAS), an IDEAS bibliography, 1,000’s of reference documents, and a free electronic version of IDEAS Group member Dr. Chris Partridge’s book, “Business Objects – Engineering for Reuse.” In addition, on-site outreach tutorials can be requested through Mike.Wayson@osd.mil, membership in the DM2 Working Group is open to all by registering at www.silverbulletinc.com/dm2. This science is emerging as the future for knowledge representation for applications where integration of multiple heterogeneous data sources or automated algorithmic
analysis or processing is required and so IDEAS learning is professional development that will be applicable to and open up future career paths.

**Why was UML used for the DM2 Logical Data Model instead of an ontology tool?**

A UML tool was used for the DM2 LDM. However, it is not a UML class model because the ModelFutures’ IDEAS Profile turns the UML tool into an ontology tool. Existing ontology tools make commitments and lack features necessary for IDEAS. Consequently, the ModelFutures’ IDEAS Profile was developed that allows the UML tool to be used for ontology development in a simple yet thorough way.

**Why did this mathematics suddenly emerge as applicable?**

As IT has developed, greater indirection has been permissible. In similar vein to Codd’s introduction of relational databases was enabled by higher performance IT, so too higher performance IT is now enabling the adoption of ontologic mathematics.

**Why is AS&I spearheading the introduction of ontologic mathematics in DM2?**

Enterprise Architecture is ambitious in supporting transformational processes in DoD. We know those transformations must be accomplished so we will have an agile and efficient defense. That makes it incumbent on AS&I to apply whatever science is needed to support the DoD’s core processes.

**What’s the difference between ontology and taxonomy?**

Technically, a taxonomy is a “type” structure, much like naïve set theory but with provisions to prevent paradoxes. So a taxonomy may represent categorizations of real world things (e.g., a simple set), subsets and super sets, categorizations of sets, and so on. An ontology goes beyond this an includes other types of relationships between concepts such as whole-part, overlaps, temporal whole-parts, etc.

**I hear the word “ontology” used a lot nowadays. Is it just another IT fad?**

Yes and no. As in all progressions in IT, there tends to be a bit of overselling. No doubt some ontology projects will fail to live up to expectations. There are many challenges in developing automation, whether for data integration or analysis, as there always have been. However, the newly adopted tools of ontology science – e.g., applying set theory, mereotopology, and 4-dimensionalism – will be long-lasting contributions.

**Formal methods in computer science have been around for quite a while. They usually were too intractable and inaccessible. Why are we adopting them now?**

The key to simultaneously achieving user understandability and rigorous formality in the DM2 is the layering: the Conceptual Data Model (CDM), Logical Data Model (LDM), Physical Exchange Specification (PES), and IDEAS Foundation. The formality in DM2 is largely hidden in the IDEAS Foundation layer which most users will never need to look at or understand.
Some of the IDEAS and DM2 mathematics seem to be esoteric – addressing issues below the 90% or good enough level. Is this degree of precision really necessary?

90% level disambiguation and semantic precision works well for human-readable and interpreted data, as we fill-in missing information and bring to bear interpretive knowledge or for rehearsed automated processing -- when the programmers or database administrators can iterate and trial-and-error towards proper processing of the exchanged data. Automated processing by non-rehearsed algorithms, e.g., by integration or analysis algorithms by heretofore new data sources, can be very sensitive to flaws in datasets such as imprecisions, ambiguities, or unstated incompletions.

Who’s developing DM2 or IDEAS analysis tools?

This is just starting. We anticipate at least these two categories: M&S tools and entailment tools. M&S tools will be able to ingest DM2 datasets and, because of the precision and disambiguity afforded by DM2, be able to “run” or “execute” the architectural models to measure performance and/or effectiveness of proposed architectures. Entailment tools, some of which exist today and can operate on RDF, RDFS, and OWL datasets, will be able to carry out the logical implications of DM2 datasets whereupon contradictions and inconsistencies can be detected. For instance, an interoperability assessment tool might entail that two systems need to interact in some way (e.g., exchange data) but that is contradicted by all the means available to do so.

Why are there so many DM2 open action items?

The application of ontology science to Enterprise Architecture descriptions is new. There are still many things the community does not yet know how to represent mathematically. We could always fall back on language-based representations but we know that will result in improperly integrated or analyzed data. In other words, the DM2 Working Group is the forum for clearly defining and disambiguating EA concepts in the DoD. Membership in the DM2 Working Group is open to all by registering at www.silverbulletinc.com/dm2. The DoDAF / DM2 Action Item tracker is updated weekly and is available for download there.

Is the DM2 done?

Yes! Version 2.0 was baselined May 2009 and version 2.01, with 68 fixes and improvements, was baselined Feb 2010. However, as the DoD EA community seeks to represent additional things, as DM2 pilots and early adopters develop, and as concepts evolve – e.g., Services, Capabilities – the DM2 will respond to the community’s needs. This done by a formal Configuration Management (CM) process by the DM2 Working Group, a subordinate body to the Federated Architecture Council (FAC). Membership in the DM2 WG is open to all by registering at www.silverbulletinc.com/dm2.

How can the DoDAF / DM2 Working Group be effective if anybody is allowed to join and participate? Doesn’t it just become chaotic?

Remarkably, the WG is very effective even with 100’s of members. The reason for this is the process and business rules established and documented in the DoDAF / DM2 Configuration Management (CM) Plan which can be obtained at the DM2 Collaboration Site, www.silverbulletinc.com/dm2. Although the process and rules are subject to modification, once agreed-to, they provide a principled basis for discussion, debate, and analysis of potential issues.
Why didn’t DoD just adopt a commercial standard for EA data exchange?

Existing commercial data exchange formats do not meet the representation requirements for DoDAF architectural descriptions or are tool or tool-type specific. For instance, the XMI UML model interchange standard is specific to UML tools and consequently has many elements that are not applicable to non-UML tools. The DM2 Conceptual and Logical Data Models are the DoD expression of required data semantics for EA descriptions; the DM2 Physical Exchange Specification (PES) is a simple tool- and methodology-neutral format for EA data exchange between databases, repositories, EA development tools, EA analysis tools, authoritative data sources, EA reporting tools, and M&S tools.

Is there a way to represent metrics with DM2 and what kinds?

The DM2 represents metrics as in IDEAS as what may be thought of a “measure sets.” The DM2 defined several broad categories of metrics (measures) and then allows users to define as many additional types of measures as needed. Measures can be associated with any DoDAF concepts, e.g., Systems, Resource Flows, Capabilities, Desired Effects. Measures can be at a technical performance level (e.g., MOPs) up to operational effectiveness levels (e.g., MOEs).

How are temporal models handled in DM2?

DM2 is founded on IDEAS which is 4-dimensional. So all real-world things are modeled as per their spatial and temporal extent. In other words, everything in DM2 is temporal. DM2 and IDEAS have elements for temporal boundaries and before-after and temporal-whole-part relationships to model any form of temporal behavior. For more on 4-dimensionalism, see, e.g., http://en.wikipedia.org/wiki/Four-dimensionalism or a very popular book, Sider, Theodore; “Four Dimensionalism: An Ontology of Persistence and Time”; Oxford University Press, Oxford ; 2001.

How are Services modeled in DM2?

The DoD defines services as a mechanism to access capabilities (or resources.) The DM2 models Services as types of Performers that have a Service Port that is described by a Service Description. The Service has relationships to the Resources that are accessed. The Service Description is a type of Architectural Description and so it can have all the structure of an Architectural Description, including functionality, behavior, rules, information schemas, etc. New service concepts emerging from OASIS, OMG, and other organizations are being considered by the DM2 Working Group for incorporation in later DM2 baseline versions.

How can I implement the DM2?

All DM2 implementers should join the DM2 Working Group so they will be up to date on all developments, actions in-progress, and gain access to DM2 resources. In addition, the DoDAF / DM2 AS&I has resources to assist DM2 pilots and early adopters. Contact Mike.Wayson@osd.mil to request assistance in your pilot or implementation project.

I don’t see how to model requirements vs. solutions in DM2. Is it possible?

Yes! DM2 supports multiple levels of reification, indeed, as many as are needed by your project. Each level of reification is an architectural description that becomes rules that constrain the next level. Conversely, each artifact at a level can
trace its pedigree to a higher level using DM2’s Pedigree model. With DoDAF 2, you are no longer restricted to just the OV “requirements” level and SV/TV “solution” level, but can have as many levels of reification as are needed, with each level having whatever mix of operational, capability, systems, services, or technical description as is appropriate for your project.

DoDAF 2.0


The BORO Program

Source: http://www.boroprogram.org/

DoD Metadata Registry

Source: https://metadata.ces.mil/mdr/

IDEAS Group

Source: http://www.ideasgroup.org/

Welcome to the IDEAS Group Website

IDEAS is the International Defence Enterprise Architecture Specification for exchange. The purpose of the project is to develop a data exchange format for military Enterprise Architectures. The purpose is to allow seamless sharing of architectures between the partner nations regardless of which modelling tool or repository they use. The initial scope for exchange is the architectural data required to support coalition operations planning:

• Systems – communications systems, networks, software applications, etc.
• Communications links between systems.
• Information specifications – the types of information (and their security classifications) that the comms architecture will handle.
• Platforms & facilities.
• System & operational functions (activities).
• People & organizations.
• Architecture meta-data – who owns it, who was the architect, name, version, description, etc.,

NEWS – December 2010 – The Swedish Armed Forces recently sponsored an investigation to develop an IDEASversion of the MODAF Meta-Model.

NEWS – 24th April 2009 – The IDEAS Foundation is now formally released (version 1). It can also be downloaded as a Sparx EA File or as XMI MY NOTE: Did not download because old.
The IDEAS Group is developing a formal ontology to facilitate interoperability of Enterprise Architecture (EA) models. The most common usage of IDEAS will be in direct exchange of information between architectural modelling tools and repositories. In this case, one system exports an RDF file which conforms the IDEAS Ontology:
Another usage pattern would be a publish and subscribe approach. In this case, each IDEAS user would simply publish their architectural models in IDEAS format on their website. Because the format is RDF based, the various users can link their architectural models:

History

The IDEAS Group was set up in 2005 to examine the issue of interoperability of Enterprise Architecture Data. The group consists of subject matter experts on the Australian, Canadian, UK and USA defence architecture frameworks. These experts have been working together in the IDEAS Group to define a common information structure for data exchange.

Initial development efforts took a traditional data modelling approach. However, it quickly became apparent that terminology differences between the nations was making this a difficult and imprecise approach. In late 2005 it was decided to trial the BORO Methodology. This is an approach that uses very rigid criteria for identifying common concepts. Its main advantage is that it does not rely on names for things, so is very effective at achieving consensus in team modelling sessions.
The BORO Method results in an Ontology. It was not the original aim of IDEAS to develop a formal ontology, but there are a number of advantages to this approach

- It is extensible – each nation can extend the IDEAS Ontology with their own elements and patterns
- If RDF or OWL is used, the data exchange syntax requires no additional work
- A formal ontology is precise and based on sound set-theoretic principles

**Model**

Source: [http://www.ideasgroup.org/4Model/](http://www.ideasgroup.org/4Model/)
The IDEAS Model is currently under development and will not be published until fully tested. The foundation model has been published though, and can be viewed [here](http://www.ideasgroup.org/4Model/)

**Methodology**

Source: [http://www.ideasgroup.org/5Methodology/](http://www.ideasgroup.org/5Methodology/)

IDEAS uses the BORO™ Methodology, which is very precise about criteria for identity. BORO™ reasons that in order to ascertain if two things are the same, we have to ground our reasoning in something that can be accurately identified. So, comparing two individuals, if they occupy precisely the same space at the same time, they are the same. Clearly this only works for individuals, but the principle can be used to compare types too. For two types to be the same, they must have the same members. If those members are individuals, their physical extents can be compared. If the members are types, then we have to keep analysing the members until we reach individuals, then they can be compared.

Note that at no stage in this analysis process have the names of the things being analysed come into play. This is the advantage of the BORO™ process – there is no possibility of confusion about what is being discussed. The process is slow, but not as slow as endlessly debating the meaning of a term, which is a common problem in collaborative model development.

**BORO (TM) Process - Flowchart**

Source: [http://www.ideasgroup.org/5Methodology/19/boro-process-flowchart](http://www.ideasgroup.org/5Methodology/19/boro-process-flowchart)
Experiments

Source: [http://www.ideasgroup.org/6Experiments/](http://www.ideasgroup.org/6Experiments/)

The first IDEAS experiment was carried out in 2007, with development teams in the UK and USA working on IDEAS interfaces to cover the scope of an OV-5 Operational Activity Model. The UK developed an import/export interface for Sparx EA and the USA developed an import interface for Telelogic System Architect.

The experiment demonstrated exchange of an OV-5 process model derived from medical / casualty management procedures.

UK MOD Ontology Demonstrator

Source: [http://www.ideasgroup.org/6Experiments/20/uk-mod-ontology-demonstrator](http://www.ideasgroup.org/6Experiments/20/uk-mod-ontology-demonstrator)

The UK MOD used the IDEAS model as the basis for a GeoPolitical ontology demonstrator. This can be downloaded from:


Documents

Source: [http://www.ideasgroup.org/7Documents/](http://www.ideasgroup.org/7Documents/)

- IDEAS CISA Williamsburg.pdf [244.94KB] - IDEAS Introduction - presented at CISA Conference in Williamsburg in 2006

- IDEAS Foundation v1.0 Released 2009-04-24.eap.zip [851.85KB] - IDEAS Foundation v1.0 as EAP File (zipped)

- IDEAS Foundation v1.0 Released 2009-04-24.xmi.zip [325.87KB] - IDEAS Foundation v1.0 as XMI File (zipped)
IDEAS TOR ver 19 Sep 08.pdf [19.99KB] - Revised IDEAS Terms of Reference signed in Sept 2008


TORs-10_20Feb_2006.pdf [30.65KB] - Original IDEAS Group Terms of Reference which was signed in 2006 by representatives from all the member nations

Dave McDaniel presented on IDEAS at the 2008 Integrated Enterprise Architecture Conference. The slides can be downloaded here

Ian Bailey presented on the BORO Method at the EKIG Conference in Oct 2008. The slides can be downloaded here

Software

Source: http://www.ideasgroup.org/8Software/

Add-In for Sparx EA

The IDEAS ontology was created using a UML profile in Sparx Enterprise Architect™. The Plug-In used is now available for download by willing beta testers. It includes a PES XSD generator (as used by DoDAF 2.0) and a database export facility. It also installs a simple browser for the exported databases.

It can be downloaded here

Links

Source: http://www.ideasgroup.org/9Links/

modaf.com - the MODAF community website - with forum, FAQ and links

Official MOD MODAF Site - the MODAF documentation site

DNDAF (Canada) - The official Canadian Defense DNDAF Site

DoDAF - the DoD Architecture Framework version 2.0

DoDAF 2.0 Meta-Model (DM2) - The DM2 is loosely based on the IDEAS Foundation and is the first national framework meta-model to be based on IDEAS.

Enterprise Ontologies - A light-hearted look at Systems Engineering and the applicability of enterprise ontologies such as IDEAS

Matthew West's Papers - A great resource for further reading on model development, ontology and set theory

Resource Description Framework - The W3C specifications for RDF
SOA Standards Comparison - A study carried out for UK MOD using BORO principles to compare the semantics of various SOA standards

Contact

Source: http://www.ideasgroup.org/Contact/
IDEAS is a four-nation group. To find your local contact, or if you just require general information on IDEAS, please mail us.

The BORO Program

Source: http://www.boroprogram.org/index.html

The BORO Program is the vehicle for BORO Consulting and The BORO Centre’s research activities.

http://www.boroprogram.org/boro_consulting/index.html
http://www.boroprogram.org/boro_prog...ntre_about.htm

Currently, the prime focus of The BORO Program is on the CEO (Core Enterprise Ontology) Project.

http://www.boroprogram.org/boro_prog...eo_project.htm

The program has made a number of resources available to the public. These are stored at the Public Resources Website.

The Purpose

Source: http://www.boroprogram.org/boro_program/purpose.htm

The purpose of this Public Resources Website is to provide resources that will assist enterprises in reaching BORO’s goal.

Links to the four main types of resources are given below:

• Educational materials—for developing an understanding of the BORO approach.
  ◦ In his website these are in the form of Working Papers and can be found here.
    http://www.boroprogram.org/boro_program/resources.htm

• A business object ontology—an overall framework for encouraging simplicity and ensuring consistency within reference ontologies.
  ◦ The evolution of this ontology is described in Volume O - Ontology of the Working Papers and can be found here.
    http://www.boroprogram.org/boro_program/wp_o.htm

• Explanations of elements of the ontology are described in Volume B - The BORO Business Object Ontology of the Working Papers and can be found here.
About the CEO Project

Source: [http://www.boroprogram.org/boro_program/ceo_project/ceo_project.htm](http://www.boroprogram.org/boro_program/ceo_project/ceo_project.htm)

The CEO Project's aim is the construction of an 'industrial strength' ontology to be used as a tool by enterprises to significantly improve the semantic aspects of their information systems.

The CEO Project's Scope

The CEO has a wide scope encompassing the full range of enterprises and the activities that they undertake. However, as a Core Ontology, its focus is restricted to the major core categories that underlie and unify most enterprises. As part of the initial planning an intuitive guess was made as to what these might be - and this identified these three major categories:

- Person (AKA Party), who can enter into a
- Transaction, which often includes agreements which involve an
- Asset.

The CEO's prime deliverable

The CEO's prime deliverable will be a Core Reference Ontology - which will provide a semantic framework that can be used as a tool to assist in many types of project, including the development, deployment and inter-operation of systems.

The CEO's Synthesis Stage

The strategy of the CEO is to, as far as possible, build upon the 'state of the art'. So it has initiated an initial Synthesis Stage, which has as its goal the harvesting of insights from current 'state of the art' enterprise ontologies and their synthesis into a single coherent whole. This will then be used as the foundation for the development of the final CEO.

The 'State of the Art' Review

The planning for the synthesis stage started with an informal review of what ontologies were available. This found that the 'state of the art' is immature and, in particular, that:

- there are not many enterprise ontologies (though there are many resources from which these could be mined), and
those that exist have not yet reached 'industrial strength' as ontologies.

This ruled out a strategy of merging/integrating existing ontologies. The CEO needed to undertake a synthesis - which will involve an informed, intelligent re-construction on the basis of a sound ontology.

The review selected the following four enterprise ontologies for synthesis:

- TOVE's (TOronto Virtual Enterprise) Organisation Ontology,
- AIIA's Enterprise Ontology,
- Cycorp's Cyc® Knowledge Base, and
- W.H. Inmon's Data Model Resource Book.

The plan for the synthesis stage identified sub-projects based upon each of these four ontologies divided into the three core categories. It selected as the initial project the 'Person' core category of TOVE's Organisation Ontology - this was named the STPO (Synthesis of Tove's Person Ontology) project.

A more detailed introduction to the CEO Project is available here.

http://www.boroprogram.dsl.pipex.com...t_r_07-02.pdf

A description of the STPO sub-project is available here.

http://www.boroprogram.org/boro_prog...ject/stpo.htm

The CEO Project's approach to ontological analysis grew out of the REV-ENG Methodology.

http://www.boroprogram.org/boro_prog...ng/rev_eng.htm

About the STPO Project

Source: http://www.boroprogram.org/boro_program/ceo_project/stpo.htm

The STPO's prime deliverable is an ontological model that builds upon TOVE's insights to arrive at something closer to an 'industrial strength' model of the Person category.

The choice of the core enterprise category Person gives us one boundary on STPO's scope, TOVE gives us another. So the STPO's scope is the intersection of these - the person-relevant elements of TOVE.

About the REV-ENG Methodology


Origins of the REV-ENG Methodology

The REV-ENG methodology grew out of a series of legacy application re-engineering projects each of which started with the re-engineering of a business model out of the existing legacy application. The re-engineering focused on recovering a model of the business objects that underlay the legacy applications. This was typically a demanding task as there was little or no documentation, only the implemented application. Over time the approach was codified into a systematic process, called the REV-ENG (for REVerse ENGineering) Methodology, which is thoroughly documented in Business Objects: Re-engineering for re-use, Partridge, 1996.
REV-ENG and the origins of the CEO Project

Experience with REV-ENG showed that a number of the same general patterns were being repeatedly unearthed in different projects - surprisingly often in quite different business areas (e.g. banking and telecommunications). Typically the specific patterns in the applications looked different because they were combinations of different sets of general patterns. It soon became clear that significant time was being wasted repeatedly re-engineering these from scratch. This indicated the potential for high levels of re-use, which was exploited by making the general patterns available for re-use in subsequent projects.

Experience also showed that the potential for generalising (and so simplifying) was rarely exhausted in a single re-engineering. The general patterns found in one project were found, in subsequent projects, to be combinations of even more general patterns. This indicated that there was significant scope for evolving the patterns to greater and greater levels of generality and simplicity.

The CEO Project was conceived out of the realisation that there would be significant economies in the application of the REV-ENG approach if one could start with a core business model for the enterprise. Reasonable economies would come from having the lower level general patterns found in single re-engineerings. But the really significant benefits would come from the very general patterns found in heavy duty re-engineering. Hence the project aimed not only to recover the most common patterns found in businesses into a coherent and consistent model - but also to try and evolve this to much higher levels of generality and simplicity.

The desire to re-engineer very general patterns led to a requirement for a stricter engineering discipline than would be necessary in a 'normal' REV-ENG project. An important part of the CEO project was "upgrading" REV-ENG to meet this stricter requirement.

Overview of the BORO Program

Source: http://www.boroprogram.org/boro_program/overview.htm

- The goal of the BORO Program
  ... is to help enterprises implement seamless interoperatability between their business applications, by working with them to continue using and developing BORO's approach, which provides a framework for radically simplifying their application interfaces' semantic complexity.
  More ... http://www.boroprogram.org/boro_program/goal.htm

- The focus of the BORO Program
  ... is currently on the seamless interoperability of enterprises' operational applications.
  More ... http://www.boroprogram.org/boro_program/focus.htm

- The challenges facing the BORO Program
  ... are both technical and managerial.
  More... http://www.boroprogram.org/boro_prog...challenges.htm

The Goal

Source: http://www.boroprogram.org/boro_program/goal.htm

... is to help enterprises implement seamless interoperatability between their business applications, by working with them to continue developing and using BORO's approach, which provides a framework for radically simplifying their application interfaces' semantic complexity.
The motivation for BORO’s goal can be summarised as:

- Technological trends are creating an emerging strategic need for seamless interoperability,
- Seamless interoperability brings new strategic capabilities,
- It also brings a significant (outstanding) challenge - semantic interoperability,
- The BORO Program’s goal to work with enterprises to overcome this challenge.

Technological trends are creating an emerging strategic need for seamless interoperability

Enterprises' business processes typically involve a number of business applications - both across and within enterprises. Different enterprises typically do not share business applications. And individual enterprises' architectures typically involve a variety of business applications - both by design and accident. Once there is more than one application, there is a potential need for interoperability.

Now the footprints of these applications are increasing to encompass significant chunks of the business processes. This is leaving many of the residual manual processes - whether within or across enterprises - as (apparently) little more than links between the applications. This creates a situation where the strategic focus on opportunities for improvement shift from automating the specific processes to automating the links between applications. Trends such as the globalisation of the world's economy mean these opportunities exist on a global scale.

Strategically the way is clear; either enterprises make their systems interoperate more and more closely - or get left behind. The long-term goal becomes to provide a framework for managing these links - enabling what can be called seamless interoperability.

Seamless interoperability brings new strategic capabilities

Automating the links creates end-to-end 'straight through' automated processes. This not only improves the existing process, it also creates strategic opportunities for new business models and corresponding threats to followers of the existing models. It further removes a major barrier to the strategic capability to quickly adapt business models to changing business conditions, by enabling business applications to be plug and played in the configurations needed to support changes in their business model.

Seamless interoperability also brings a significant (outstanding) challenge - semantic interoperability

While there are many promising solutions to the technological requirements, experience in implementing interoperability is showing that there is (at least) one significant challenge. This is semantical - in ensuring that the meaning of the data sent by one system is sufficiently well understood by the receiving system that it can process it properly.

BORO’s goal is to work with enterprises to meet this semantic interoperability challenge.

BORO aims to meet the semantic interoperability challenge by continuing to work with enterprises;
- developing and applying its methodology for extracting specifications of the semantic content - reference ontologies - from their business applications, and
- enhancing and extending its stock of reference ontologies available for re-use.

By working with enterprises, BORO aims to ensure that:
- its approach is focused on the real needs of enterprises, and
• enterprises get the full benefits of its approach, by applying it appropriately

The Focus
Source: http://www.boroprogram.org/boro_program/focus.htm

... is currently on the seamless interoperability of enterprises’ *operational* applications.

The choice of operational applications

... is motivated by two main considerations.

1. This is the area in which many businesses’ strategic need to establish adequate interoperability (and the challenge of semantic interoperability) is particularly acute - both in terms of the costs of not achieving it and the benefits of successfully implementing it.

2. Operational systems provide a particularly fruitful subject for BORO’s approach - both as suitable material for the BORO Methodology and as a source for reference ontologies.

The Challenges Facing the BORO Program
Source: http://www.boroprogram.org/boro_program/challenges.htm

The BORO Program faces both technical and managerial challenges.

• Technical - developing an approach that can address the emerging wide-ranging requirements for seamless semantic interoperability, and

• Managerial - facilitating the take-up of a radically new approach, including assisting with individual implementations.

The technical challenges

... for seamless semantic interoperability relate to both content and independence.

The content requirements can be characterised in terms of width, range and diversity.

The semantic content for any particular enterprise application comes as a piece - its meaning depending on how the parts of the piece link together. So the specification of the content has to span this width. A simplistic example. The semantics of a foreign exchange trading application has to include a reasonably complete range of the objects that are involved in that type of enterprise. It would make no sense to specify the concept of a foreign exchange trade without some link to the concept of the dealer who makes the trade.

Interoperability also has to cater for the ways in which processes range across domains. The payment of a particular premium an insurance application might also appear as a deduction in a payroll application and a transfer between accounts in a banking application. The specification of content has to span, at least to some extent, the range of aspects that a object appearing in one application can acquire in other applications - if these applications are to interoperate.

If interoperability is to be able to cater for different enterprises with different ways of doing business, it cannot prescribe a one size fits all regime - a single standard for everyone. It needs to be able to account
for at least some of the diversity in practice that currently exists - and allow different kinds of diversity to evolve in the future.

The independence requirements can be characterised as eliminating any unnecessary dependence on any non-semantic aspects of specific implementations

So the specification of semantic content needs to be independent of the particular characteristics of any enterprises' systems - such as; architecture, applications, and technologies. Changing the application architecture, or removing (or replacing) a particular enterprise application within the architecture, or introducing a new technology should have no impact on the semantic specification.

A more difficult requirement, is the need to be independent of particular business models. So if an enterprise with a new, different, business model needs to interoperate - the semantic specification should not need enhancing.

The extent to which these requirements are met will determine the agility with which an enterprise can redeploy its applications in response to a changing business environment.

The managerial challenges

... mainly relate to facilitating the implementation of the new approach. Before people will sanction a new way of working, they need to be persuaded that there is a benefit in doing so. Before they can start working productively in this new way, they need to understand and acquire some experience of how this is done. BORO recognises that this is necessarily part of its remit.

Resources

Source: http://www.boroprogram.org/boro_program/resources.htm

Resources available On-site

BORO Working Papers

Source: http://www.boroprogram.org/boro_program/resources.htm

Volumes

Volume A - The BORO Approach
http://www.boroprogram.org/boro_program/wp_a.htm

Volume O - Ontology
http://www.boroprogram.org/boro_program/wp_o.htm

Volume B - The BORO Business Object Ontology
http://www.boroprogram.org/boro_program/wp_b.htm

Volume M - The BORO Methodology
BORO Technical Reports Articles and Papers

http://www.boroprogram.org/boro_program/trap.htm

BORO - CEO Project reports

http://www.boroprogram.org/boro_prog...eo_project.htm

BORO Reference Ontologies

http://www.boroprogram.org/boro_program/ront.htm

BOOK - Business Objects: Re-engineering for re-use

http://www.boroprogram.org/boro_program/bo_rfr.htm

BORO Technical Reports, Articles and Papers
Source: http://www.boroprogram.org/boro_program/trap.htm

BORO-LADSEB Technical Reports

Report 04-02 - What is Pump Facility PF101? A Study in Ontology
http://www.boroprogram.org/boro_prog..._t_r_04-02.pdf

Report 05-02 - The Role of Ontology in Integrating Semantically Heterogeneous Databases
http://www.boroprogram.org/boro_prog..._t_r_05-02.pdf

Report 06-02 - Note: A Couple of Meta-Ontological Choices for Ontological Architectures
http://www.boroprogram.org/boro_prog..._t_r_06-02.pdf

Report 07-02 - The CEO Project: An Introduction
http://www.boroprogram.org/boro_prog..._t_r_07-02.pdf

http://www.boroprogram.org/boro_prog..._t_r_24-02.pdf

BORO Papers

A Synthesis of State of the Art Enterprise Ontologies: Work in Progress

http://www.boroprogram.org/boro_prog...rap/OES-01.pdf

Presented at OES-SEO2001 - to the International Workshop on Open Enterprise Solutions: Systems, Experiences, and organizations (paper).

What is a customer? The beginning of a reference ontology for customer

http://www.boroprogram.org/boro_prog...ap/O-02-BS.pdf

Presented at OOPSLA 2002 - to the 11th Workshop on Behavioral Semantics.

The Role of Ontology in Semantic Integration.

http://www.boroprogram.org/boro_prog...ap/O-02-SE.pdf

Presented at OOPSLA 2002 - to the 2nd Workshop on the Semantics of Enterprise Integration. (Note: Report 05-02 The Role of Ontology in Integrating Semantically Heterogeneous Databases above is an extended version of this paper)

http://www.boroprogram.dsl.pipex.com... t_r_05-02.pdf

BORO - CEO Project reports
Source: http://www.boroprogram.org/boro_centre/nay.htm

the document you requested is not available yet

BORO Reference Ontologies
Source: http://www.boroprogram.org/boro_program/ont.htm

FRO - Framework Reference Ontology (*** under construction ***)

BROnt - Business Reference Ontologies

A - Organisation (*** under construction ***)

B - Geo-Political Region (*** not yet available ***)

C - Asset (*** not yet available ***)

D - Transaction (*** not yet available ***)

FROnt - Financial Reference Ontology (*** not yet available ***)

BOOK - Business Objects: Re-engineering for re-use
Source: http://www.boroprogram.org/boro_program/bo_rfr.htm

Book Overview

This page is devoted to the book 'Business Objects: Re-engineering for Re-use'

It was published in 1996 by Butterworth-Heinemann (ISBN: 075062082X)

The book describes the Business Object Paradigm (a kind of top level Ontology) and how it evolved from earlier paradigms.
It also describes the REV-ENG methodology for re-engineering legacy systems with the framework of the Business Object Paradigm.

The first edition has sold out, although it is still listed on Amazon and used copies are normally available - the link is http://www.amazon.com/exec/obidos/ASIN/075062082X.

A second edition is in the process of being prepared for publication. Until this process is substantially complete a review copy of the second edition is being made available on the strict condition that it only used for review purposes. A single (large) PDF copy can be downloaded from here.

Or it can be downloaded in parts using the links below:

BusObj1.ZIP 0.9Mb http://www.brunel.ac.uk/~cssrcsp/Parts/BusObj1.pdf
BusObj2.ZIP 0.9Mb http://www.brunel.ac.uk/~cssrcsp/Parts/BusObj2.pdf
BusObj3.ZIP 1.1Mb http://www.brunel.ac.uk/~cssrcsp/Parts/BusObj3.pdf
BusObj4.ZIP 0.6Mb http://www.brunel.ac.uk/~cssrcsp/Parts/BusObj4.pdf
BusObj5.ZIP 1.2Mb http://www.brunel.ac.uk/~cssrcsp/Parts/BusObj5.pdf
BusObj6.ZIP 1.8Mb http://www.brunel.ac.uk/~cssrcsp/Parts/BusObj6.pdf

Links

Source: http://www.boroprogram.org/boro_program/links.htm

There are a growing number of websites devoted to Ontologies (in all its guises). Listed below are those most relevant to the BORO Program. If you are looking for an extensive list of ontological sites, then most of the sites below maintain such a list.

EPISTLE

The European Process Industries STEP Technical Liaison Executive has used the BORO techniques extensively in the construction of its 'data models'. Its home page is at:

http://www.epistle.ws/

The latest EPISTLE Core Model - version 4.0 - can be found at:

http://www.btinternet.com/~chris.ang...m/ecm_400.html

Laboratory for Applied Ontology (LOA)

Has a website devoted to matters ontological. Its home page is at:

http://www.loa-cnr.it

The Buffalo Ontology Site

This is maintained by Barry Smith. It contains information on ontology, on the history of ontology, and on contemporary ontology and its applications, as well as links to other ontology sites and announcements of relevant conferences and publications.

http://ontology.buffalo.edu/
John Sowa maintains an interesting website devoted to explaining (his vision of) ontology at:

http://www.jfsowa.com/ontology/

Business Objects: Re-Engineering for Re-Use

This book describes the BORO Approach in some detail. The link to Amazon is:

http://www.amazon.com/exec/obidos/ASIN/075062082X

An electronic copy of a version currently being revised can be downloaded from here:
http://www.boroprogram.org/boro_program/bo_rfr.htm

The BORO Centre

Source: http://www.boroprogram.org/boro_centre/index.htm

Developing and exploiting opportunities for applying Reference Ontologies (RO) based upon the Business Object (BO) paradigm to build significantly better business systems through the use of the BORO Methodology™.

http://www.boroprogram.org/boro_cent...ethodology.htm

The centre is currently involved in two main streams of work:

Business Services - Helping enterprises to exploit the benefits of applying reference ontologies to their business systems development. http://www.boroprogram.org/boro_cent... induction.htm

Research - Developing a better understanding of the application of reference ontologies to business systems and evolving the toolkits to support their commercial development and deployment. This research work is undertaken within the BORO Program. http://www.boroprogram.org/boro_program/resources.htm and http://www.boroprogram.org/index.html

About BORO Centre

Source: http://www.boroprogram.org/boro_centre/centre_about.htm

The BORO Centre is a private corporation that has been set up to assist enterprises in exploiting Reference Ontologies (RO) based upon the Business Object (BO) paradigm.

The centre is currently involved in three main areas:

• Research - Developing BORO reference ontologies - and toolkits to support their development and deployment.
• Consultancy - Helping enterprises to exploit the benefits of using BORO reference ontologies - assisted by BORO toolkits.
• Education - Helping enterprises to develop the skills needed to work with the BORO reference ontologies and toolkits.

The BORO Centre - Research

The research activities of The BORO Centre are undertaken within The BORO Program.
Currently, the prime focus of The BORO Program is on the CEO (Core Enterprise Ontology) Project

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**Approach**

Source: [http://www.boroprogram.org/boro_centre/centre_approach.htm](http://www.boroprogram.org/boro_centre/centre_approach.htm)

The BORO Methodology is a systematic process for the re-engineering of a business model from existing business materials, typically an existing legacy application. Its key feature is the ability to extract the underlying general patterns that inform the business - enabling much simple business systems to be built.

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**Business Services**

Source: [http://www.boroprogram.org/boro_centre/centre_services.htm](http://www.boroprogram.org/boro_centre/centre_services.htm)

The BORO Centre aims to provide a series of services to help enterprises establish and grow a BORO-based development team.

This is achieved by:

- **BORO Induction** - Supporting enterprises in creating a BORO-based development team. This involves training and mentoring in the use of a BORO Toolkit which includes: the BORO Methodology™ and the BORO Starter Business Model.

  - [http://www.boroprogram.org/boro_cent... induction.htm](http://www.boroprogram.org/boro_cent... induction.htm)
  - [http://www.boroprogram.org/boro_cent...methology.htm](http://www.boroprogram.org/boro_cent...methology.htm)
  - [http://www.boroprogram.org/boro_cent...inessmodel.htm](http://www.boroprogram.org/boro_cent...inessmodel.htm)

- **BORO Consultancy** - Providing "on the ground" coaching/mentoring support to ensure the successful delivery of projects.

- **BORO Training** - Courses on the BORO Approach, including the BORO Methodology™ and the BORO Starter Business Model to help the team grow their understanding.

  - [http://www.boroprogram.org/boro_cent...s_training.htm](http://www.boroprogram.org/boro_cent...s_training.htm)
  - [http://www.boroprogram.org/boro_cent...methology.htm](http://www.boroprogram.org/boro_cent...methology.htm)
  - [http://www.boroprogram.org/boro_cent...inessmodel.htm](http://www.boroprogram.org/boro_cent...inessmodel.htm)
Enterprise Architecture
DoDAF 2.0 Principal Authors
DoDAF MetaModel (DM2) Lead Developer
Methodology Development
Enterprise Architecture Data & Analysis
Architecture Database and Tools

Data and Information Fusion
Data Fusion experimentation across the Naval subsurface, surface, air and C4ISR domains using the Networked Naval laboratories.

Combat Systems and C4ISR
Comprehensive understanding of, and experience in, information fusion, processes, techniques and underlying ontologies.

Ontologies and Bayes Nets
The underlying ontology has all the causal taxonomic, meronymic, associational, etc., knowledge to inform the construction and execution of the Bayes Network.

Services
Silver Bullet Solutions approach is to understand the “essence” of the problem and then devise appropriate solutions.

Focus Areas
- Sensor, data, and information fusion
- Enterprise, information technology, and C4ISR architecture
- Database software development

Enterprise Architecture
Describing the architecture of an enterprise improves the effectiveness or efficiency of the business itself. This includes innovations in the structure of an organization, the centralization or federation of business processes, the quality and timeliness of business information, and ensuring that money spent on information technology (IT) can be justified.

Methodology Development
Silver Bullet's Results-Driven Approach
Enterprise Architecture Data

Source: [http://www.silverbulletinc.com/dataware.htm](http://www.silverbulletinc.com/dataware.htm)

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**IntegratedEA**

- International Briefing for DoD CIO
  - IDEAS Recap
  - Why we used IDEAS – benefits
    1. Reduce common patterns across a lot of work
    2. Redundancy and analysis
    3. Information architecture
    4. Design methodology
    5. Information traceability
    6. Standards
    7. Semantic precision
  - How we implemented IDEAS
  - Implementation challenges

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EA Data Analysis

Source: [http://www.silverbulletinc.com/subEADataAnal.htm](http://www.silverbulletinc.com/subEADataAnal.htm)
Data Fusion

Source: http://www.silverbulletinc.com/datafusion.htm

Comprehensive understanding of, and experience in, information fusion, processes, techniques, and underlying ontologies.

Data and Information Fusion

Source: http://www.silverbulletinc.com/datainfofusion.htm
Data-Driven Fusion

Source: http://www.silverbulletinc.com/edatafusion.htm

Knowledge-Assisted Fusion

Source: http://www.silverbulletinc.com/knowasstfusion.htm
The Importance of Prior Knowledge

- For example, any human estimator would certainly use knowledge of Hartsfield’s runway, taxiway, and terminal area layout to predict where aircraft and ground vehicles are likely to move.

- This is hard to encode for computers and very few fusion algorithms dare to yet it is easy to show it has significant effects
  - We know how to encode
  - We know ways to use

Ontologies and Bayes Nets

Source: [http://www.silverbulletinc.com/demos.htm](http://www.silverbulletinc.com/demos.htm)
The underlying ontology has all the causal, taxonomic, meronymic, associational, etc. knowledge to inform the construction and execution of the Bayes Network. Small example for Electronic Warfare.

Demo: [Click here to run Ontology and Bayes Net Concept Demo](http://www.silverbulletinc.com/c4isr.htm)

## Combat Systems and C4ISR

Source: [http://www.silverbulletinc.com/c4isr.htm](http://www.silverbulletinc.com/c4isr.htm)

We take a unified approach to requirements analysis and formalization, acquisition, systems engineering, and configuration management that provides traceability across the entire system life-cycle. We also employ tools and techniques to make the life-cycle tractable and focused on key technical challenges.

- Acquisition System Engineering and Architecture Artifacts
- MOE’s and MOP’s
- Functional Designs and Specifications
- Performance and System Specifications
- Technical Requirements Documents
SeaPort™

Source: http://www.silverbulletinc.com/seaport.htm

- Task Orders Received
- Instructions Received
- Team Members
- Team Members Professional Support Experience
- Description of QA Program
- Points of Contact

We have many Government contracts available and can work with you to setup purchase orders or other service agreement vehicles.

Email your interest to David McDaniel, President, at davem@silverbulletinc.com for a speedy response.

Task Orders Received

Source: http://www.silverbulletinc.com/tor.htm

None

Instructions Received

Source: http://www.silverbulletinc.com/ir.htm

None
Silver Bullet Solutions, Inc. (SBSI) specializes in sensor and data fusion and integration, enterprise / IT / C4ISR architecture, and software and database development. SBSI is a recognized innovator in advanced levels of data fusion important for command and control, battle management, and surveillance and reconnaissance. These include ontology-based fusion, multiple-hypothesis databases, and real-time command and control databases. SBSI has recently published papers on these topics. These technologies are being employed by the Virtual SYSCOMs. SBSI is a nationally recognized expert on enterprise / IT / C4ISR architectures and is currently supporting the Office of the Secretary of Defense (OSS), Joint Forces Command, and the Air Force Engineering and Development Center. SBSI was designated the Department of Navy representative for a two year assignment to revise the DoD Architecture Framework, the document cited in many DoD, JCS, and service level instructions and directives. SBSI has developed many software applications and databases for the Virtual SYSCOMS using rapid prototyping techniques and innovative data translation and data warehousing techniques. In particular, the functional areas in which SBSI is strongest are:

- **R&D Support.** SBSI has extensive expertise with the Virtual SYSCOMs in information, data, and sensor fusion and integration, from research to systems implementation. Recent R&D includes ontology based fusion, development and use of inference algorithms and nets, knowledge based fusion, complex data translation, and in-depth experience in performing fusion with intelligence-based databases. These technologies are involved in many of the Virtual SYSCOM programs for C4ISR, Weapons Systems, and databases.

- **Engineering Support.** SBSI has widely recognized capabilities in C4ISR architecture, system-of-systems engineering, enterprise architecture, and force warfare systems engineering and architecture. SBSI has worked with the Virtual SYSCOMs in these areas. Particular focus has been on Force, C4ISR, and Weapons Systems data architectures including TADILs, intelligence databases, interoperability standards, and core command and control data models.

- **Prototyping.** SBSI has developed prototypes for the Virtual SYSCOMS for mission and decision support systems related to new data architectures, next generation fusion, integrated M&S data warehouses, and enterprise architectures.
• **Software.** SBSI is on the leading edge of technology enhancement through its use of innovative tools, techniques and products. SBSI has developed data fusion, data integration, and decision support software for the Virtual SYSCOMS. These include development of real-time databases for Battle Management and Command and Control, taxonomy tools, and data translation tools. SBSI has developed a wide range of database products in database design and implementation and related applications for Virtual SYSCOM projects involving RDA/CHENG, SPAWAR, NAVAIR, Department of the Navy CIO, HQ USCG, OASD (NII), and US Joint Forces Command.

• **IS/IA/IT.** SBSI has been engaged in a wide range of IS/IT and other technology-related tasks since its founding in 1996 for a broad range of Naval customers, to include NAVSEA, SPAWAR, RDA/CHENG, Department of the Navy CIO, and the US Coast Guard. During that time, SBSI has gained significant expertise in program management, program/task support, system analysis and design, System of Systems (SOSe) Development, analysis of requirements for systems integration, systems migration, and Sunsetting of legacy systems.

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**AMSEC** provides naval architecture and marine engineering, electronic systems engineering, vessel system assessments, maintenance engineering and program development, shipyard industrial engineering, and complete logistics services, from technical manual development to provisioning documents, spare parts management and training. AMSEC currently has some 5000 employees in 30 offices nationwide, providing direct support in all Navy homeport concentrations and technical centers.

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**Ausley Associates Inc. (AAI)** provides expertise in several critical areas of Seaport-e, to include program and acquisition management, Engineering, Systems engineering, weapons integration, logistics management, and DoD Enterprise architecture development and maintenance. AAI supports DoD in defining and engineering future weapon systems, and assisting Program Managers in positioning their systems within the larger context of a Family of Systems. For the Navy and marine Corps, AAI is engaged in those organizations in documenting and streamlining business processes, developing information architectures, managing data assets, and integrating today’s legacy systems with tomorrow’s warfighting capabilities into one, Global Information Grid (GIG). Ausley also supports the Battle Space Engineering (BSE) Team in an analytical capacity, our work in the Systems Engineering and Architecture Analysis Environment (SEAAE) lab provides an integrated and advanced engineering environment to conduct the requisite complex analyses across the hardware, software and human factor aspects of architecture development. AAI is working with NAVAIR SEAAE to define the requirements that will enable multi-disciplinary development teams to address all architecture activities in a comprehensive and integrated manner.

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**BAE Systems** spearheads major multi-divisional engineering development and precursor advanced development programs for the Army, Navy, Air Force, Marine Corps, and Missile Defense Agency. This includes business development, systems engineering and project management. The Intelligence Programs Office provides technical solutions in the Intelligence and Security markets and operational solutions for customers working in counterterrorism, intelligence analysis, infrastructure protection, and cyber defense in the Intelligence Community and Department of Homeland Security.
CACI Inc. modernizes legacy systems and develops new ones to improve efficiency and reduce cost, while enhancing productivity, using proven Software Engineering Institute Capability Maturity Model Level 3 tools and procedures. The tools and techniques include: Activity-Based Costing - a comprehensive methodology guides us to deliver exactly the right ABC tool to each client; Business Intelligence (BI) - using a best practices approach; Enterprise Contract Management - solutions that seamlessly integrate into existing business environments; Manpower and Personnel Systems - CACI supports the U.S. Navy on development and integration projects involving manpower and personnel systems; Modeling and Simulation (M&S) - a component of CACI's software systems development and integration line of business; Simulation-Based Acquisition (SBA) - an Open Architecture acquisition process supported by collaborative applications of simulation technology across all phases of acquisition for all programs; and Wide Area Workflow - a web-based, e-Procurement, government-off-the-shelf (GOTS) system providing reconciliation and payment of commercial invoices, as well as acceptance documentation.

Concurrent Technologies Corporation (CTC) is an independent, nonprofit, applied research and development professional services organization that provides management and technology-based solutions to a wide array of clients representing state and federal government as well as the private sector. Through collaborating agreements with leading research institutions, government agencies and other organizations, CTC identifies, develops, analyzes, and applies the right technologies to position clients in world-class competitiveness. CTC's work in applied research and development moves high technology concepts from laboratories to practical applications by government, industry, and the nonprofit sectors. CTC's ability to conduct in-depth, impartial assessments of programs, processes, systems, and technologies results in affordable solutions that improve operations and add value.

CYLAB Inc. is a systems engineering and integration firm. Cylab was established in 1993 and was 8(a) certified with the Small Business Administration in February 1997. The Cylab mission is to provide innovative, creative, yet simple solutions to complex problems. The robustness of the software development, operation, and maintenance tool sets available today enable the implementation of these simple solutions significantly faster than was possible in the past. Cylab also strives to identify generic solutions that can be reapplied in similar situations. Through the use of flexible approaches such as data driven techniques and dynamic SQL, Cylab often identifies component solutions that work with applications of widely varying functionality. Cylab utilizes a strategic approach for effectively consolidating multiple systems, innovative architectural concepts in system implementation, and we produce new technologies and architectures to meet client requirements. The procedural approach of multiple system consolidation involves 'doing a small part fast' and helping the customer get internal support.

http://semanticommunity.info/Information_Sharing_Environment/DoDAt-DM2_Collaboration_Site
Updated: Wed, 23 Sep 2015 06:14:04 GMT
Powered by mindtouch
G2 Software Systems, Inc., (G2SS) based in San Diego County California, has been providing high-quality Software Application Development and Systems Engineering solutions to satisfied clients since 1989. A woman-owned small business, G2 Software Systems boasts an experienced and highly qualified staff of over 100 employees. The G2 Software Systems’ professional team is comprised of technical managers, senior software engineers, and training specialists with extensive expertise in all aspects of software development. This expertise includes systems analysis and design, database application development and administration, real-time processing applications implementation, communication systems development, Multilevel secure systems design and implementation, Java, C++, SQL, C and Ada language programming, along with training and field support.

Integrits conducts systems requirements analysis, system design reviews, develops concepts of operations for state of the art instrumentation (radar, optical, telemetry, SATCOM, and classified networks. They also provide systems engineering support for design, development, installation, integration, testing, and acceptance of complete, state of the art instrumentation systems, and support development of prototype test tools and simulation systems used in support of CSIT testing. Integrits conducts CM checks, documentation, and software configuration for CSIT and CSAT Testing; provides IA & IT support services; expertise in review and analysis of System Security Authorization agreements; CNO Level 1A Policy documents; GCCS-M, SSAA, DITSCAP, and DCID 6/3 Requirements.

Lockheed Martin (Orincon Defense) offers an expanding portfolio of data and information fusion products as baselines to enhance the Government’s multiple INT fusion efforts. We are pleased to complement the fusion technologies of Silver Bullet, Inc. to develop level 2(scene) and level 3(threat) fusion techniques for multiple-INT efforts plus refine level 1 (kinematic) fusion efforts for time-sensitive and asymmetric warfare operations. Cognitive space applications are offered as one example of higher order inferencing for information fusion. Lockheed Martin Orincon is positioned to support such efforts in Both Zones 2 and 6 from its offices in Arlington, VA and San Diego, CA.

Team Members Professional Support Experience

Source: http://www.silverbulletinc.com/tmpse.htm

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Description of QA Program

Source: http://www.silverbulletinc.com/dqap.htm

1.1.1. Ability to monitor and maximize quality

SBSI has a well-developed, time-tested set of policies and procedures, captured in the SBSI Policy & Procedures Manual (PPM). This manual details in depth the SBSI Quality Control Program for deliverables to clients. SBSI will apply PPM to its associates, under this contract, in the following ways:

- Quality Control training. Every associate who will be involved in the production of deliverables for a client, under a task order, will be required to participate in a formal session on the SBSI Quality Method. All deliverables will be reviewed against the Quality Control Method.

- In-Process Reviews with clients. SBSI will establish a ‘service band’—designated periods during which deliverables are expected to clients—and will arrange for In-Process Reviews immediately following product delivery, to ensure levels of quality on deliverables are maintained, and client requirements recognized that might cause modification or customization of established quality controls.

- Associates will be evaluated by the levels of quality achieved, in conformance with the SBSI Quality Method; the necessity for revisions to deliverables, and any known customer dissatisfaction. Mutually agreed upon corrective actions will be initiated that are designed to bring customer satisfaction up to desired levels.

1.1.2. Approach to guarantee responsiveness to and cooperation with customers

SBSI will conduct periodic reviews with senior Federal project staff to assess the level of cooperation, responsiveness, and adherence to stated project requirements. Some sessions with be with subs, and others conducted only prime to client during the life of a project.

1.1.3. Approach to problem resolution

Project resolution is best accomplished at the lowest level possible, and in the soonest period of time. SBSI will establish a problem resolution process, which will require all associates, as a problem in encountered, to document the problem, the steps to be taken to resolve the problem, and the results of the process.

Points of Contact

Source: http://www.silverbulletinc.com/poc.htm
Point of Contact to provide information on customer satisfaction with the services performed:
Elizabeth McDaniel, CEO
BethM@SilverBulletInc.com

Points of contact for information related to the Seaport program:
David McDaniel, President
David.McDaniel@SilverBulletInc.com

Products/Downloads

Source: http://www.silverbulletinc.com/products_downloads.htm

Silver Bullet Solutions has created a Database Tree Tool Suite (DTTS), consisting of a set of tree-control tools that enable tree viewing, creating, editing, and mapping of data stored in conventional DBMS’ such as MS Access, SQL Server, and Oracle. The two principal tools are Tree and Phrase.

Database Tree Tool Suite (DataTree / DataPhrase)

Source: http://www.silverbulletinc.com/dtts.htm

What

DTTS is a set of tree-control tools that enable tree viewing, creating, editing, and mapping of data stored in conventional DBMS’ such as MS Access, SQL Server, and Oracle. The two principal tools are Tree and Phrase. Tree is shown below for a typical application.

![Figure 1. Tree](http://semanticommunity.info/Information_Sharing_Environment/DoDAF-DM2_Collaboration_Site)

Working much like MS Window’s Explorer and similar tools, a left pane displays a tree whose branches can be expanded and collapsed just as in Explorer, using the +/- symbols to the left of the branch name. Just as in Explorer, branches can be moved by drag-and-drop. Branches can be deleted, added, and renamed.
Again like Explorer, the right pane is a list view. The columns shown in the list pane can be any field in the database record. The selection of fields shown is similar to Explorer, via a right-click action on the column header. Unlike Explorer, a Custom view can be defined by Customize popup selectable at the right-click action on the column bar. With the popup, the fields to be shown in the left to right order of the columns can be made quickly. Also, the row height can be specified. Like Explorer, clicking on a column header causes the list to sort in the order, click again causes it to reverse order.

The tree is loaded by selecting a database upon which a popup is presented that allows mapping of the name, description, and tree-parent fields. In case there is a qualifier, e.g., a database code indicating a type of parent, that can also be specified. Upon mapping completion, the tree is created. Any changes to the tree or database fields are stored back into the database. The a field is added to the database or the database is changed in some other way after loading in Tree, the tree can be recreated using a Refresh (contents only change) or CreateTree (structure change) button.

Phrase in a typical application is shown below. Phrase displays and allows the entry and edit of all forms of mappings between trees. Phrase and Tree can operate against the same database at the same time. The left and right panes display the same tree although the branch expansions and collapses are independent. The middle pane displays a mapping “type” tree. The mapping type tree can be as simple (one node – “maps”) or complex as needed (e.g., a domain’s predicates.”) Because of this, Phrase’s use can span from simple mapping to elementary sentence or RDF triple creation to more complex sentence and logical forms, e.g., triples where the object and predicates can be triples and sophisticated predicate trees of logical or mereotopologic operators.

**Why**

DTTS was created to increase the dimensionality of database user interfaces. One of the powerful features of DBMS’ is the ability of users to view and edit their data in very flexible ways interactively. No compilation, program code, or batch processes are required. This enables a sort of end-user computing, wherein end-users can rapidly create and iterate reports and data analysis queries in what is relatively “real time” compared to a program development cycle and with respect to the time from recognition of the need to achievement of the result.

However, the dimensionality of the GUI is limited even when the dimensionality of the data is high. High dimensional data occurs in all sorts of applications:

- Part-of relationships in a supply database
- Type-of relationships in a catalog database
- Before-after in a personnel database

Relational databases support high-dimensionality data with relationships, sometimes many-to-many. However, the GUI for viewing and data entry out-of-the-box is linear – that is rows vs. columns. There is no way to tractably create, view, and edit multi-dimensional data and associated relationships with this type of GUI.
Examples of Navy processes in which these types of multi-dimensional GUIs have been needed:

- **Schema mapping.** Data schemas often have a hierarchical structure, e.g., classes have attributes, messages have fields. Mapping schemas is an important part of Community of Interest (COI) management under the Net Centric Data Strategy guidance (DODI 8320.02G.) Mapping flat lists is intractable for large and structurally different data schemas. Such mapping is important for just about every COI and for many capabilities, e.g., C2 and ISR.

- **Enterprise and Solutions Architectures.** As defined by DoD Architecture Framework (DoDAF) 2.0, hierarchies, taxonomies, mappings, and complex multi-dimensional relationships are required often to describe capabilities, business and operational processes, services, systems, and implementations of solutions. For example, the SV-5 relates System Functions (Activities performed by Systems) to Operational Activities (Activities performed by Organizations). Activities are almost always hierarchical, e.g., the Joint Chief’s of Staff Universal Joint Task List (UJTL), the basis for operational training for all U.S. Forces. Another is the development of a Systems Function hierarchy for the Performance Specification of a new program, so that its function can be understood, agreed-upon, and contracted for development. Phrase can then be used to maintain different types of traceability to requirements and legacy sources. There are many other examples for DoDAF and many of DTTS features had their genesis in DoDAF and prior C4ISR architecture work.

- **Joint Capabilities Integration and Development System (CJCSI 3170.01E).** The JCIDS process requires development of DoDAF views.

- **Interoperability and Supportability of Information Technology and National Security Systems (CJCSI 6212.01E).** This process requires submission of DoDAF views so that interoperability and supportability assessments can be made for programs in and of them selves and as parts of family or systems of systems.

- **Operation of the Defense Acquisition System (DODI 5000.2).** The DAS requires use of DoDAF views at milestone reviews.

- **Operational Situation Awareness and Data Fusion.** Higher orders of data fusion associated with situation awareness (e.g., object-object and object-event association) require representation of high-dimensional data. Indeed, Phase was initially developed under an ONR project for ontologically-supported data fusion in which complex threat behaviors were entered in Phrase and the reasoned-upon by a sophisticated multi-reasoning type application built by the University of Buffalo’s Center for Multisource Information Fusion (CMIF).
How

DTTS is a set of applications that run under Microsoft’s .NET Framework. The Microsoft .NET Framework is a software framework that includes a large library of coded solutions to common programming problems and a virtual machine that manages the execution of programs written specifically for the framework. The class library is used by DTTS programmers, who combine it with their own code to produce applications.

Consequently, DTTS execute in a software environment that manages the program's runtime requirements.

Download Now

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<th>Database Tree Tool Suite</th>
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White Papers, Articles, Briefings

Source: [http://www.silverbulletinc.com/articles.htm](http://www.silverbulletinc.com/articles.htm)

**Enterprise Data Architecture**
Presented at the Sixteenth Systems and Software Technology Conference, April 2004:

"The Role of Information Elements in Net Centric Data Management"

**Enterprise Data Fusion**
Conference Paper:

"An Information Fusion Framework for Data Integration"

**Data and Information Fusion**
Presented at the 5th International Conference on Information Fusion:

"Real-time DBMS for Data Fusion"

http://semanticommunity.info/Information_Sharing_Environment/DoDAF-DM2_Collaboration_Site

Updated: Wed, 23 Sep 2015 06:14:04 GMT

Powered by mindtouch
Presented at the 2005 National Symposium on Sensors and Data Fusion:

"Early Experiments with Ontology-Based Fusion"

Knowledge-Assisted Fusion
White Paper

"Airport Movement Area Knowledge-Assisted Association and Tracking"

Ontologies and Bayes Nets
White paper:

"Bayes Networks for Diverse-State and Large-Scale Fusion"

Presented at the 5th International Conference on Information Fusion:

"Multi-Hypothesis Database for Large-Scale Data Fusion"

Combat Systems and C4ISR
Document:

"FY 06 OA FN Experiment DEMO - Bravo Zulu"

Demos

Source: http://www.silverbulletinc.com/ontbayes_demo.htm

Ontologies and Bayes Net Concept Demo

Instructions:

3. Use these to start, pause, stop

4. Whenever you place cursor, shows the probabilities of threat at that point at that time

1. Use these sliders to setup the number of threats and sensors you want in the scenario

Ready?

Click here to run Demo
or Click here to view Demo video

Ontology knowledge being used:

Ontologies and Bayes Nets

Source: http://www.silverbulletinc.com/Bayes...sNetDemo02.htm
To run your own demo, [click here](#).

(NOTE: Latest Java Runtime Environment required. [Click here to download](#).)

---

**Careers**


Excellent Compensation
- Competitive salary structures
- Generous holidays & vacations
- Employee-managed 401K
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- Medical cost sharing
- Production Bonuses
- Sales Bonuses

We welcome, and are interested in talking with, innovators and those with an entrepreneurial spirit. As a small employee-owned company, we are eager to partner with you to bring your ideas and energy to our solutions set and help you in achieving your goals.

- **The SBSI Family**
- **Current Opportunities**

Email your interest to Dave McDaniel, President, at [David.McDaniel@SilverBulletInc.com](mailto:David.McDaniel@SilverBulletInc.com), for a speedy response.

Silver Bullet Solutions, Inc. is an Equal Opportunity Employer (EOE). Qualified applicants are considered for employment without regard to age, race, color, religion, sex, national origin, sexual orientation, disability, or veteran status. If you need assistance or an accommodation during the application process because of a disability, it is available upon request. The company is pleased to provide such assistance, and no applicant will be penalized as a result of such a request.

---

**The SBSI Family**

Source: [http://www.silverbulletinc.com/sbsi.htm](http://www.silverbulletinc.com/sbsi.htm)
Silver Bullet Solutions approach is to understand the “essence” of the problem and then devise appropriate solutions.

Focus Areas

- Sensor, data, and information fusion
- Enterprise, information technology, and C4ISR architecture
- Database software development

Capabilities

Download Silver Bullet Solutions' Capabilities Statement.

Partners

Silver Bullet has partnered with the Transformational Technologies Group, LLC, a multi-dimensional consortium centered around architectural methods, tools, and data.
<table>
<thead>
<tr>
<th>Capabilities-Based Management</th>
<th>The Essence of Enterprise Solutions</th>
<th>Enabling Transformation through Innovative Thinking</th>
<th>Practice Architecture</th>
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<tr>
<td>• Capabilities</td>
<td>• Enterprise Architecture:</td>
<td>• Portfolio Management</td>
<td>• DoD Architecture</td>
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<td>- “Open systems” -- “self-regulating” units of organization</td>
<td>- Ontologies</td>
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<td>- Also “wholes unto themselves” and “parts of other wholes.”</td>
<td>- Taxonomies</td>
<td>Portfolio objectives and managing investments</td>
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<td>• Open Systems Engineering:</td>
<td>- Data Models</td>
<td>in accordance with those goals.</td>
<td>Architecture</td>
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<td>- “Deciders” transform messages into actions</td>
<td>- Databases</td>
<td>• Capability Analysis</td>
<td>DoD Framework</td>
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<td>- “Transducers” translate messages between the decider and its internal resource structure and its external environment.</td>
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<td>Implementing a logical, incremental process</td>
<td>Framework Consulting</td>
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<td>• Scale-Free Networks:</td>
<td>• Data Model Mapping Techniques</td>
<td>toward the goal of understanding capability</td>
<td>Federal Framework</td>
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<td>- Changes cascade through clusters creating emergent behavior.</td>
<td>• Taxonomy and Mapping Tools</td>
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<td>Framework Consulting</td>
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<td>- Engineering enables management to avoid unintended consequences and maximize desired effects.</td>
<td>• Data Strategy</td>
<td>• Governance Planning and Implementation</td>
<td>Data Modeling/Architecture</td>
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<td>• Management Algebra</td>
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<td>A uniquely targeted approach to understanding governance requirements,</td>
<td>• Enterprise Architecture Tool</td>
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<td>- Defines a capability’s regulatory infrastructure.</td>
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<td>evaluating institutionalized processes and mechanisms</td>
<td>Evaluations and</td>
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<td>• Value-Based Cost</td>
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<td>• Transformation Planning &amp; Management</td>
<td>Recommendations</td>
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<td>- Focused on the development of Yield Curves.</td>
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<td>Making Enterprise Architecture relevant to transformation activities.</td>
<td>Software</td>
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<td>- The direction of change in the effectiveness of the capability relative to its cost.</td>
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<td>• Business Process Improvement / Re-engineering</td>
<td>- Business Process</td>
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<td>- Derived from the management algebra using “cost utility analysis.”</td>
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<td>• Enterprise Architecture Tool Bridges,</td>
<td>- Management</td>
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<td>Interfaces and Add-ons</td>
<td>- Design/Revolution</td>
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**Current Opportunities**

*Source: [http://www.silverbulletinc.com/opportunities.htm](http://www.silverbulletinc.com/opportunities.htm)*

**Excellent Compensation**

- Competitive salary structures
- 10 paid holidays
- Start at 15 paid vacation days
- Employee-managed 401K with 3% SBSI match
- Stock-Option Plan -- be an owner!

**Current opportunities:**

<table>
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<th>Position</th>
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**Source:** [http://semanticommunity.info/Information_Sharing_Environment/DoDAF-DM2_Collaboration_Site](http://semanticommunity.info/Information_Sharing_Environment/DoDAF-DM2_Collaboration_Site)

Updated: Wed, 23 Sep 2015 06:14:04 GMT

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About

Source: http://www.silverbulletinc.com/about.htm

Same as The SBSI Family above

Why "Silver Bullet"?

Source: http://www.silverbulletinc.com/whysilverbullet.htm

Responding to the overpromises of Computer Aided Software Engineering (CASE) tools, Brooks, who had been the Chief Architect for the renowned IBM OS 360 system and author of the landmark, “Mythical Man Month”, argued that tools could help with the “accidental” problems of software engineering but could not solve the “essence” of the problem. So today, enterprise tools are advertised as solving more than they can.

Silver Bullet Solutions was founded to draw focus on the “essence” of the problem and to bring to bear the right skills, knowledge, tools, and techniques.

Contract Vehicles

Source: [http://www.silverbulletinc.com/contractvehicles.htm](http://www.silverbulletinc.com/contractvehicles.htm)

Current Contracts
- Seaport-E (prime)
  - Team Members
  - Team Members
- Professional
  - Support Experience
  - Description of QA Program
  - Points of Contact
- Seaport-E (subs)
  - ITES-2S
  - Quick React
  - SPAWAR MSA
  - DON CIO Omnibus

Purchase Agreement Types
- Cost-Plus
- T&M
- Fixed Price
- Rate Audit Status

We have many Government contracts available and can work with you to setup purchase orders or other service agreement vehicles.

Email your interest to David McDaniel, President, at [David.McDaniel@silverbulletinc.com](mailto:David.McDaniel@silverbulletinc.com) for a speedy response.
## Corporate

Source: [http://www.silverbulletinc.com/corporate.htm](http://www.silverbulletinc.com/corporate.htm)

| Company details:       | • Founded in 1997  
|                       | • Incorporated State of California |
| Ownership:             | All United States, no foreign ownership |
| 3-yr average annual revenue: | $1,500,000 |
| Number of employees:   | 12 |
| NAICS Code(s):         | 334220, 334511, 334513, 334519, 336413, 336419, 336999, 517910, 518210, 519190, 541330, 541380, 541511, 541512, 541519, 541611, 541614, 541618, 541690, 541710, 541990 |
| Number of years in business: | 10 |

### Point of Contact:

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1901 N Ft. Myer Drive, Suite 501  
Arlington, Virginia 22209  
Phone 703.892.6062  
Fax 253.663.2023  
bethm@silverbulletinc.com

### Other:

• DCAS approved rate  
• Current and recent DoD contracts and subcontracts available for reference

## Personnel

Source: [http://www.silverbulletinc.com/personnel.htm](http://www.silverbulletinc.com/personnel.htm)

• Data Fusion Mathematicians

• Enterprise, IT and C4ISR Architects
• Cognitive and AI Scientists

• DBA, DA, OO and E-R Modelers

• Programmers

Current / Recent Projects

Source: http://www.silverbulletinc.com/projects.htm

• Airport Movement Area Safety System (AMASS) Fusion
  Federal Aviation Administration (Details...)

• Architecture Database and Analysis Support for Decision Support Center Studies
  Decision Support Center in the OASD for C3I (Details...)

• C4ISR Architecture
  Space and Naval Warfare Systems Command (SPAWAR) (Details...)

• C4ISR Data Warehouse
  Space and Naval Warfare Systems Command (SPAWAR) (Details...)

• CENTRIXS Architecture and NR-KPP Development
  Joint Interoperability Test Center (JITC) (Details...)

• Combat ID Data Requirements
  Naval Sea Systems Command (NAVSEA) Combat ID System Engineering Team (Details...)

• Core Architecture Data Model and DoD Architecture Framework
  Office of the Assistant Secretary of Defense for Network Infrastructure and Integration (Details...)

• Cost Allocation Program (CAP)
  Space and Naval Warfare Systems Command (SPAWAR) (Details...)

• Department of the Navy Enterprise Architecture
  Department of the Navy Chief Information Officer (Details...)

• DoD Architecture Configuration Management
  Office of the Assistant Secretary of Defense for Network Infrastructure and Integration (Details...)
• Enterprise Architecture Development, Arnold Engineering Development Center
  US Air Force, Arnold AFB, TN (Details...)

• Integrated Deepwater System C4ISR Taxonomies
  US Coast Guard (Details...)

• Joint Information Elements Dictionary
  Decision Support Center in the OASD for C3I (Details...)

• Joint Task Force Command and Control Architecture
  Joint Forces Command (JFCOM) (Details...)

• Multi-INT Fusion Model
  Decision Support Center in the OASD for C3I (Details...)

• Navy Common Data Base (NCDB)
  Chief of Naval Operations (CNO), Assessments Division (N81) (Details...)

• Navy Theater Wide (NTW) Battle Management and C4I (BMC4I) Architecture
  Naval Sea Systems Command (NAVSEA) Navy Theater Wide (NTW) Program Office (Details...)

• Next Generation Fusion Architecture
  PEO for Integrated Warfare Systems / Naval Air Systems Command (Details...)

• OACSIM Enterprise Architecture
  Office of the Assistant Chief of Staff for Installations Management (OACSIM) (Details...)

• PEO-IWS SIAP Architecture
  Naval Sea Systems Command (NAVSEA) (Details...)

• SIGINT Integration Directorate (SID) Architecture Support
  National Security Agency (NSA) (Details...)

• System of Systems Engineering in support of the Joint Battle Management Command and Control (JBMC2)
  Office of the Under Secretary of Defense (OUSD) for Acquisition, Technology, and Logistics (AT&L) (Details...)
Office Locations
Source: http://www.silverbulletinc.com/locations.htm

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Fax: 253.663.2023

Contact Us
Source: http://www.silverbulletinc.com/contact.htm

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David.McDaniel@SilverBulletInc.com  
(703) 892-6062, Ext. 2#  
(619) 253-9040 (Cellular)

Slides

DoDAFDM2WG20120626  
[Slides]
## 26 Jun 2012 DoDAF - DM2 WG Agenda

### Agenda

<table>
<thead>
<tr>
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<th>Topic</th>
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<tr>
<td>13:15</td>
<td>Recap last meeting &amp; DM2 v2.03 plan and DM2 OWL-LOL</td>
<td>McDaniel</td>
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<td>13:30</td>
<td>Brief Call</td>
<td>Schroder</td>
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<td>13:35</td>
<td>DM2 OWL-LOL Deep Dive</td>
<td>OCMO</td>
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<td>13:50</td>
<td>Demo of DM2 OWL-LOL BRM Use Cases</td>
<td>OCMO</td>
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<td>14:15</td>
<td>Next meeting</td>
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### New Topics:

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Meeting Objectives

- Walkthrough the DM2 v2.03 OWL-DL that describes draft content, structure, and usage patterns.

Outline

- BEA Ontology Framework Release 1
- DM2 v2.02 OWL-DL Approach Review
- Migrating from DM2 v2.02 to DM2 v2.03
- DM2 v2.03 vs. DM2 v2.02
- Lessons Learned with DM2 v2.02 OWL
- DM2 v2.03 OWL-DL Structure
- DM2 v2.03 OWL-DL Structure Points
- Usage Patterns for DM2 v2.03
- Example
- Demonstration
- Next Steps
BEA Ontology Framework Release 1

DM2 v2.02 OWL-DL Approach Review

- The goal is to describe DM2 completely in OWL open specification based constructs
  - Started with classes from the DM2 conceptual model
  - Expanded conceptual class model using details from DM2 logical model
  - All DM2 IDEAS based constructs that could be expressed in OWL were represented with standard OWL constructs; e.g.
    - ideas:Thing => owl:Thing
    - ideas:Name => rdfs:label
    - ideas:Type => owl:Class
  - All DM2 IDEAS based constructs that were not required to express DM2 in OWL-DL were not included at this time
Migrating from DM2 v2.02 to DM2 v2.03

- Evaluate lessons learned when creating DM2 v2.02
- Analyze differences between DM2 v2.02 model and DM2 v2.03
- Incorporate DM2 v2.03 model changes and lessons learned into DM2 v2.03 OWL structure and usage guidance
- Implement use cases for DM2 v2.03 structure
- Incorporate DM2 v2.03 into BEA Ontology Framework (BEAOF) Release 2

DM2 v2.03 vs. DM2 v2.02

- Rules and Desired Effects
  - Their Descriptions are produced by rule and goal-setting authorities
  - They are consumed by Activities (ala Controls in IDEF0)
  - Conforming Activities are subtypes
- Information Resource Flow was simplified into flatter type structure so it would be logically correct and consistent with other Resource Flows
- Capability made a subtype of Property so that it is the set of Tasks performed under Conditions that meet certain performance standards (Measures)
  - Makes Capability comparison and dependencies more direct (simple set operations)
- Distinguished that Guidance influences Activity from Rules that control Activity
- Added SoA, Joint Action concept and distinguished business services from enabling services
- Continued work on distinguishing Roles (within scope of EA) from types of persons (outside scope of EA)
Lessons Learned with DM2 v2.02 OWL

- Most BEA classes are easily mapped to types in the DM2 Conceptual Data Model
- DM2 contains a lot of different domain information in a single model; detailed OWL ontologies are better managed in distinct mid-level ontologies rather than grouped into a single ontology (best practice)
- DM2 Tuples represent both forward and inverse relationships, e.g. beforeAfter, wholePart
- DM2 Property is a key concept (e.g. Measure, Skill) and even more critical in v2.03 (e.g. Capability, Condition)
- DM2 is under formal configuration control and changes must be vetted via an agreed upon process

DM2 v2.03 OWL-DL Structural Adjustments

- Partition DM2 OWL into ‘upper’ and ‘horizontal’ ontology namespaces
  - General ‘upper’ ontology spanning more detailed horizontals
    - IDEAS Foundation Objects (IFOs) and DM2 concepts based on IFO
    - Namespaces and prefix mappings for ifo: and dm2:
  - More detailed and agile ‘horizontal’ ontologies spanning general functional areas
    - Namespaces for measures: location, security: ... (from DM2)
    - Namespace for process: (from BPMN)
- Model DM2 tuples as OWL object property + inverse pairs
  - DM2 tuple beforeAfter ➔ OWL ifo:before + ifo:after
  - DM2 tuple wholePart ➔ OWL ifo:hasPart + ifo:isPartOf
- Domain COI extensions (‘vertical’ ontologies) will extend the DM2 horizontal and upper ontologies
  - i.e. namespaces for HRM, FM, MSSM, RPILM, WSLM:
DM2 v2.03 OWL-DL Structure

DM2 v2.03 OWL-DL Structure Points

- DM2 Upper:
  - Founded on the DM2 Conceptual Data Model (CDM)
  - Enhanced with DM2 Logical Data Model (LDM)
  - IDEAS Foundation Objects (IFO) in separate namespace

- Horizontal Ontologies:
  - A broader set of more focused concepts
  - Some based on detailed portions of DM2 Logical Data Model (LDM)
  - Detailed Business Process Models (BPRM)
  - Potential to include models from other Communities (e.g., JCA extending DM2 Capability?)
  - Can evolve on more agile time line than 'upper' with oversight

- Domain Specific Vertical Ontologies
  - Communities build domain-specific vertical ontologies
  - COI extension of DM2 Upper and Horizontals to represent their applications / systems
  - Potentially BMAs (HRM, FM, MSSM, RPLIM, WILM), etc.
Usage Patterns for DM2 v2.03

- Extension of DM2 Upper Concepts
- Extension of DM2 Horizontal Ontologies
- IFO Property Object to OWL Design Pattern
  - `ifo:Property` types are modeled as OWL Classes and are subclassed from `ifo:Property`
  - For Example: `dm2:Capability` is defined as a sub-class of `ifo:Property`
- IFO Property mappings to OWL/RDFS
  - `ideas:superSubType` is represented using `rdfs:subClassOf`
  - `ifo:propertyOfType` is mapped as a sub-property (i.e. - `rdfs:subPropertyOf`) of `rdfs:subClassOf`
- OWL-DL reasoner provides added benefit of identifying non-explicit relationships

Sample BEA Capability Taxonomy

(IFO Property Object to OWL Design Pattern Example)
Demonstration

Example 1
Example 2

Example (cont.)

Requires that all of the listed activities be performed to have this capability.

Example Performer

Example Performer

Activities explicitly performed by the performer (e.g. - Army)

Note: These are incoming relationships (from the activity to the performer)
Inferred Relationships

- Using an OWL-DL reasoner, we can make inferences using what we know (i.e. – was has been explicitly asserted)

Notice that our Army performer is now a member of the "Engineering" class of capabilities

(remembe that dtu.superSubType mapping?)

Next Steps

- Continue to work with CIO and build out mini use-cases, test and adjust ontology according
  - Determine appropriate ‘cut off’ points between upper and horizontal
  - Develop OWL-DL horizontal ontologies already included in the DM2 LDM (Measures, Location)

- Implement Search and Rescue (SAR) use case

- Include DM2 v2.03 OWL in DM2 release package

- Include DM2 v2.03 OWL in the BEA Ontology Framework (BEAOF) Release 2
DM2 is Central Ontology to the BEA Ontology Framework (BEAOF)

BEA Ontology Architecture Vision

E2E Level 0 and Level 1 concepts as Instance Models in the BEA: represented as DoDAF CV models describing BMA reference capabilities – aligned with the ICAIs

E2E Level 2 concepts as Instance Models in the BEA: represented as DoDAF OV-6c models describing BMA reference processes, activities, etc
OWL based architecture data exchange

- Interoperability achieved through dynamic SPARQL queries not PES file transfer
- Well defined DM2 OWL-DL Ontology Architecture provides foundation for verticals to inherit consistent vocabulary
- OWL equivalentClass and sameAs constructs support harmonization of vertical ontology vocabularies if necessary

Why use OWL based Ontologies?

- OWL is an industry standard to express Ontologies:
  - WC3 open specification
  - Support from Open Source and COTS tool vendors
  - Tools exist to create/visualize OWL files, and process OWL rules
  - Active growing community continues to submit new, rich, supporting specifications/capabilities, i.e. R2ML, RIF, SPIN, RDFa, etc.
- Contains a rich set of constructs and data types
  - Is extendable and provides a path for modular development & reuse
  - Captures both data, and rules that can be quickly adjusted in a controlled fashion vs. capturing rules in code with a long change/deploy process
  - Formal logic and supports reasoning
- Interoperability:
  - OWL files are easily shared, making structures visible and well understood
  - SPARQL query specifications provide solution to dynamic federated queries
  - Same concepts with different terms across federated ontologies can be resolved via OWL “sameAs” constructs
DCMO Federation via Semantic Standards

Hierarchy of Process Models

Enterprise Architecture

End-to-End Processes

Business Process Areas

Business Processes

Value Chain

Value Chain Segments

Business Process Map

AV-1, OV-1
• Provides Context
• Shows Focus Areas

• Shows Dependencies
• Organized around Outcomes

• Shows High-Level Info Flow
• Organized around Key Concepts

• Shows Activities, Decisions, Services, and Responsibilities
• Organized around Objectives
Discussion

Discussion

- IDEAS Foundation, DM2, and extensions
- ROI
  - BMA mandate X JCIDS process
  - Applicability to WMA, IC, & IEA
  - NSA ROI statistics (UFO, Kathern Goodier present future WG)

NSA ROI statistics (UFO, Kathern Goodier present future WG)

15 Jun 2012 DoDAF - DM2 WG Agenda

15 Jun 2012 DoDAF - DM2 WG Agenda

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<tr>
<td>10:15</td>
<td>DoDAF v2.03 Plan Update</td>
<td>McDermott</td>
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<td>10:30</td>
<td>Roll Call</td>
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<td>11:00</td>
<td>152D DLT-OL Workshop</td>
<td>CDMO</td>
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<td>McDermott</td>
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DoDAF v2.03 Status and Plan Update

Information brief to FAC
Mr. Walt Okon
27 April 2012

Office of the Chief Information Officer

Agenda

- DoDAF Roadmap
  - Common Approach Artifact Working Group
  - MODAF Ontological Data Exchange Model (MODEM)
  - NATO Architecture Capability Team (A CaT)
- Structure and contents of DoDAF v2.03
Direction for Unified Defense Architecture Framework

Common Approach

- Documentation section identifies 50 artifacts
- All but 9 map to the DoDAF 52
- AWG members from all Federal agencies working on refining the list and defining “one liners” for the artifacts
- 1st draft from DoD submitted to OMB 30 April 2012
MODEM: A Semantic Foundation For Enterprise Architecture

- Based on semantics to deal with semantic heterogeneity between the nations national Architecture Frameworks by the use of an approach based on Business Objects Reference Ontology (BORO)** Methodology.
- IDEAS Foundation has been exploited by US DoD for DoDAF 2 – DoDAF Meta Model (DM2).
- MODEM is the result of a Swedish led effort within IDEAS aiming for an evolution of MODAF Meta Model (M3) by exploiting the IDEAS foundation.
- A report was provided to the USA DoD:
  - "MODEM is significantly different from DM2, especially as regards the use of the IDEAS foundation."
  - "This is a concern given the fact that we all strive towards framework convergence."
- The DoDAF team reviewed the report:
  - 16 comments that were Quality Assurance (QA) in nature and have been fixed
  - Roughly 44 other comments, not critical, that can be discussed by the DoDAF DM2 Working Group in the future and entered as Change Requests (CR) for V.0.04

NATO Architecture Capability Team (A CaT)

- Determining how to support the Interoperability CaT as they maintain the NISP, the NATO version of the DISR baseline
- Tracking the new Information Integration Services CaT (IIS CaT) being stood up the first week of June
- Planning for the Sept 2012 A CaT Workshop to converge all of the existing frameworks
IDEAS Layered Approach

1. Foundation (upper ontology)
2. Common patterns
3. Universal objects & relationships

1. Ontologic concepts and relationships
2. Commonly used patterns, e.g., Resource Flow, Exchange
3. Universally accepted concepts and relationships, e.g., person, organization, material, etc.

Reports drawn from the architecture data specific to needs and policies of individual nations

Structure and contents of DoDAF v2.03

- Vol. I - Normative
  - DMZ Conceptual Data Model (CDM) documentation
  - DoDAF Viewpoints & Models
- Vol. II - Normative
  - DMZ Logical Data Model (LDM) documentation
  - DoDAF Model specs
  - DoDAF Glossary
- Vol. III - Normative
  - IDEAS documentation
  - DMZ Physical Exchange Specification (PES) documentation
  - DMZ OWL. DL documentation
- In the DoD MOD "ARCH" namespace supporting the DoD EA COI - Normative
  - Labs for IDEAS documentation v1.0
  - SparEa EA-DM2 OWL file
  - DMZ ONAF OWL file
  - DMZ OWL. IX file
- Vol IV - Informative
  - DoDAF Informative material (e.g., history of the DoDAF, 5-step, approximately 30 articles)
  - NOT under formal IDM
Revised Production Schedule

Office of the Chief Information Officer
Questions in JCS J6 DD C2I Architecture Federation Branch

1. Are there any documented/storyboard use cases to show the "value added" of using OWL? i.e. Why should we do this?
2. Where is the analysis of alternatives/proofof concept to show this is beneficial to incorporate?
3. Has a full set of DM2 compliant architecture products been extracted, transformed to OWL schema, consumed and put to use, then exported and transformed back to DM2 to validate the methodology?
4. 70 percent of all JCSS documents we have reviewed in the last 12 months are still only DoDFAF 1.5 conformant, the rest being flat files that are DoDFAF 2.0, and NONE are being delivered with a DM2 compliant data set. How does OWL deal with legacy products? How much level of effort is involved in converting legacy 1.5 products to OWL compliance?
5. What is the level of effort involved in creating an OWL compliant schema from a DM2 compliant schema?
6. Who will be responsible for resourcing the training of personnel in OWL compliant schemas?
7. Where is the actual demonstrated capability residing? Or is this still in the "idea" phase?
8. Bottom line: Where is the analysis of alternatives to show this is the right way to go? Where is the demonstrated value in doing this? How will this benefit our customers? Who will resource this transition (training and implementation)? Has this been completely tested and proven in an environment where it can be demonstrated, code made available for analysis and open for the community to comment?
9. We have a lot more technical questions, but will hold until thorough review of the OWL schema and can see a demonstrated capability in action.

DM2 OWL-DL Approach

June 15, 2012
Meeting Agenda

Objectives of the Meeting

Goal:
• Educate DoDAF-DM2 WG on the DM2 OWL-DL in DoDAF 2.03, Volume 3

Objectives:
• Describe an OWL based alternative to the existing DM2 framework
• Describe the intended use of the DM2 OWL-DL
• Outline the benefits of a proposed OWL based DM2 alternative
• Overview the DCMO semantic path to Federation and the related work that has occurred to date in support of the DM2 OWL-DL
DCMO Mandate - Standards Approach

DoD Federated/Net-centricity and DCMO Approach

**Enterprise Architecture Federation Strategy** on Semantic Alignment excerpt:
A key goal of net-centricity is to enable semantic understanding of data so that interoperability can be achieved between any applications that have the ability to access and interpret the structural and semantic rules associated with data.

**Net-centric Data Strategy** on Interoperable except:
Data Interoperability - The ability to share information among components while preserving its accuracy, integrity and appropriate use. The ability of two or more systems or components to exchange information and to use the information that has been exchanged.

Goal: Decentralize data management to communities of interest (COIs) to allow prioritization and collaboration based on immediate operational needs while providing enterprise infrastructure for self-synchronization on a larger scale.

**BEA - DoD Federated/Net-centric approach through Standard Semantic Specifications**
- OWL (Web Ontology Language)
- OWL-QL (Descriptive logic)
- SPARQL 1.1 (OWL Query Language)
- BPMN 2.0 (Business Process) 
- Standards adopted by DoD in the DoDAF

A standards-based semantic understanding between enterprise applications supports the shift from a stale data warehousing approach to federated dynamic retrieval of authoritative data sources approach.
Intended Use of the DM2 OWL-DL

- Mandated for “all enterprise and solution architectures federated or asserting compliance with the BEA”
  - When/How? As directed by the Business Investment Review Board schedule
  - DCMO to initiate discussion with Joint Staff to synchronize policy mandates (e.g. CJCSI 6212, 3170)
  - DCMO offering “Equipping The Workforce” to assist in guidance and building competency
- Optional for non-business architectures
  - Level 4 DoDAF Conformance

DCMO Federation via Semantic Standards

http://semanticommunity.info/Information_Sharing_Environment/DoDAF-DM2_Collaboration Site
Updated: Wed, 23 Sep 2015 06:14:04 GMT
Powered by mindtouch
Hierarchy of Process Models

End-to-End Processes

Business Process Areas

Business Processes

BPMN 2.0 XML – Process Model as Data

Process Content in XML can be transformed to Semantic Standards for advanced analytics
Semantic BEA Objectives

- Design and create a BEA ontology that establishes and integrates BEA, DM2, BPMN 2.0, and other domain ontology OWL files
- Migrate existing BEA data to RDF store that reflects new integrated ontology
- Test the BEA RDF store with SPARQL queries
  - Query from BEA, BPMN, and DM2 perspective

DCMO Foundational Ontologies

Notional View of Foundational Ontologies
Alignment with DoDAF v2.0

Why use OWL based Ontologies?

- OWL is an industry standard to express Ontologies:
  - W3C open specification
  - Support from Open Source and COTS tool vendors
  - Tools exist to create/visualize OWL files and process OWL rules
  - Active growing community continues to submit new, rich, supporting specifications/capabilities, i.e. R2ML, RIF, SPIN, RDFS, etc.
  - Consistent with IDEAS

- Contains a rich set of constructs and data types:
  - Is extendible and provides a path for modular development & reuse
  - Captures both data and rules that can be quickly adjusted in a controlled fashion vs. capturing rules in code with a long change-deploy process
  - Formal logic and supports reasoning

- Interoperability:
  - OWL files are easily shared, making structures visible and well understood
  - SPARQL query specifications provide solution to dynamic federated queries
  - Same concepts with different terms across federated ontologies can be resolved via OWL "sameAs" constructs

http://semanticommunity.info/Information_Sharing_Environment/DoDAF-DM2_Collaboration_Site
Updated: Wed, 23 Sep 2015 06:14:04 GMT
Powered by mindtouch™
DCMO DM2 OWL-DL Approach

- The goal is to describe DM2 completely in OWL open specification based constructs
  - Started with classes from the DM2 conceptual model
  - Expanded conceptual class model using details from DM2 logical model
  - All DM2 IDEAS based constructs that could be expressed in OWL were replaced with standard OWL constructs; e.g.
    - `idea:Thing` => `owl:Thing`
    - `idea:Name` => `rdfs:label`
    - `idea:Type` => `owl:Class`
  - All DM2 IDEAS based constructs that were not required to express DM2 were not included

BEA Ontology Implementation

- **Release 1 Delivery of BEA Ontology(DM2 v2.0.2, BPMN 2.0, BEA 9.0)**
  - Ontologies Credited: by Small Working Teams
  - DM2 Working Teams; BPMN 2.0 Working Teams; BEA Working Team
  - Groups compiled of diverse members: Engineers, Ontologists, SMEs...

- **Created DM2 v2.0.2 Ontology**
  - Based on DM2 Logical and Conceptual Model
  - Replaced IDEAS constructs with OWL constructs

- **Created BPMN 2.0 Ontology**
  - Contains BPMN Analysis Conformance
  - BPMN 2.0 specifications used to create ontology
  - Plan to submit to OMG has a industry standard

- **Created BPMN 2.0 to DM2 Mapping Ontology**
  - Maps some BPMN concepts and relationships to DM2 OWL
  - Mapping achieved via OWL sub-classing and chaining axioms

- **Create BEA Core Ontology**
  - BEA: Core, TCB; process use BPMN 2.0 directly
  - BEA non-BPMN enabled data (CV2, CV3, CV6, CV7, CV8, CV10, CV12) map to DM2 directly via sub-ontology
Status of BEA Ontology Framework

Release 1 Delivery

- BEA 9.0 data was migrated into DCMO Phase 1 Foundational Ontologies and tested with SPARQL queries

- A “BEA Ontologies” repository has been established on Forge.mil
  
  https://software.forge.mil/projects/techcentre/ontologies

  - Version 1.0.0 of DM2 v2.02, BPMN 2.0, and 1.0.0 BEA ontologies have been submitted to the “BEA Ontologies” directory

  - Ontology versioning is currently specified via owl:versionInfo tag

  - A “BEA Ontology Framework Usage Guide” and readme file are also provided on Forge.mil

DM2 Ontology Sample Snapshot

http://semanticommunity.info/Information_Sharing_Environment/DoDAF-DM2_Collaboration_Site
Updated: Wed, 23 Sep 2015 06:14:04 GMT
Powered by mindtouch
BPMN 2.0 Ontology Sample Snapshot

Example BPMN-DM2 Class Mappings
DM2 v2.02 and OWL-DL DM2 v2.03

Summary: Proposing an alternative to the existing DM2 conformance approach that would:
- Represent DM2 architecture in a pure OWL-DL based ontology
- Perform federated architecture data exchange via SPARQL queries

Current Focus: Update ontology to reflect DM2 v2.03
- Working with CIO, using lessons learned
- Analyze differences between DM2 v2.02 and DM2 v2.03 and incorporate into new OWL-DL DM2 v2.03 model
- Integrate OWL-DL DM2 v2.03 file into DCMO Foundational Ontology Architecture and test
- Include Version 1.0.0 of DM2 v2.03 ontology with DoDAF 2.03, Volume 3

Lessons Learned

- Most BEA classes are easily mapped to types in the DM2 Conceptual Data Model
- DM2 contains a lot of different domain information in a single model, detailed OWL ontologies are better managed in distinct mid-level ontologies rather than grouped into a single ontology
- DM2 Tuples represent both forward and inverse relationships, e.g. beforeAfter, wholePart
- DM2 Property is a key concept (e.g. Measure, Skill) and even more critical in v2.03 (e.g. Capability, Condition)
- DM2 is evolving and changes must be vetted via a long running process
- PES interoperability is typically achieved via large pre-generated file transfers
Adjustments Based On Lessons Learned #1

- Partition DM2 OWL into ‘upper’ and ‘horizontal’ ontology namespaces
  - General ‘upper’ ontology spanning more detailed horizontals
    - Namespaces ifo: and dm2:
  - More detailed ‘horizontal’ ontologies spanning general functional areas
    - Namespaces for measures:, location:, security:… (from DM2)
    - Namespace for process: (from BPMN)
  - Domain specific ‘vertical’ ontologies extending the horizontals (and upper)
    - Namespaces for HRM:, FM:, MSSM:, RPILM:, WSLM:

DM2 v2.03 OWL-DL Ontology Architecture

- OWL-DL DM2 Conceptual Upper Ontology
  - Measures, Location, Process, Security

- Warfighter, Ballistic, Missile Defense, Business Mission, Areas

- Developed by DM2 and C2I
- Content from DM2 CORAF DM2 DM2, Ds, and operational ontologies
- Developed content DM2 CORAF DM2 DM2, Ds, and operational ontologies

- All industry standards
- Data exchange done via dynamic SPARQL queries across the enterprise
- Leverage larger pool of C2I’s resources for developed horizontal ontologies
- Power of same technologies and extended ontologies to map international differences
OWL-DL DM2 Conceptual Upper Ontology

- Founded on the DM2 Conceptual Data Model (CDM)
  - Enhanced with semantically stronger “links” (i.e. DM2:couple) from the DM2 Logical Data Model (LDM)
  - IDEAS foundation concepts used directly by DM2 (i.e. ifo) in separate namespace
- A stable set of general concepts
  - Expect less change and CM needs
  - DM2 WG configuration item?

OWL-DL Detailed Horizontal Ontologies

- A Set of Focused Cross-Domain Vocabularies
  - Some based on detailed portions of DM2 Logical Data Model (LDM)
  - Detailed Business Process Models (BPMN)
  - Potential to include models from other Communities (e.g. JCAs extending DM2 Capability?)
- A broader set of more focused concepts
  - Expect more focused, distributed WG communities
  - Can evolve on more agile time line than ‘upper’
  - DM2 WG oversight role?
OWL-DL Vertical Domain Ontologies

• Communities build domain specific vertical ontologies that extend horizontalis to represent their applications/systems

• Business examples could align to PSAs and include: HRM, FM, MSSM, RPILM, WSLM

Adjustments Based On Lessons Learned #2

• Model DM2 tuples as OWL object property + inverse pairs
  – DM2 tuple beforeAfter \(\rightarrow\) OWL ifo:before + ifo:after
  – DM2 tuple wholePart \(\rightarrow\) OWL ifo:hasPart + ifo:isPartOf
Adjustments Based On Lessons Learned #3

• Explore Modeling DM2 Property Assignment using rdfs:subClassOf
  – DM2:propertyOfContentType is an IDEAS:superSubType
• DM2 Capability, Skill, Measure, and Condition are all subtypes of DM2 Property
  – capabilityOfPerformer, skillOfPersonRole,
    measureOfType all subtypes of propertyOfType
  • activityPerformableUnderCondition an overlapType

OWL based architecture data exchange

• Interoperability achieved through dynamic SPARQL queries not PES file transfer
• Well defined DM2 OWL-DL Ontology Architecture provides foundation for verticals to inherit consistent vocabulary
• OWL equivalentClass and sameAs constructs support harmonization of vertical ontology vocabularies if necessary
Next Steps

- Understanding of proposed DM2 v2.03 Ontology Architecture
- Prove-out approach using realistic scenario
- Complete development of DM2 v2.03 Ontology Architecture
  - Complete OWL-DL DM2 Conceptual Upper Ontology
  - Determine appropriate ‘cut off’ points between upper and horizontal
  - Develop OWL-DL horizontal ontologies that are already included in the DM2 LDM
    - Measures, Location, Security, etc.

How to use DM2 v2.03 OWL-DL

- Use DM2 v2.03 OWL-DL in DoDAF along with its published guidance, or
  - The published DoDAF with DM2 v2.03 will include links to a repository containing the DM2 and BPMN Ontologies with mappings between these standards
- Use the DM2 v2.03 OWL-DL that DCMO will incorporate in the BEA Ontology Framework Release 2
  - BEA Ontology Framework contains DM2, BPMN, and BEA Ontologies along with the mappings between these standards

Two ways to use the BEA Ontology Framework, when directed:
- Participate in the DCMO “Equipping The Workforce” competency delivery
- Migrate your Architecture Data directly into a BEA Ontology Framework RDF repository, or
- Use relational technologies proven by DCMO, such as R2RML mappings from your legacy architecture data
Chat

- Benton "Ben" Bovee, SAF-AQXI - guest: A well-formed relation is intrinsically uni-directional. Bidirectional relations are rectified with a ternary object or relation.
- Tom Dalpini - guest: After the more detailed ontologies are developed and found to be stable, what would be the pros and cons of then better aligning/integrating the concepts in them with each other into a single model?
- Benton "Ben" Bovee, SAF-AQXI - guest: I wonder how the "owner" of relations between ontologies will be determined...?

DoDAFDM2WG20110504

Slides

Concept computing and Be Informed

Source: http://www.slideshare.net/Mills/concept-computing-andbeinformeddavisaai12keynote20120723notes

Mills Davis AAAI 2012 Keynote July 23 Notes Slides

- 1. #ConceptComputing: Bringing ACTIVITY-CONTEXT aware WORK & PLAY SPACES into the mainstream Mills Davis Project10X mmdavis@project10x.com 1-202-667-6400This is a keynote presentation from the Association for the Advancement of Artificial Intelligence2012 conference (AAAI 12) in Toronto, Canada. It discusses the vision and
principles of "conceptcomputing," how this paradigm shift impacts different aspects of software functionality and value; and examines how one software company, Be Informed, is successfully applying concept computing to mainstream enterprise class applications.

• 2. This is the entrepreneur’s cautionary “forward looking statements” slide. I prefer to show it as a roadsign.

• 3. Roy Lichtenstein meets The Internet of thingsThis triptych is from a hypothetical scene in the middle depicts difficulties expectations in the near future, whencomic strip entitled “Roy Lichtenstein we currently experience trying to share almost everything we encounter hasmeets an Internet of Things” (1) A meanings and link knowledge models some intelligence and communicatesyoung woman at the left pines over together so that both people and spontaneously -- we’ll be very angry ifwhich approach and investment to machines can reason with it. (3) The the computer doesn’t understand whatmake to realize her dreams. (2) The woman to the right depicts consumer we mean. Source: Project10XSetting the stage...

• 4. Topics • What is “concept computing”? (It’s time for a mainstream lexicon. (activity context is more than interpreting sensor feeds, & more than a semantic web of data) • How will concept computing impact software functionality and value? (If it’s a paradigm shift, then “what won’t be affected?”) • Where is concept computing already mainstream and prime time? (A real world case example...)Three topics in this talk about concept computing: what it is, how it will impact us, and where is it already happening.

• 5. Let’s travel the yellow brick road. First the vision of concept computing; then discuss the impacts; then I’ll précis a company that’s already taking concept computing into the mainstream.

• 6. What is concept computing? • a better lexicon • paradigm shift from information to knowledge-centric patterns of computing. • Spectrum of knowledge representation, from search to knowing. • Architecture where every aspect of computing is semantic, activity-context aware, and directly model-driven. • Development methodology where Every stage of the solution lifecycle becomes semantic and model-driven. • A new domain where value amplifies

• 7. Source: Project10XConcept computing will drive the next internet. It’s mainstream-ready, semantic, model-driven, activity-context aware technology for both consumer and enterprise markets. But, most important, concept computing is something that broad audiences can understand.

• 8. How do we define concept computing? • Concept computing is semantic model-driven computing that is activity and context aware. • A concept is semantic model. • Its meaning derives from a network of relationships to other concepts. • The basic idea is to model concepts, relationships & contexts separately from the supporting IT systems and then to compute with this knowledge. Source: Project10X

• 9. Source: Project10XThe basic IT stack has user interface, application, information, and infrastructure layers. The internet has overlaid this with point and click network access to subjects, services, and things. Concept computing goes further. The concept plane interconnects and enables reasoning across all layers of the IT and internet stack. Concept computing represents and processes knowledge about domains, user interface, application functionality, processes, information, and infrastructure separately from theunderlying IT systems and other artifacts so that both people and computers can interpret concepts and put this knowledge to work.

• 10. Concept computing every aspect of the solution is model-driven, activity context-aware, and semantic. How is this different? Historically, lots of things have been modeled. But, modeling has only seemed cost-effective for individual aspects of software applications. Going back to the beginning of IT, there was only an application program. It was a deck of cards that gave instructions to a computer. It was low-level code. Over the decades, we began model knowledge about some things separately and take this functionality out of the application, so that multiple programs could share it. The sequence was something like this: operating systems, then data, workflow, rules, services, and goals. As modeling evolved, different kinds of concepts required separate tools to model them. With different kinds of modeling tools came different formalisms and standards. For example for: data schemas, decisions using business rules, processes flow-charted with BPMN, services accessed through APIs. Different formalisms and standards result in tools that don’t know about each other and don’t share semantics. That’s a problem when you want to combine multiple types of models in an application. It gets complicated. Often you are obliged to write some code. Other times, you import or export models into other tools, which adds a layer of complexity. With concept computing this ceases to be a problem. Concept computing provides a unified environment for creating, managing, and executing all types of models. Further, there is new hardware designed for concept computing at scale.
11. With concept computing, the model is the design, is the documentation, is the application, is the user interface. This is what happens when every aspect of the solution and every stage of the solution life cycle is semantic and model-driven. The model is the application. At every stage of development, the model executes. The model self-documents. It's just another way to express the model. And the model can explain its every decision and action taken. Moreover, the model drives the user interface. Change devices, channels or the underlying model itself and system behaviors change automatically. You don't write program code. You don't draw flow charts in swim lanes either. You don't compose a waterfall of documents that translate requirements to designs to specifications to code and so on. Business logic is packaged in knowledge models, and delivered as knowledge-as-a-service, where it can be reused by external applications. One interconnected knowledge model directs activities and decisions dynamically towards the goal. Under the hood, it's all RDF & RDF/S. All system knowledge updates quickly, without your having to rebuild databases or compile new program code.

12. #conceptcomputing reveals a new domain where value amplifies! A previous slide that showed a concept plane being abstracted from the IT stack and the Internet network. This doesn't tell the whole story. When every aspect of the solution is semantic and model driven, then a new world of value opens up. A vista or landscape in which innovations build on each other, and amplify in value.

13. How will concept computing impact software functionality and value? • Smarter user interface • Semantic data • Pragmatic processes • Value-based decisioning • Autonomic infrastructure Concept computing is a paradigm shift. It does things differently. It's capabilities are game changing. It's a value dynamo. Here are four impacts of concept computing: 1) It delivers a new user experience that people find compelling. No UX. No market pull. b) Concept computing "democratizes" new social concepts of work, play, sharing and communicating. Where computers understand language, social interactions, and the way people collaborate. c) It synthesizes functionality into capabilities, standards, and higher-level solution concepts that encompass and go beyond what was previously possible. The direction is toward systems that know, learn, and reason as people do. The upside is that concept computing can solve problems that are intractable with previous technologies. d) Concept Computing is a breakthrough in value and life cycle economics as measured by gains in capability, user experience, performance.

14. Concept computing impacts every aspect of software functionality. In the following slides we will discuss five areas.

15. Concept computing makes user experience simpler, smarter and more helpful. Semantic and model-driven user interface design allows implementation of different types of "smarter" user experience. The progression is from fixed tools, to appliances, to advisors, to virtual assistants that can complete tasks, to expert agents. More about this in a moment.

16. Source: Project10X Meanwhile, remember that consumer expectations are changing. Before long we'll all be very angry if our computing devices don't understand concepts.

17. Mobility is all about new user experience. Make no mistake about this. Mobile internet user experience demands computers that understand concepts. One illustration of this is Apple's SIRI. What happens when semantic models enable computers to understand concepts? Computers that understand concepts are systems that know. That is, they are more than electronic pencils, more than calculators, and more than search appliances that retrieve information. Think about it. Systems that know can advise you. They can help you. They can simplify complex, knowledge-intensive tasks. They can adapt and optimize their behavior when events happen and something changes. But that's not all. They can become virtual assistants that get something done for you.

18. Source: Project10X Go girl! Enterprises and governments too are getting this message. They're asking for a SIRI behind the firewall -- a smart agent that knows and can help you get things done.

19. Source: Project10X The transition from IT as we've known it to concept computing impacts multiple dimensions of user experience. Four person view of user experience: 1. I — Subjective: the "I" in UI, how I experience things, the demands on my attention, focusing on my personal values, thoughts, emotions, memories, states of mind, perceptions and immediatesensations. Trend towards exploiting higher bandwidth content dimensionality, multiple sensory modalities, context awareness, and reasoning power in the user interface. 2. WE — Intersubjective: the "we" in web, social computing, our lived culture, shared values, language, relationships, cultural background, & how we communicate. Trend towards collaborative work and play spaces where computer understand, integrate, reason with, and communicate multipleforms of content and language, models, services, and behaviors. 3. IT — Objective:
The world of individual things viewed empirically, anything you can see or touch or observe in time and space; like product structure & behavior. Trend towards hi-bandwidth, intelligent, autonomic, autopoeitic, and autonomously communicating digital products, services, things, and intellectual property. 4. ITS — Interobjective: the systemic world of standards, laws, systems and ecosystems, networks, technology, government, and environment(s). Trend towards, everything self-aware, somewhat intelligent, connected and socially autopoeitic, and capable of solving problems of complexity, scale, security, trust, and change management.

- 20. Semantic and model-driven user interface design allows implementation of different types of "smarter" user experience. The progression is from fixed tools, to appliances, to advisors, to virtual assistants that can complete tasks, to expert agents.

- 21. If you want to connect and integrate information, the first thing you have to do is integrate what you know about it. Semantic web standards are gaining traction as a way of describing different data sources, structures and metadata so that they can be linked together. Concept computing goes further to put data to work.

- 22. Concept computing spans a comprehensive and expressive spectrum of knowledge representation (KR). More expressive KR powers greater reasoning capability. This figure shows a spectrum of executable knowledge representation and reasoning capabilities. As the rigor and expressive power of the semantics and knowledge representation increases, so does the value of the reasoning capacity it enables. From bottom-to-top, the amount, kinds, and complexity, and expressive power knowledge representation increases. From left-to-right, reasoning capabilities advance from: (a) Information recovery based on linguistic and statistical methods, to (b) Discovery of unexpected relevant information and associations through mining, to (c) Intelligence based on correlation of data sources, connecting the dots, and putting information into context, to (d) Question answering ranging from simple factoids to complex decision-support, to (e) Smart behaviors including robust adaptive and autonomous action. Moving from lower left to upper right, the diagram depicts a spectrum of progressively more capable forms of knowledge representation together with standards and formalisms used to express metadata, associations, models, contexts, and modes of reasoning. More expressive forms of metadata and semantic modeling encompass the simpler forms, and extend their capabilities. In the following topics, we discuss different forms of knowledge representation, then the types of reasoning capabilities they enable.

- 23. Here is an IBM's vision of concept computing. Notice the three slides to the right. The first says we are entering the era of smart systems. The second identifies four technologies that have a 1000X impact on capability and performance. The third shows a concept diagram for IBM's WATSON.

- 24. I like this slide from an Infosys manifesto about next generation work and play spaces. It says: “The real data revolution is in business structure and processes and how they use information for decision-making.”

- 25. I sum it up this way: Concept computing puts semantic data to work. Concept computing uses semantic models to link sources; connect knowledge and data; enhance context; and, most important, integrate data, decisions, and actions. Semantic models encompass: • goal-oriented activities to perform • pre- and post-conditions for these activities • decisions required to take action • rules and conditions to be met for choosing data and calculations required. All model(s) are managed in one environment. Models are compact and integrated. For example, business rules always appear in context of their use. Schemas, ontologies, models, and business logic can be imported, exported, or updated using open standards. Concept computing can import linked data and ontologies in RDF/OWL and connect these to ontologies. Concept computing can combine natural language understanding with semantic models to extract and apply knowledge and information from unstructured sources.


- 27. With Concept computing, every aspect of a process and every stage of the solution life cycle becomes model-driven and semantic. What's game changing is how comprehensively this is happening: • aspect of a solution I include: user interaction, data, decisions, processes, and infrastructure. By Everything. • stage of a solution life cycle I include: development, operations and ongoing evolution. By

- 28. This diagram shows how concept computing impacts a spectrum of process types. 1. Fixed transaction processes follow a preset procedural sequence. Straight-through-processes are like this. So are simple workflows and instruction sequences. Trend is to use concept computing (semantic model driven) approaches when
transaction systems need to be connected across boundaries. 2. Dynamic case management systems process events and rules in order to determine the specific sequence of steps to follow to reach a goal in this particular case. Modeling the potential variations can be complicated (for example, like a phone tree), or relatively elegant (like a GPS system) depending on how the process gets modeled. Trend is to use goal oriented, event driven concept computing approaches for administrative, investigative, and customer facing processes that are complex and knowledge intensive. Processes are compact and elegant. They adapt and self-optimize when events happen, exceptions occur, and needs change. 3. Emergent projects (like dynamic cases) have an underlying goal-oriented methodology (process model). However, they address problems for which not conditions can be pre-defined. Events can occur, which demand definition of a new task, methodology and deliverable outcome. The emergent process model evolves (learns) as well as adapts and self-optimizes.

• 29. Concept computing processes become goal-oriented, event-driven, and context-aware. Goal-oriented processes adapt, self-configure, and optimize when events happen, exceptions occur, or needs change. Like a GPS navigation system, the process interprets events and computes the next best action based on the current context, system knowledge, and content of the case. A dynamic activity plan continuously tracks and updates the status of actions taken in the system. No difference exists between straight through processing (STP) and exception handling. What can be automated is what can’t, isn’t. It’s still the same process.

• 30. Source: Project10X + Be Informed Imagine a multi-benefits solution that puts the user in the center of the action: “system knowledgebase integrates all legislation, regulation, and policies needed to guide the A administrative process.” A core business process pattern defines common high-level functions. “These might include to inform, advise, apply for benefits, answer questions, decide eligibility, track status of cases, resolve exceptions, explain decisions, and communicate actions taken.” Specific requirements of individual benefits programs are modeled as specializations. “Every exception is just another business rule.” Meanwhile, the user experiences a single interface where s/he can access information, advice, and obtain services for all benefit programs. “Similarly, the caseworker has only to deal with actions actually needed for the specific case.” Dynamic case management can reduce clicks and keystrokes required by a factor of ten.

• 31. Concept computing empowers deeper reasoning that can deal with questions involving more than just logic. Value is the foundation of meaning. It is the measure of the worth or desirability (positive or negative) of something, and of how well something conforms to its concept or intension. Value formation and value-based reasoning are fundamental to all areas of human endeavor. Theories embody values. The axiom of value is based on “concept fulfillment.” Most areas of human reasoning require application of multiple theories; resolution of conflicts, uncertainties, and competing values; and analysis of trade-offs. For example, questions of guilt or innocence require judgment of far more than logical truth or falsity. Axiology is the branch of philosophy that studies value and value theory. Things like honesty, truthfulness, objectiveness, novelty, originality, “progress,” people satisfaction, etc. The word ‘axiology’, derived from two Greek roots ‘axios’ (worth or value) and ‘logos’ (logic or theory), means the theory of value, and concerns the process of understanding values and valuation.

• 32. Source: Project10X Is computing with knowledge only for niche applications? Concept computing overcomes difficulties of previous expert system, modeling, and model-driven technologies. Expert systems have been mainstays of AI and business rule driven applications for decades. But, there have been issues. The usual concerns cited are technical complexity, brittleness of the knowledge models, poor scalability of the solutions, difficulty to maintain, and lack of fit with mainstream programming paradigms. These concerns are no longer warranted. Concept computing is now robust, flexible, scalable, dynamic, and mainstream ready.

• 33. With concept computing, run-time semantic models provide a web of knowledge about infrastructure, information, application process, user interface, system behavior, and other domains. A concept plane cross-cuts and connects resources within and across each layer of the IT stack. It can be queried, interpreted and reasoned over both by people and machines. Semantic model-driven infrastructure opens a different dimension for architecture and development allowing cost-effective, sustainable solutions to problems of scale, complexity, connectedness, mobility, context, security, and interoperability.

• 34. Concept Computing technologies can solve problems of scale, complexity, function, security, performance & agility. Key drivers of global economic expansion in the coming decade include the build-out of broadband telecommunications, mobility, and the deployment of intelligent services across this infrastructure (Mobile internet of subjects, things, and services). IT has reached the limits of what it can do with stacks, object orientation,
metadata madness, fixed knowledge embedded in code (with norun-time learning), and architected development versus emergent solutions. Concept computing impacts infrastructure because it can enable overcoming problems of integration, interoperability, parallelism, mobility, ubiquity/versatility, scale, complexity, speed, power, cost, performance, autonomic, automation, intelligence, identity, security, and ease of programming.

- 35. Smart devices are transforming the internet. Both consumer and enterprise markets.
- 36. Media growth is a key driver for mobile growth as well as a key driver for growth of bandwidth capacity.
- 37. It's not just smartphones and tablets that will play a role. Ambient displays, reality browsing, augmented reality all are coming into the conversation.
- 38. #ConceptComputing = supercomputing goes mainstream Concept computing demands big think. Energy consumption is being worked on as an issue. Memory is becoming a non-issue. Meanwhile, super computing will be everywhere. Supercomputing at the edge. In smart devices. In the cloud. Intel. Nvidia. Cray. IBM. And more. All have supercomputing roadmaps and market plans.
- 39. Security challenges are shifting from:
  - Predictable, slowly-evolvable threat & risk models, interaction scenarios and behavior patterns toupredictable and highly-dynamic ones;
  - Platform monopolies to massively distributed systems exhibiting unprecedented levels of sw/hw platform heterogeneity;
  - Device-and infrastructure-centric security models towards user-context and information-centric ones;
  - Predefined to opportunistic interactions with unknown parties in open, inherently insecure environments; and
  - Limited and fragmented data to unparalleled level of personal information richness and precision collected/processed/stored and communicated. Our expectation is for secure, trustworthy pervasive environments where:
    - Users control which data is being collected and the manner in which it is aggregated, processed, stored and distributed;
    - Information is disclosed only to authorized parties and used for authorized tasks only;
    - Individuals are always sure with whom they are interacting;
    - Users are surrounded by millions of invisible, data collecting nanodevices building a huge, complex and dynamic system an omnipresent life-recorder; and
    - Data are captured continuously with unprecedented precision and completeness, both inside and outside us.
- 41. Concept computing, as with object oriented software before it, requires a new methodology, new tooling, and a new definition of "integrated development environment."
- 42. Source: Project10X With concept computing one of the biggest changes is "who does what?" Business users, subject matter experts, and IT specialists are all involved. Business users shape the business logic. Subject matter experts shape domain knowledge. And IT professionals shape the infrastructure and its operations. Each has the tools and user interface it needs. Concept computing handles all kinds of modeling in one environment. No more separate modeling tools and file formats.
- 43. Source: Project10X Concept computing enables everyone to model. There are multiple choices of user-friendly modeling methods. Examples include: graphical modeling, forms, spreadsheet style tabular modeling, and writing in controlled natural language. Concept computing lets users express ideas in ways they find natural. The computer learns how to make sense of it.
- 44. Development using concept computing practices is fast and lean. Business users, subject matter experts, and IT specialists all participate in development and are involved throughout. Development starts with discovery of requirements. Then comes definition of the functional architecture and design of the core application. A small senior team of business analysts and system architects conducts these steps. A functional design is like a plan view for a building that shows the basic layout and infrastructure, but not all the details of each room. Plus, the functional design is already a working core application. From this core application, development builds in parallel, adding details. Teams are smaller than with conventional IT. Team roles encompass project leads, system architects, UI designers, knowledge modelers, software engineers, test and quality assurance, trainers, support personnel, and system administrators. Time to solution is two to ten times faster than with conventional IT development. Benefits start early. This reduces risk. Integration with existing systems and infrastructure is non-invasive. Development is iterative and incremental. Development can be highly parallel, but is significantly less labor-intensive. Testing and acceptance is ongoing rather than weighted towards the back end of the process. Deployment is incremental.
45. Concept computing lowers operating costs, total cost of ownership (TCO), and cost of maintenance compared to current operations. Based on customer experience reported by Be Informed, the rule of thumb is 30-60-90: Operating costs can be one-third less. Total cost of ownership can decrease by as much as two-thirds. Time and effort to make changes can decrease by up to 90 percent. Why? It’s much easier to integrate new data sources and interface new services by changing knowledge models than it is by writing code and rebuilding data stores.

46. Where is concept computing already mainstream and prime time? WIN a Personal Drone Spy-Cam Helicopter! OK... so who has already taken concept computing into the mainstream. BE INFORMED. No really. BeInformed is a software company from the Netherlands. Be Informed delivers concept computing technology that is mainstream, enterprise class, & ready for prime time! A moment of truth in advertising: Over the past several months I have consulted with Be Informed and conducted due diligence regarding its software products, solution packages, and customer references. Be Informed software products embrace concept computing principles, but go significantly beyond what other vendors are doing with semantic web, linked data, business process management, business rules, and intelligent user interface. Seeing is believing. Everything I’ve talked about in the first half of this presentation, you can see demonstrated live in a Be Informed demo. The following slides overview the company, its technology, development approach, and summarize customer experiences in the government sector.

47. Veterans Mobile Multi-eBenefits

48. Conclusion Activity-Context computing is coming! It’s time for a better lexicon: something we can all understand, like “concept computing” concept computing is a paradigm shift. • Architecture where Every aspect of the solution is semantic and model-driven • Development methodology Every stage of the solution lifecycle is semantic and model-driven concept computing is already entering the mainstream • the race is on to transform consumer and enterprise markets