Transitioning UPDM to the Unified Architecture Framework

Or

There's more than one way to skin a framework

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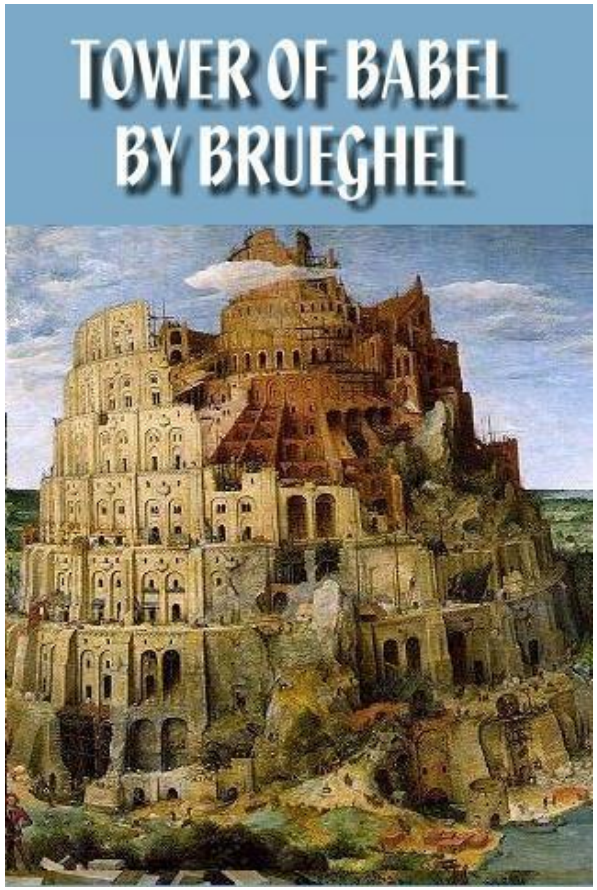
Agenda

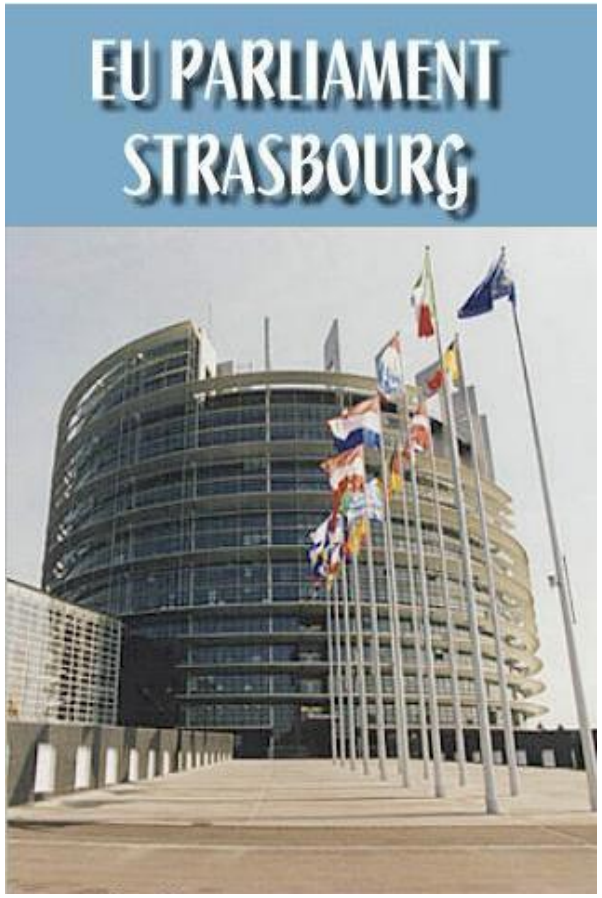
- Introduction
- UPDM 3.0 RFP requirements
- Why a UAF ?
- The Benefits of UAF
- Summary

The Tower of Babel
A Communications Fable for our Time

Ancient



Modern



Does this solve the problem?

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USA/UK: Two Countries Separated by a Common Language

- Even speaking the same language doesn't always help. Picture this:
  - A man wearing a vest, pants, and a pair of suspenders.

The American Image

Vest

UK: Waistcoat

Suspenders

UK: Braces

Pants

UK: Trousers

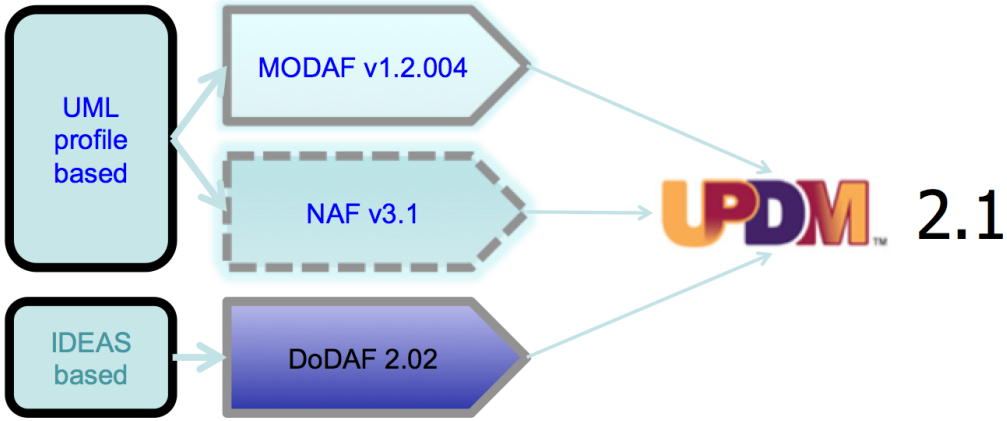
The British Image

So, if communication is hard with spoken language, are models the answer?

Skinning

MBSE and UPDM

- Pictures paints a thousand words
  - Visio is good at this
  - Language is not controlled
- Modeling languages add semantics and constraints
  - Control what is being said and how it is said
- SysML is a common language of expression that captures
  - Structure
  - Behaviour
  - Requirements
    - Functional
    - Non Functional
- Models can be quantifiable and executable



- Meta model coherence
  - Same meta-model,
  - Different presentation layers
- Took an MBSE approach
- UPDM could choose between a pure UML or UML and SysML approach.
- UPDM contained both a profile and a domain meta-model

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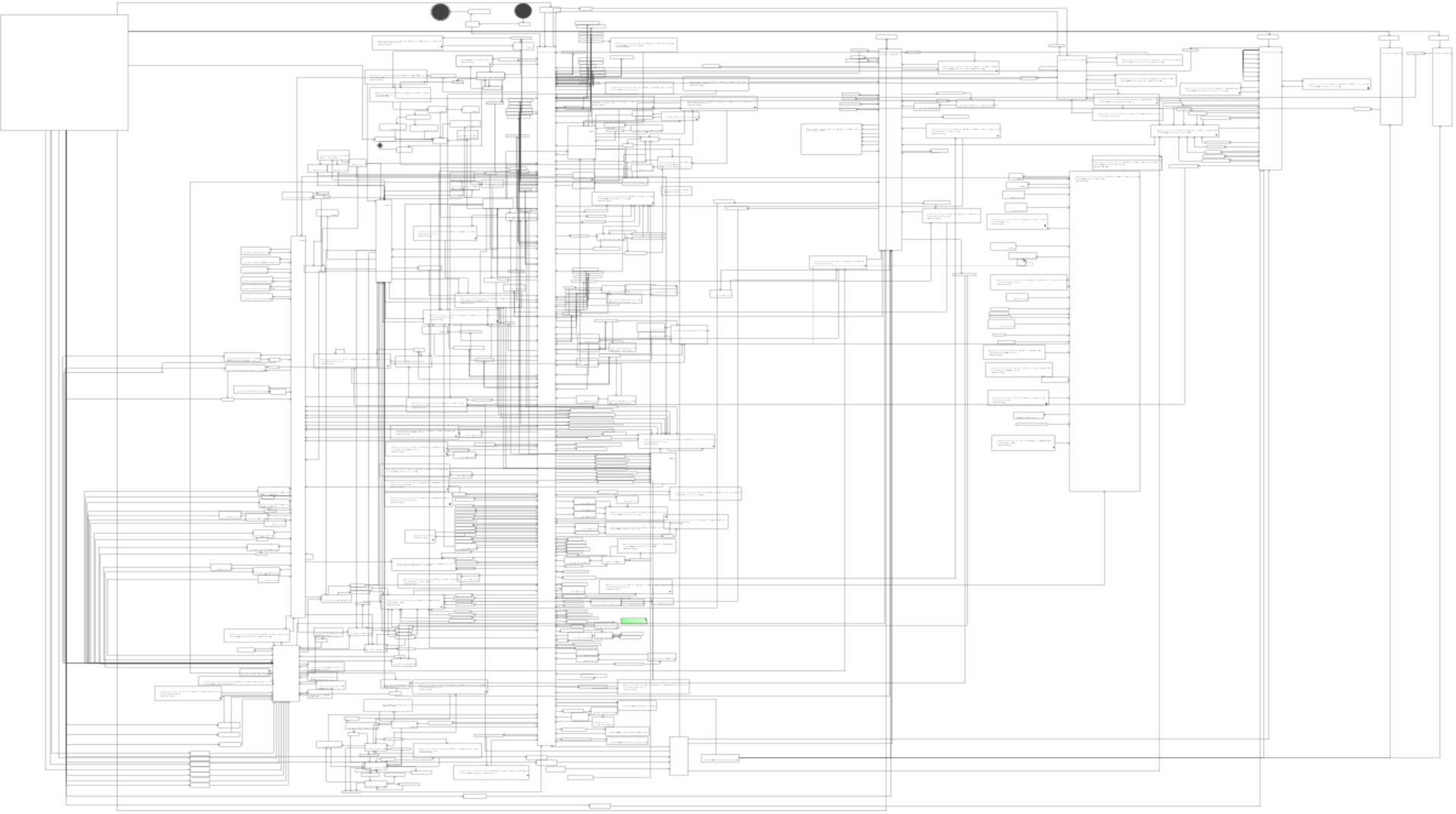
Picture worth a thousand words?



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MBSE and Engineering Analysis

Why UPDM is popular with practitioners of MBSE?

- –No standardized frameworks for MBSE
- –Integration with existing OMG standards, e.g. SysML, UML
- –Tool vendors driven: Implemented in most popular modeling tools: IBM Rhapsody, No Magic MagicDraw, PTC Integrity Modeler

Common repository (Integrated Architecture Repository)

- Application of engineering analysis methods
  - Impact Analysis
  - Coverage Analysis
  - Trade-off Analysis
  - Behavioral execution
  - Requirements compliance analysis
  - Model-based testing
- Interoperability

Adoption

- Defense:
  - Used by DOD and its contractors on various MBSE and IT projects
  - Being picked up outside of the US
    - Used in Europe, Australia, Asia, S. America
- Industry and Government (external to Defense):
  - European research projects (DANSE)
  - Starting to be looked at by European industrial companies familiar with MBSE
  - NASA, CACI, etc.
  - Starting to be looked at for modeling business processes, information systems architectures
- Industry needs:
  - Demilitarization / Industrialization
  - Wider scope (SoS, Human Views etc.)

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UPDM 3 Requirements

- UPDM RFP requirement: ” The UPDM V3.0 domain metamodel shall be derived from MODEM and DM2, both of which are based upon the International Defence Enterprise Architecture Specification Foundation [IDEAS].”
  - Mandatory requirements (excerpt):
    - Provide Domain Metamodel derived from MODEM and DM2
    - An Architecture Framework Profile Using SysML
    - Supports BPMN 2.0
    - Use of SysML Requirements Elements and Diagrams
    - Use of SysML Parametrics Elements and Diagrams Mapped to Measurements
    - Traceability Matrix to Supported Frameworks
  - Non mandatory features (excerpt):
    - UML Profile for NIEM
    - Information Exchange Packaging Policy Vocabulary (IEPPV)
    - Viewpoints in Support of SoS Life Cycle Processes and Analyses
    - Support for Additional Viewpoints beyond those defined in DoDAF, MODAF/ MODEM, NAF, and the Security Viewpoint from DNDAF.
    - Human Systems Integration (HSI)

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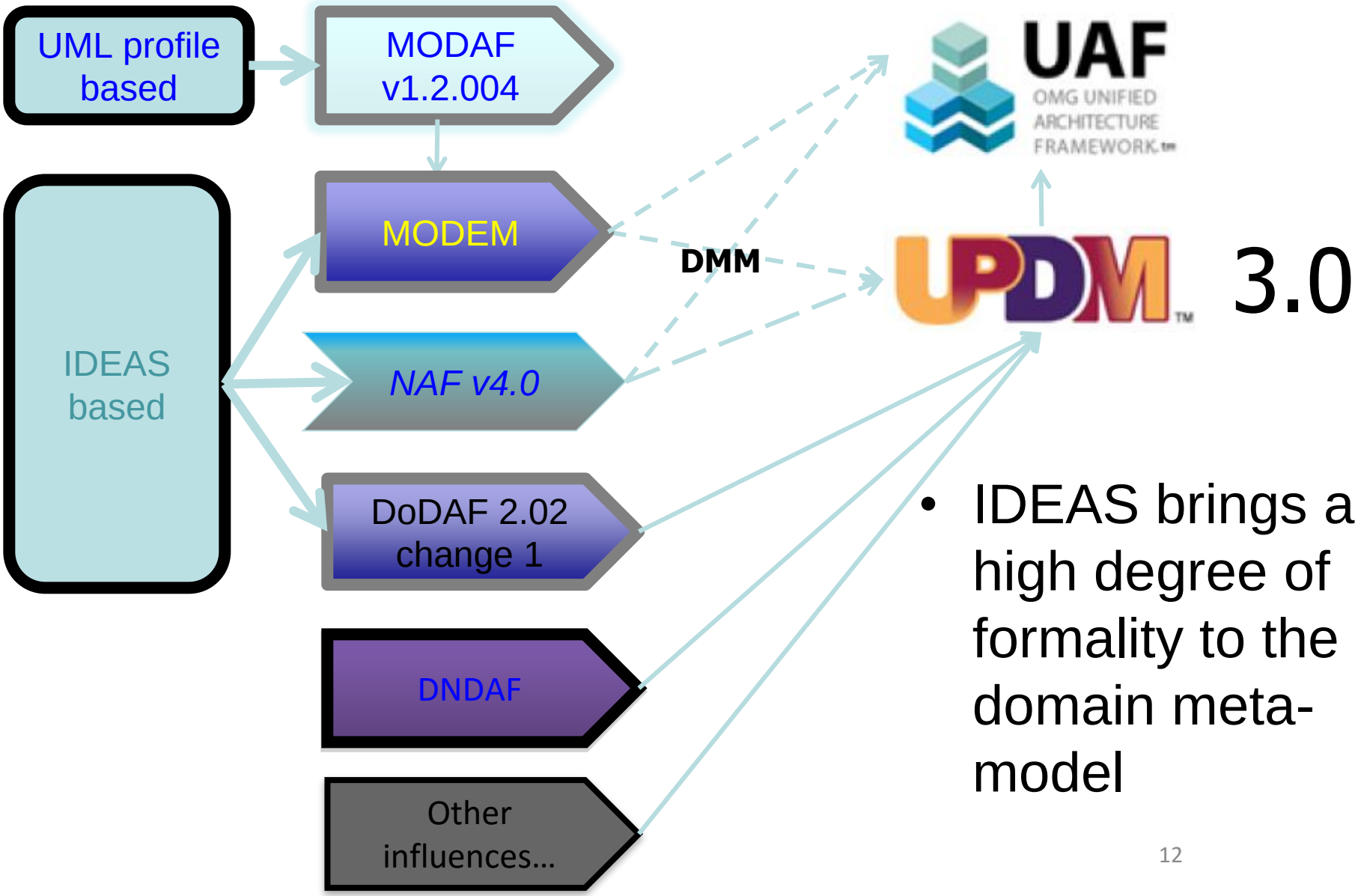
Why a Unified Architecture Framework and a Profile (UAFP)

- Proliferation of frameworks that it was being asked to support
- Need to support industry and federal usage as well as military
  - Make the framework more generic
- Ability to support other frameworks
  - By Extension
  - By Mapping
- Need to support UAF
  - A DMM that non-UML tool vendors could support
  - Conceptual mapping no implementation
  - IDEAS-Lite
- Need to support a UAFP
  - A standard profile that can be used to implement the UAF in UML/SysML tool

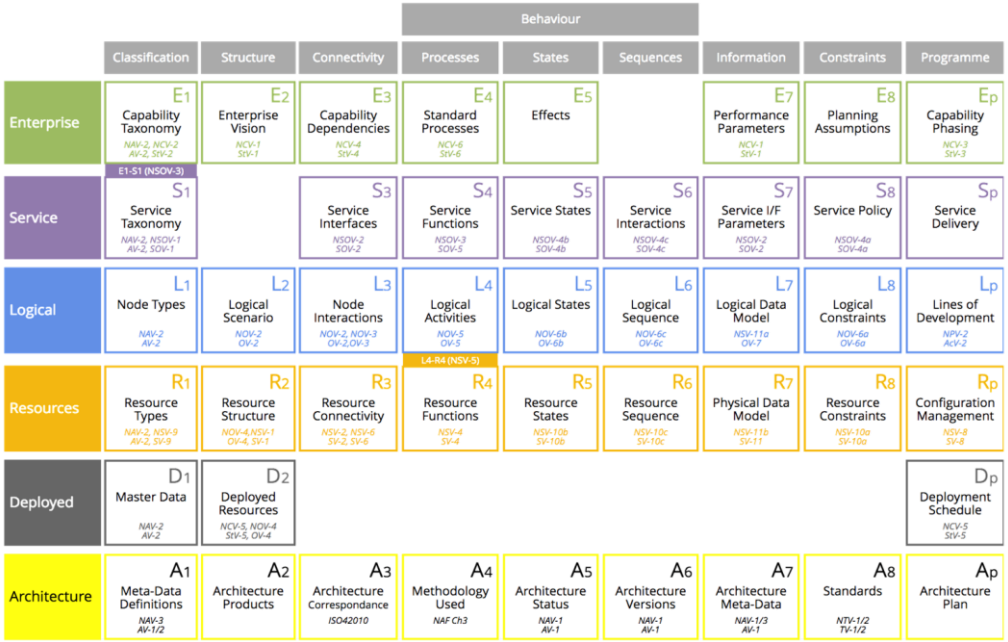
UPDM 3.0->UAFP 1.0



- IDEAS brings a high degree of formality to the domain meta-model

UAF/P Grid Representation

- Took inspiration from MODEM
- Genericise UPDM
  - Still the same underlying metamodel and view constructs that support
    - DoDAF
    - MODAF
    - NAF
  - Different presentation layer
- Very hard to manage the views with so many contributing frameworks
  - Lead to very complex mapping tables
  - Unwieldy descriptions
- Possible to map many other frameworks onto the MM
  - HIS views and SoS views
- Possible to support other frameworks



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	Taxonomy Tx	Structure Sr	Connectivity Cn	Processes Pr	States St	Interaction Scenarios Is	Information[c] If	Parameters[d] Pm	Constraints Ct	Roadmap Rm	Traceability Tr
Metadata Md	Metadata Taxonomy[ff] Md-Tx	Architecture Viewpoints [a] Md-Sr	Metadata Connectivity Md-Cn	Metadata Processes [a] Md-Pr	-	-	Conceptual Data Model, Logical Data Model, Physical schema[e], real world results	Environment Pm-En Measurements Pm-Me	Metadata Constraints [a] Md-Ct		Metadata Traceability Md-Tr
Strategic St	Strategic Taxonomy St-Tx	Strategic Structure St-Sr	Strategic Connectivity St-Cn	-	Strategic States St-St	-			Strategic Constraints St-Ct	Strategic Deployment, St-Rm Stategic Phasing St-Rm	Strategic Traceability St-Tr
Operational 0p	Operational Taxonomy Op-Tx	Operational Structure Op-Sr	Operational Connectivity Op-Cn	Operational Processes Op-Pr	Operational States Op-St	Operational Interaction Scenarios Op-Is			Operational Constraints Op-Ct	-	-
Services Sv	Service Taxonomy Sv-Tx	Service Structure Sv-Sr	Service Connectivity Sv-Cn	Service Processes Sv-Pr	Service States Sv-St	Service Interaction Scenarios Sv-Is			Service Constraints Sv-Ct	Service Roadmap Sv-Rm	Service Traceability Sv-Tr
Personnel Pr	Personnel Taxonomy Pr-Tx	Personnel Structure Pr-Sr	Personnel Connectivity Pr-Cn	Personnel Processes Pr-Pr	Personnel States Pr-St	Personnel Interaction Scenarios Pr-Is			Competence, Drivers, Performance Pr-Ct	Personnel Availability, Personnel Evolution, Personnel Forecast Pr-Rm	Personnel Traceability Pr-Tr
Resources Rs	Resource Taxonomy Rs-Tx	Resource Structure Rs-Sr	Resource Connectivity Rs-Cn	Resource Processes Rs-Pr	Resource States Rs-St	Resource Interaction Scenarios Rs-Is			Resource Constraints Rs-Ct	Resource evolution, Resource forecast Rs-Rm	Resource Traceability Rs-Tr
Security Sc	Security Taxonomy Sc-Tx	Security Structure Sc-Sr	Security Connectivity Sc-Cn	Security Processes Sc-Pr	-	-			Security Constraints Sc-Ct	-	-
Projects Pj	Project Taxonomy Pj-Tx	Project Structure Pj-Sr	Project Connectivity Pj-Cn	-	-	-			-	Project Roadmap Pj-Rm	Project Traceability Pj-Tr
Standards Sd	Standard Taxonomy Sd-Tx	Standards Structure Sd-Sr	-	-	-	-			-	Standards Roadmap Sr-Rm	Standards Traceability Sr-Tr
Actuals Resources Ar		Actual Resources Structure, Ar-Sr	Actual Resources Connectivity, Ar-Cn	Simulation [b]					Parametric Execution/Evaluation [b]	-	-

Dictionary * Dc

Summary & Overview SmOv

Requirements Rq

	Taxonomy Tx	Structure Sr	Connectivity Cn	Processes Pr	States St	Interaction Scenarios Is	Information[c] If	Parameters[d] Pm	Constraints Ct	Roadmap Rm	Traceability Tr
Metadata Md	Metadata Taxonomy[ff] Md-Tx	Architecture Viewpoints [a] Md-Sr	Metadata Connectivity Md-Cn	Metadata Processes [a] Md-Pr	-	-			Metadata Constraints [a] Md-Ct		Metadata Traceability Md-Tr
Strategic St	**StV-1 StV-2 BDD**	**StV-1 IBD**	**StV-4**	-	Strategic States St-St	-			Measurable Properties	**StV-5 StV-3**	**StV-6**
Operational 0p	**OV-2 BDD**	**OV-1a OV-2 IBD**	**OV-3/ OV-6**	**OV-5**	**OV-6b**	**OV-6c**			**OV-6a**	-	-
Services Sv	**SOV-1 BDD**	**SOV-1 IBD**	**SOV-2**	**SOV-5**	**SOV-4b**	**SOV-5c**	**OV-7**	**Environment Pm-En OV-1c SV-7**	**SOV_4a**	Service Roadmap Sv-Rm	**SOV-3, OV-5**
Personnel Pr	**OV-4 Typical**	**OV-4 IBD**	**OV-4 Typical SV-6**	**SV-4**	**SV-10b**	**SV-10c**	**SV-11**		**OV-4 Typical**	**AcV-2 SV-8 SV-9**	**SV-5**
Resources Rs	**SV-1, SV-2 BDD**	**SV-1, SV-2 IBD**	**SV-3, SV-6**	**SV-4**	**SV-10b**	**SV-10c**			**SV-10a**	**SV-8 SV-9**	**SV-5**
Security Sc	Security Taxonomy Sc-Tx	Security Structure Sc-Sr	Security Connectivity Sc-Cn	Security Processes Sc-Pr	-	-		**Measurements Pm-Me**	Security Constraints Sc-Ct	-	-
Projects Pj	**AcV-1 BDD**	**AcV-1 IBD**	**AcV-2**	-	-	-			-	**AcV-2**	Project Traceability Pj-Tr
Standards Sd	**TV-1 BDD**	**TV-1 IBD**	-	-	-	-			-	**SV-9**	**TV-1**
Actuals Resources Ar		**OV-4**	**OV-4 SV-1 & SV-2**	Simulation [b]					Parametric Execution/Evaluation [b]	-	-

Dictionary * Dc (AV-2)

Summary & Overview SmOv (AV-1, OV-1 graphic)

Requirements Rq

Benefits of UAF

- UAF goes beyond DoDAF/MODAF/NAF
- Actual Resources are instance models of the architecture that allow
  - Dynamic simulation/execution
    - Verify behaviour,
      - State, Activity level, message sequences
    - Verify interfaces
  - Computational Analysis
    - Parametric analysis
      - Trade studies and Architecture optimisation
- Security Layer included for Information assurance
  - Aligned to NIST/DOD
  - Being related to an OMG Threat Risk modelling standard
- Requirements can be defined and related to all parts of the architecture

Benefits of UAF

- Allows a mapping to an MBSE approach based on SysML
  - Same pattern applied across
    - Operational
    - Resources
    - Services
    - Personnel
  - Similar pattern applied to Security and Projects
- Cross cutting concerns
  - Information models
  - Parameters defining measurements
- Provides a
  - Standard framework for defining many different aspects of complex architectures
- SysML is a dictionary and UAF is a template for a book

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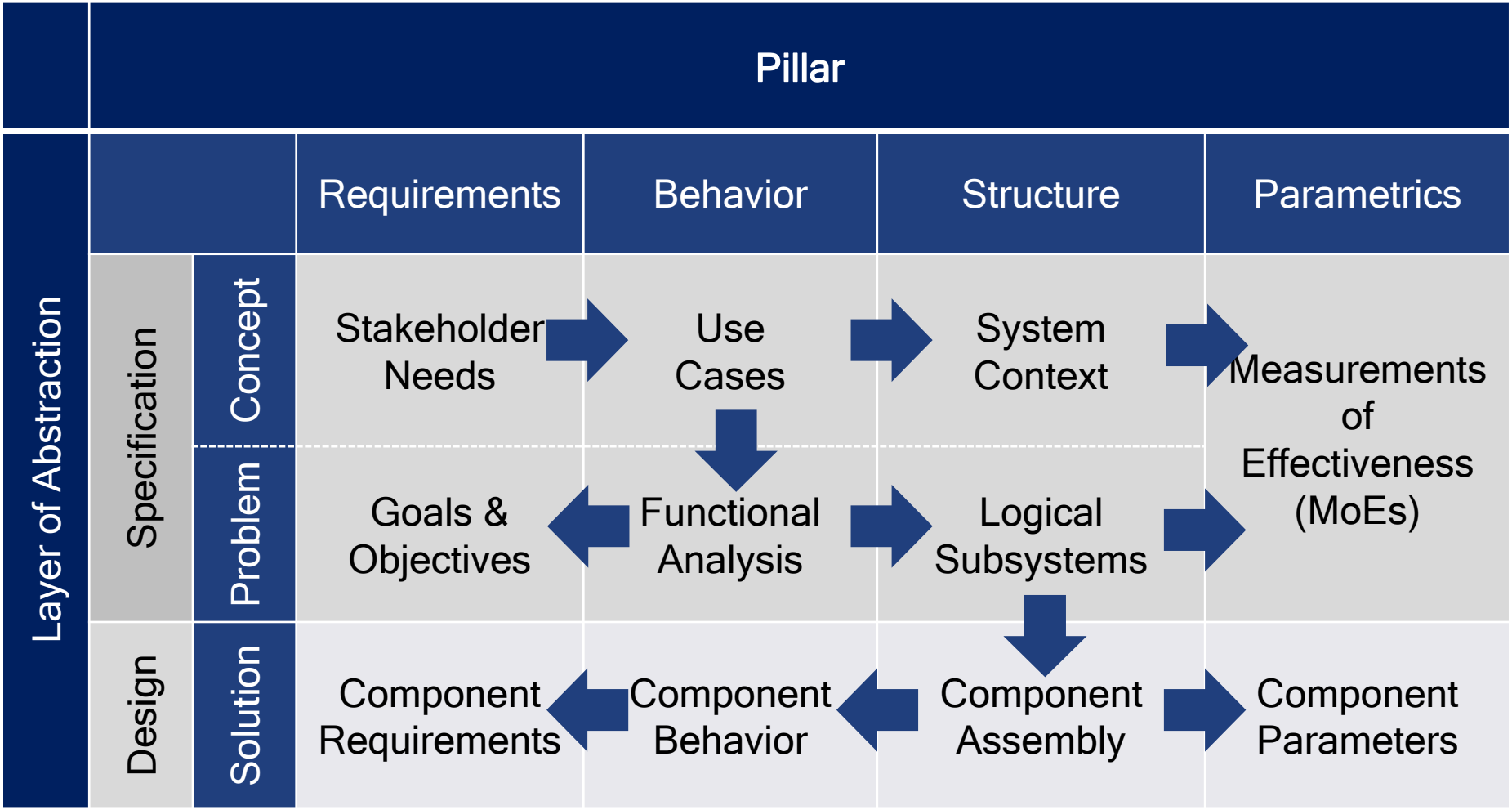

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UAF/P roadmap

- Submitted to OMG for March 2016 technical meeting
- Specification consists of 4 parts
  - UAFP, Profile and Metamodel specification
  - UAF, Domain Metamodel
  - Traceability to donor frameworks and metamodels
  - Sample problem based on Search and Rescue
- Finalisation Task Force expected to complete March 2017

Summary and conclusion

- UAF has the potential to improve communication, collaboration and interoperability between
  - Nations
  - Government and Industry
  - Industry to Industry
- Grid approach allows different industries to reuse, extend or create new views appropriate to them (Fit for purpose)
- New technologies can and will be applied to extend the use of UAF architectures to enable
  - Architecture Federation
  - Tool Federation
  - Improved interoperability
- Improving the discovery and reuse of architectural artifacts

Questions

Thank You!

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