Integrating Engineering Processes with BPMN and SysML/UML

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Engineering Enterprise Processes

- **Some engineering processes are closer to customers, others closer to development.**

- **They are described in languages suitable for customers or suitable for development**
  - **The languages are usually unintegrated.**

- **Unintegrated engineering process languages are a significant drain on enterprise resources**
  - **Cause misunderstandings and rework as process models move between people closer to customers and those closer to development.**

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DoD Engineering Processes

- **Like any large buyer of manufactured products, DoD engineering processes span customers and product designers.**

- **DoD as a customer is actively involved in specifying products it wants to buy.**
  - **Product capabilities and usage scenarios.**

- **DoD and product designers use different languages:**
  - **DoD specifying products with the Business Process Model and Notation (BPMN).**
  - **Defense product designers typically using Systems / Unified Modeling Language (SysML/UML).**

BPMN and SysML/UML in Engineering Processes

- **BPMN and SysML/UML are not integrated.**

  - **Different process terminology and notation.**

  - **Different scopes (SysML/UML includes structural models)**

  - **Different interchange formats, impairing interoperability and analysis.**

- **Integration would provide significant efficiency gains in communication between DoD and its product designers.**

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DoD Engineering Process Requirements

■ **Goal: Integration of BPMN and SysML/UML.**

■ **DoD and defense product designers have a UML-based tool chain (SysML reuses and extends UML).**

■ **Solution: Use BPMN notation with UML models, enabling:**

   – **Integrating DoD and product design models in UML tools.**
   – **Exchanging these integrated models between UML tools.**

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Unified Profile for DODAF / MODAF

- **DoD uses BPMN in the context of the DoD Architecture Framework (DoDAF).**

- **The Unified Profile for DoDAF/MoDAF extends SysML/UML for modeling within DODAF/Ministry of Defence Architecture Framework (Britain and NATO).**

- **DoD backs the intention to create a UML profile for BPMN in order to utilize BPMN notation for specifying some of the DoDAF/UPDM views**

- **DoDAF v 2 calls for Fit for Purpose Presentation & Models**
  - **Architects should be able to use modeling notation that is appropriate or "fit" for the purpose or audience**

Modeling Notation

BPMN
UML
SysML

.

.

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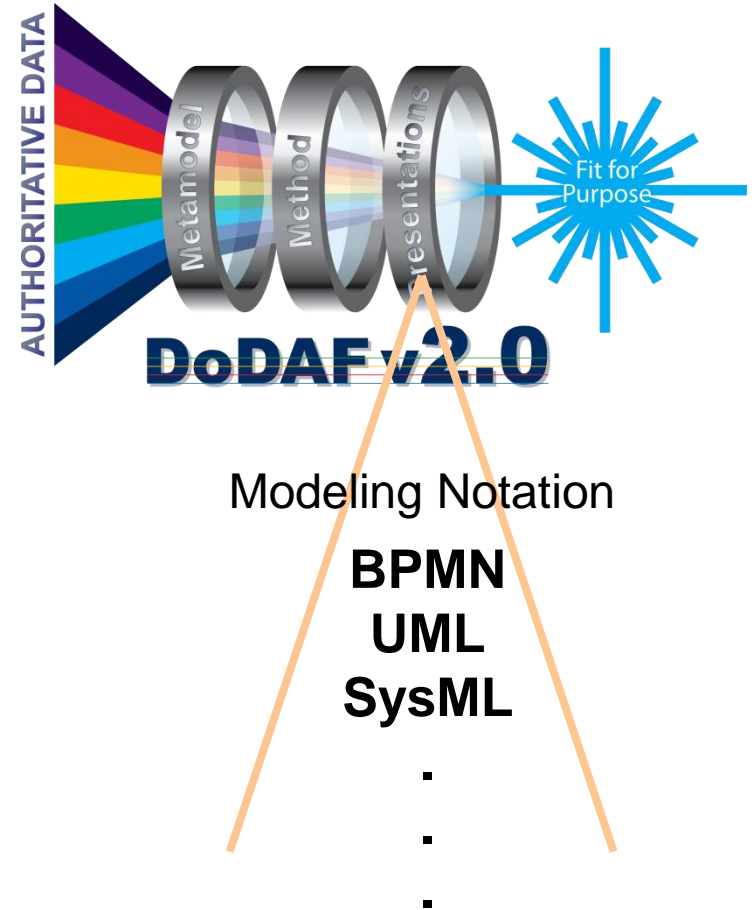
Discussion (2 of 3)

- **DoD components now use BPMN notation for specifying operational views, e.g.,**

  - **Joint Forces Command (JFCOM) for documenting Joint Close Air Support (JCAS) Scenario**

  - **Business Transformation Agency (BTA) for documenting DoD's Business Enterprise Architecture (BEA)**

- **Currently in UPDM, there is no automated mechanism for operational users (using BPMN) and system integrators (using SysML/UML) to link requirements/operational models to systems/solution models, such that:**

  - **Forward traceability between operational and system models is maintained to ensure coverage of requirements**

  - **Backward traceability from system to operational models is maintained to ensure validity of solution**

- **Creating a UML profile for BPMN would allow reusing BPMN within UPDM, in the same manner that SysML and UML are reused.**

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Discussion (3 of 3)

- **Some UML tool vendors are already providing support for BPMN within their tools**

    - **Military: DoD/NATO ISAF* application - two separate models: the process model is in BPMN, the data model is in UML. "need for well-defined links between BPMN messages (i.e., specific or generic data put/gets) and UML object representations of those data objects. .. Subsequently having SVs that link these UML class/objects to specific systems and SOA services. "**

    - **Commercial: "Native integration between BPMN and UPDM is a worthy goal as we lose the native link using tools today. So for example, we cannot query for impact analysis between OV-2 and OV-5 (as BPMN) using a native UPDM implementation. It has to be chained via meta-model transformation."**

- **Each vendor/user is defining their own path forward. This prevents common mapping and interchange**

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Role of Diagram Definition in Integration

- **Diagram Definition (DD) is a standard for exchanging the visual aspects of graphical modeling languages**
    - **Shapes, positions**

- **Used to define BPMN, and currently being applied to SysML/ UML.**

- **Enables multiple notations to be used on the same interchange formats.**
    - **BPMN notation on a UML exchange format.**

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General View: Integrated Models

■ **Users in general have expressed their need to use both BPMN and UML in a single model.**

■ **Informal poll at the Object Management Group (OMG, responsible for BPMN and SysML/UML) results:**

They remain separate standards	BPMN is a UML profile with notation	**Create unified model encompassing both**	Semantic models with UML and BPMN viewpoints	BPMN replaces UML activity diagrams	BPMN grows to make UML not required	BPMN and UML are separate models, mapped with QVT	There are ways to make links between them	Other
2	5	**15**	8	4	0	2	3	0

■ **Overwhelming support for a unified model.**

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Current supporters

- **Armstrong Process Group**
- **Atego (vendor)**
- **Axway (vendor)**
- **Canadian National Defence**
- **KnowGravity (vendor)**
- **MEGA (vendor)**
- **Model Driven (vendor)**
- **No Magic (vendor)**

- **Mitre**
- **NIST**
- **Oose Innovative Informatik GmbH**
- **Sandia National Laboratories**
- **Sodius (vendor)**
- **Softeam (vendor)**
- **Sparx Systems (vendor)**
- **US DoD**

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Status and Timeline

- **RFP issued by OMG on June 2010**

- **Initial Submission to OMG completed (February 2011)**

- **Revised Submission due (August 2011)**

- **Finalization (FY 2012)**

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Summary

- **Significant gains in integrating engineering processes that are closer to the customer with those closer to development.**

    – **Requires integration of process languages.**

- **BPMN and SysML/UML are major process languages.**

    – **Widely adopted, especially by DoD and its product designers.**

- **Solution: Integrate BPMN and SysML/UML on a UML tool chain.**

    – **Extend SysML/UML with BPMN notation.**

    – **Use Diagram Definition for integration of graphics.**

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