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Transitioning UPDM to the Unified Architecture Framework

Or

There's more than one way to skin a framework

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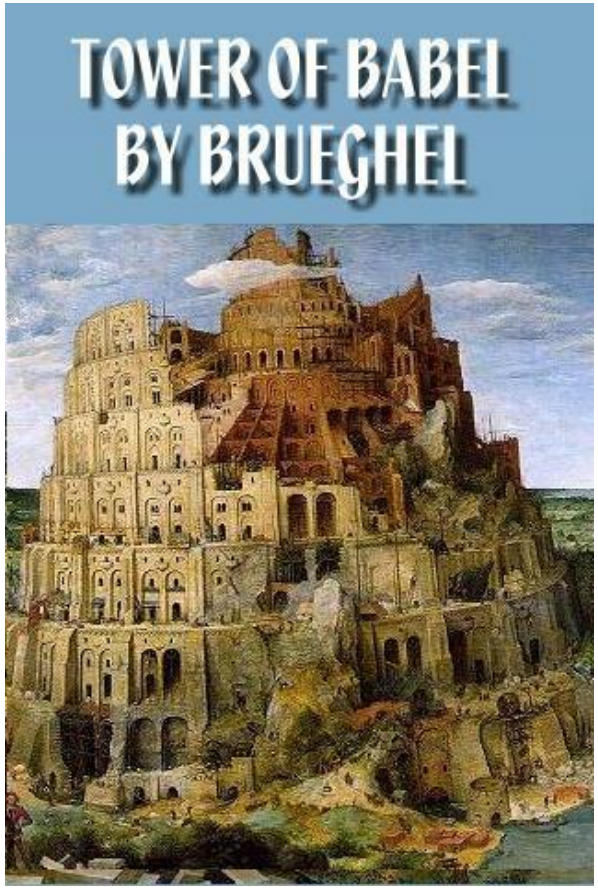
Agenda

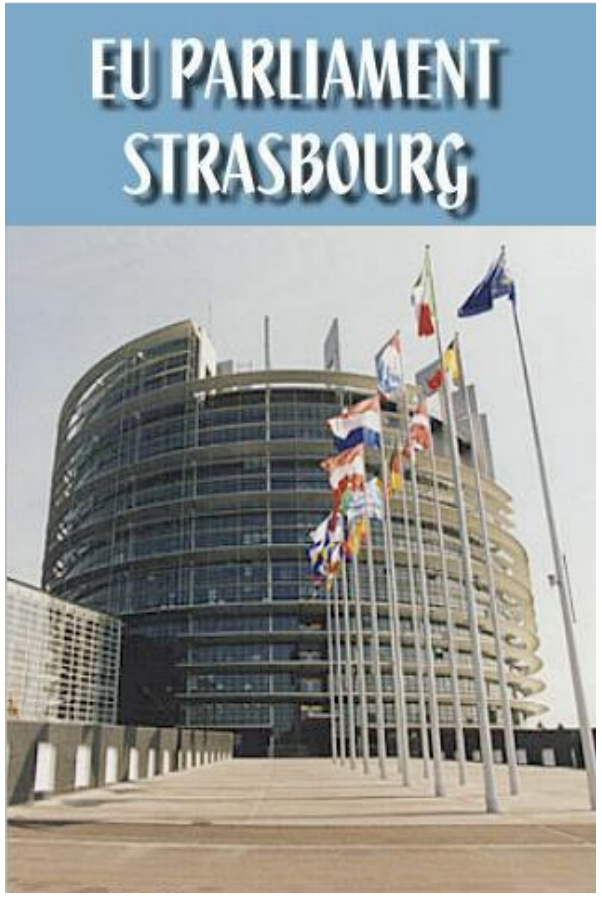
- Introduction
  - Fundamental issues
  - MBSE and UPDM
- UPDM 3.0 RFP requirements
- Why a UAF ?
- The Benefits of UAF
- Summary

The Tower of Babel
A Communications Fable for our Time

Ancient



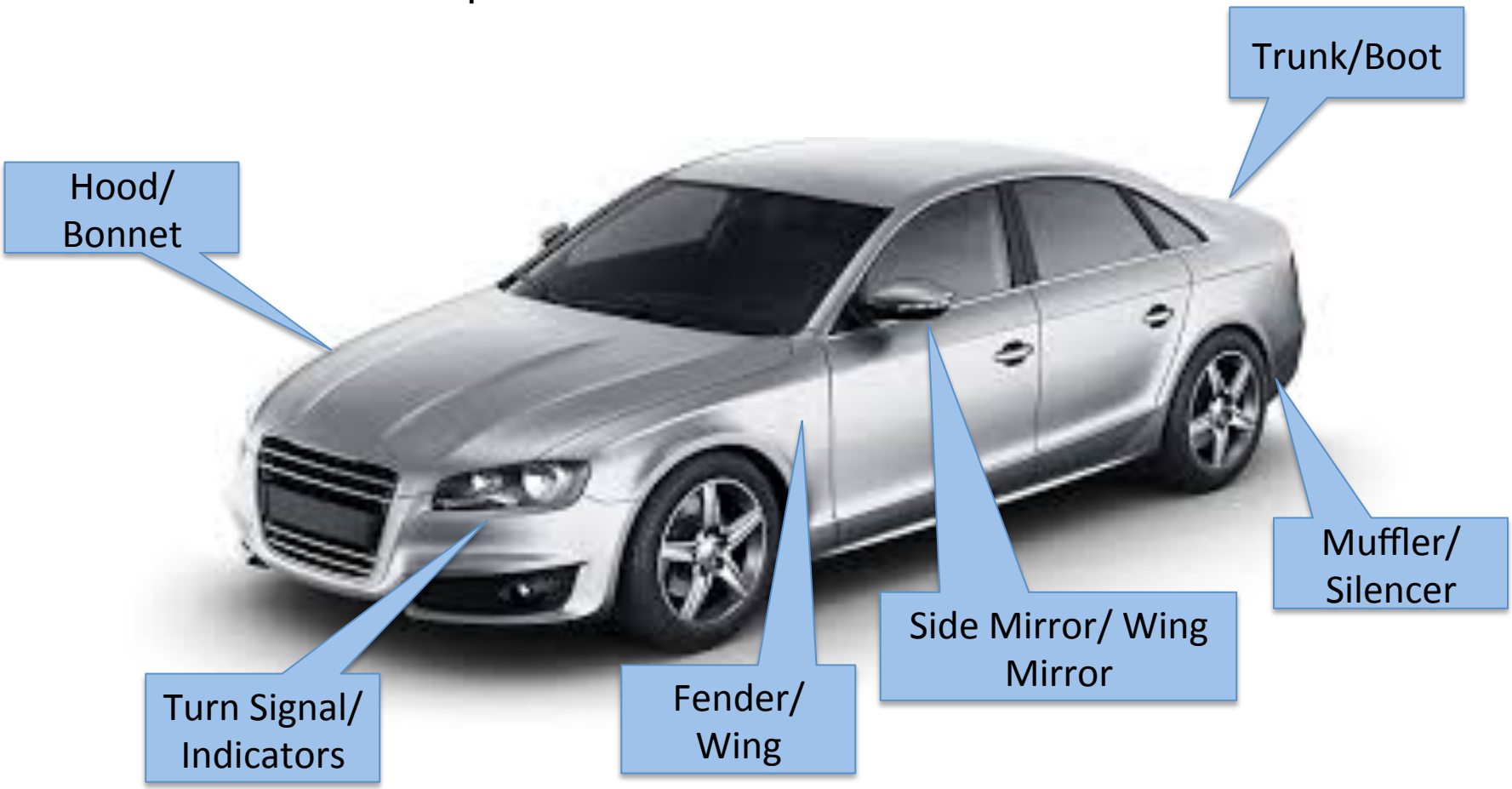
Modern



Does this solve the problem?

USA/UK: Two Countries Separated by a Common Language

- Even speaking the same language doesn't always help. For example the different names for car parts:



A US Military Example

- Secure a building

Navy: turn off the lights and lock the doors

Army: occupy the building so no one can enter.

Marines: assault the building, capture it, and defend it with suppressive fire and close combat.

Air Force: take out a three-year lease with an option to buy.

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

The Afghanistan Mission Network (AMN)

NATO Consultation, Command and Control Agency

Agence de Consultation, de Commandement et de Conduite des Opérations de l'OTAN

Reference Document 3195

DEVELOPMENT OF THE AMN ARCHITECTURE IN 2010 – LESSONS LEARNED

June 2011

The Hague

Torsten Graeber, NATO C3 Agency

What is the AMN?

- The Afghanistan Mission Network (AMN) is the primary Coalition Command, Control Communication and Computers Intelligence, Surveillance and Reconnaissance (C5ISR) network in Afghanistan for all ISAF forces and operations. It is a federation of networks with the AMN Core provided by NATO and national network extensions.
- Planning for the AMN is supported by a multi-national, collaborative effort to develop and maintain the enterprise architecture for the AMN.
- This document is a working paper that may not be cited as representing formally approved NC3A opinions, conclusions or recommendations.

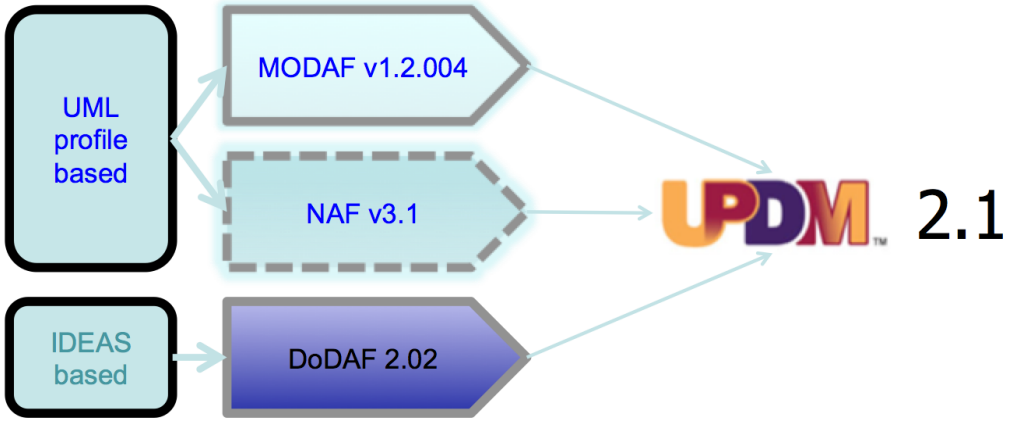
AMN Issues

- These issues included:
  - Different expectations on content and usage of the architecture leading to ever changing requirements and deliverables
  - No enforcement of the architecture during implementation
  - Usage of different architecture frameworks
  - Usage of different architecture tools.
  - No interchange between the tools
- In late 2010, a governance structure for the AMN was endorsed by Chief Of Staff SHAPE and the AWG was included in this governance structure. As a direct consequence, the situation regarding clearer expectations, deliverables and enforcement of architecture has been improved in 2011.
- **However, as the architects are sponsored by their respective nations they have to implement national policies and requirements, so that improvements regarding the usage of a single framework and tool are not to be expected.**

Skinning

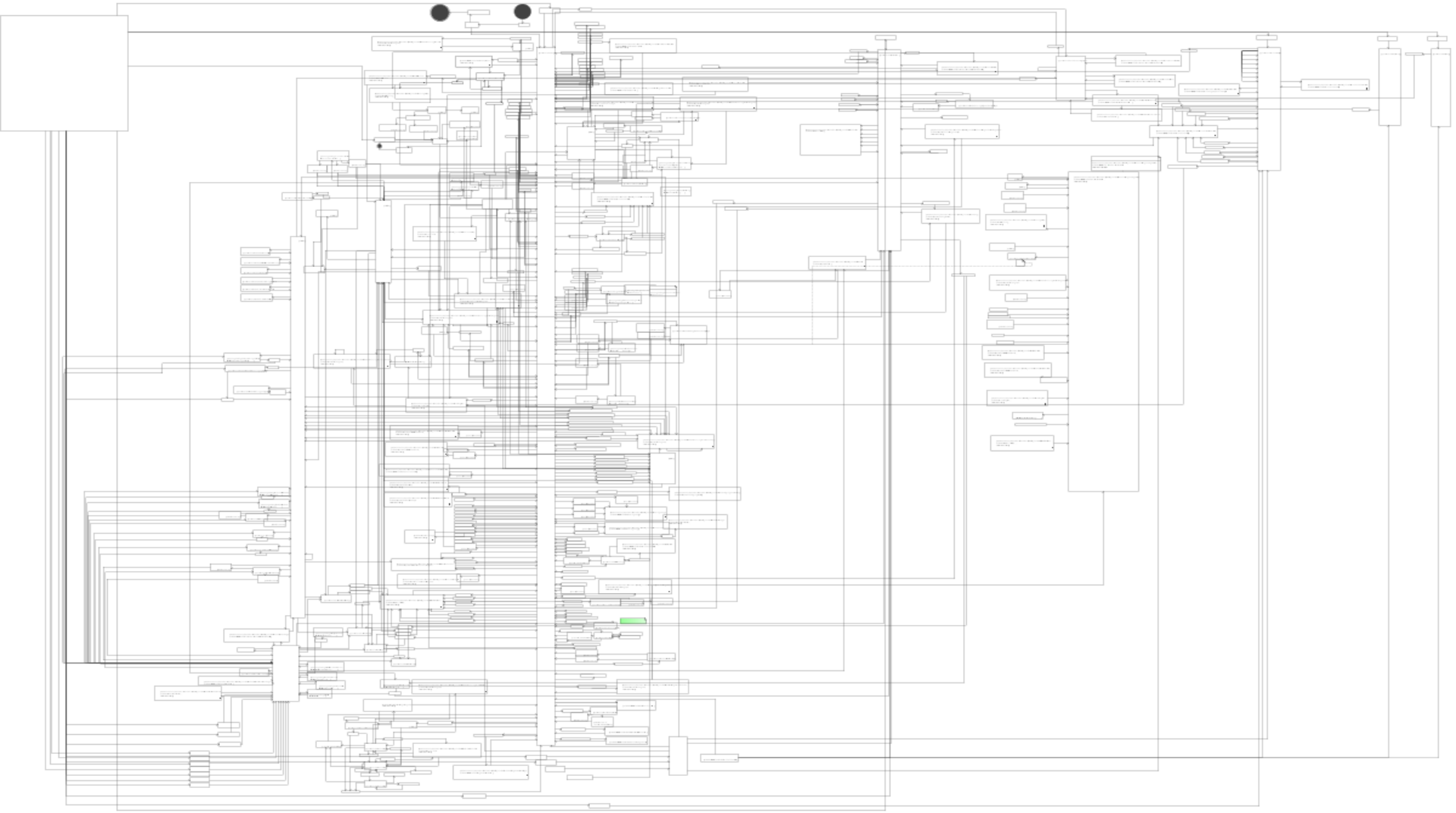
MBSE and UPDM

- Pictures paint 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 users could choose between a pure UML or UML and SysML approach.
- UPDM contained both a profile and a domain meta-model

Picture worth a thousand words?



MBSE and Engineering Analysis

Why is UPDM so popular with practitioners of MBSE?

- –No standardized frameworks for MBSE exist
- –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
- –Industry and government supported

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, COMPASS)
  - Starting to be looked at by US and 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.)

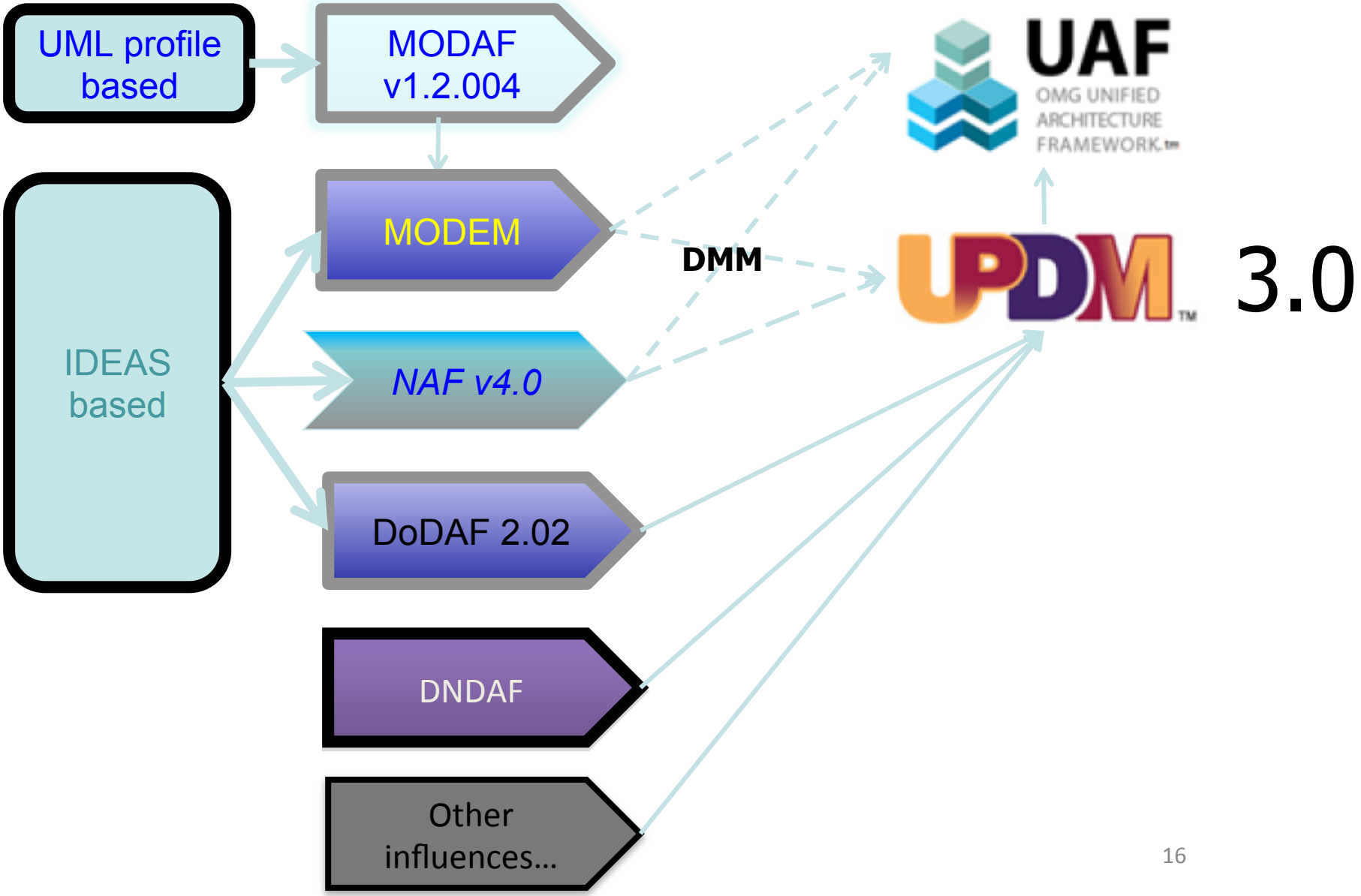
UAF Requirements

- UPDM RFP requirement: ” The UAF V1.0 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)

Why a Unified Architecture Framework and a Profile (UAFP)

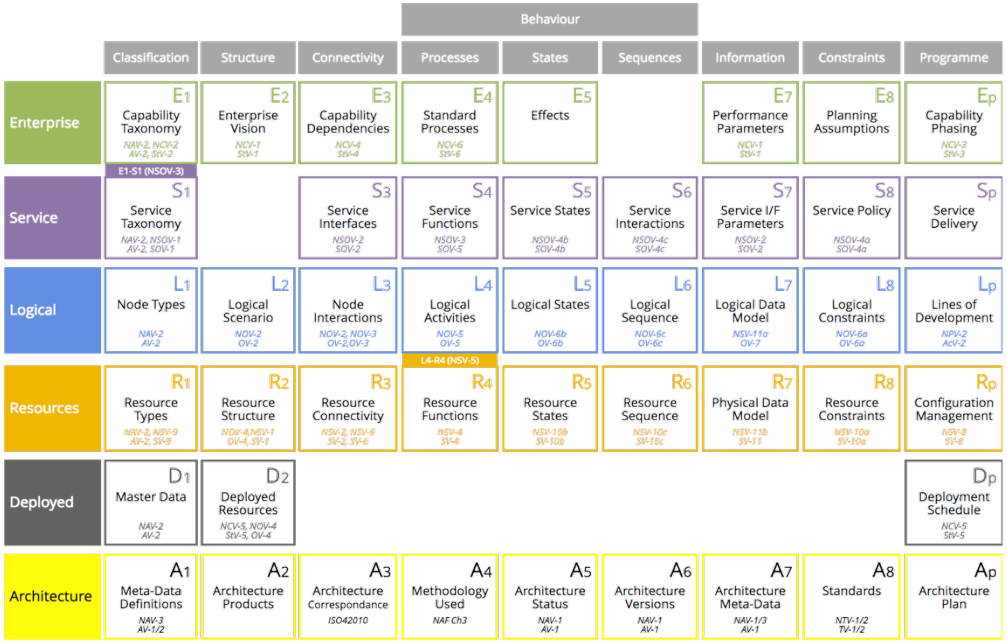
- Proliferation of frameworks that it was being asked to support
- Need to support industry and federal usage as well as military
  - Make the framework more generic
- Ability to support other frameworks
  - By Extension
  - By Mapping
- Need to support DMM that non-UML tool vendors could support
- Need to support a standard profile that can be used to implement the UAF in UML/SysML tool

UPDM 3.0->UAF 1.0



UAF/P Grid Representation

- Took inspiration from NAF 4
- Genericize 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



	Taxonomy Tx	Structure Sr	Connectivity Cn	Processes Pr	States St	Interaction Scenarios Is	Information If	Parameters Pm	Constraints Ct	Roadmap Rm	Traceability Tr
Metadata Md	Metadata Taxonomy 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	Strategic Taxonomy St-Tx	Strategic Structure St-Sr	Strategic Connectivity St-Cn	-	Strategic States St-St	-			Strategic Constraints St-Ct	Strategic Deployment, St-Rm Strategic 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	Conceptual Data Model,	Environment Pm-En	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	Logical Data Model,		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	Physical schema, real world results	Measurements Pm-Me	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 Activity PJ-Pr	-	-			-	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

Benefits of UAF

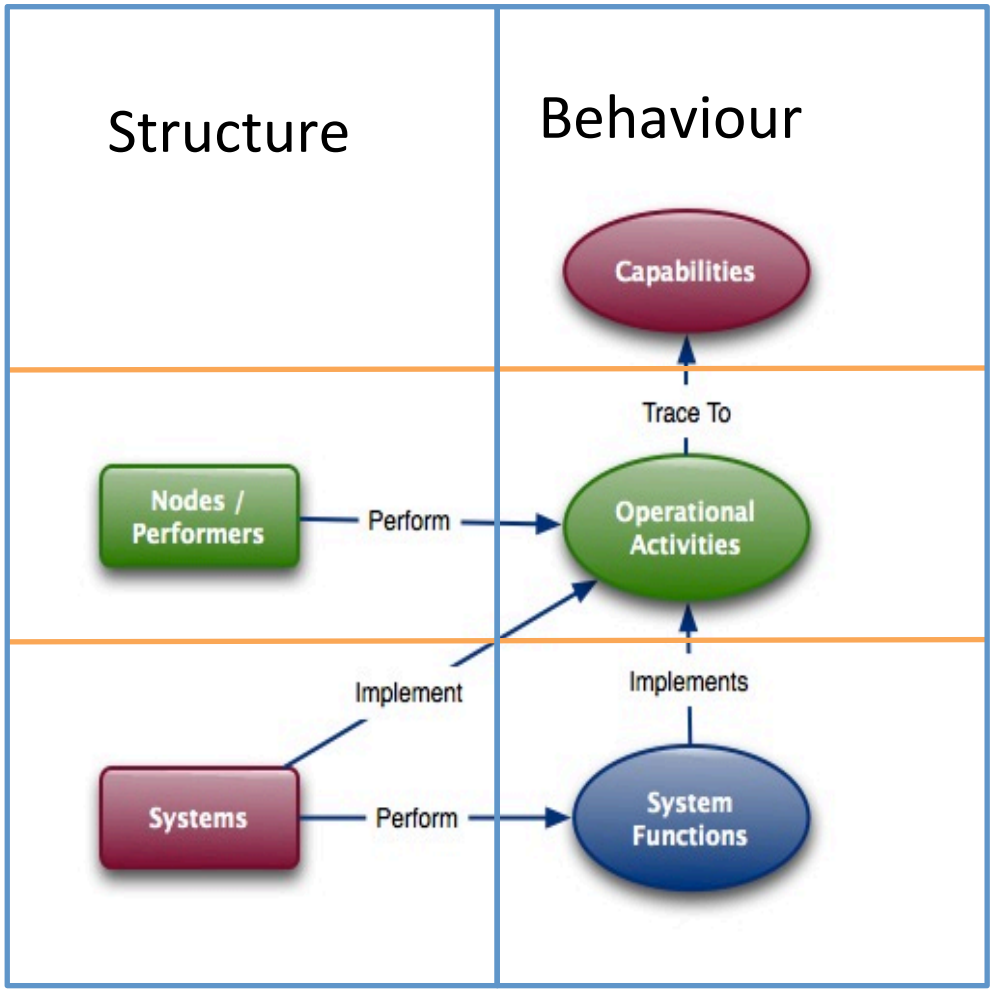
- UAF goes beyond DoDAF/MODAF/NAF
- Actual Resources are instance models of the architecture that allow
  - Dynamic simulation/execution
    - Verify behavior,
      - State, Activity level, message sequences
    - Verify interfaces
  - Computational Analysis
    - Parametric analysis
      - Trade studies and Architecture optimization
- 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

	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	AV-3				-	-					
Strategic St	StV-2	StV-1	StV-4	-		-				StV-5 StV-3	StV-6
Operational 0p	OV-1a OV-2	OV-2	OV-2/ OV-3	OV-5	OV-6b	OV-6c			OV-6a	-	-
Services Sv	SOV-1	SOV-1	SOV-2	SOV-5	SOV-4b	SOV-5c	OV-7	Environment OV-1c SV-7	SOV-4a		SOV-3, OV-5
Personnel Pr	OV-4 Typical	OV-4	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	SV-1, SV-2	SV-3	SV-4	SV-10b	SV-10c			SV-10a	SV-8 SV-9	SV-5
Security Sc					-	-		Measurements		-	-
Projects Pj	AcV-1	AcV-1	AcV-2	-	-	-			-	AcV-2	
Standards Sd	TV-1	TV-1	-	-	-	-			-	SV-9	TV-1
Actuals Resources Ar		OV-4 Actual	OV-4 SV-1 & SV-2	Simulation [b]					Parametric Execution/ Evaluation [b]	-	-
Dictionary * Dc (AV-2)											
Summary & Overview SmOv (AV-1)											
Requirements Rq											

UAF On One Slide



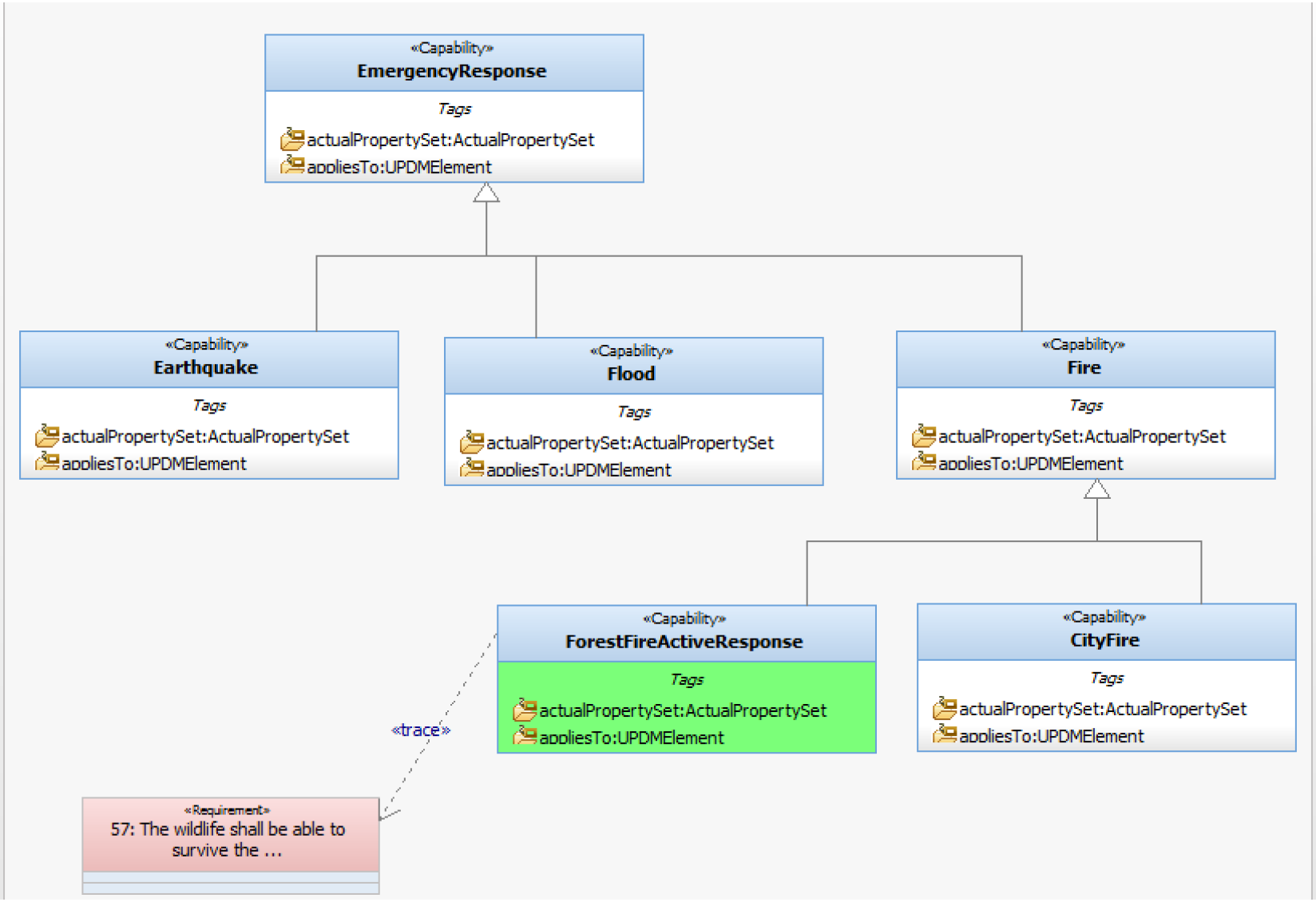
High Level
Need

WHAT
Functional/
Organisational

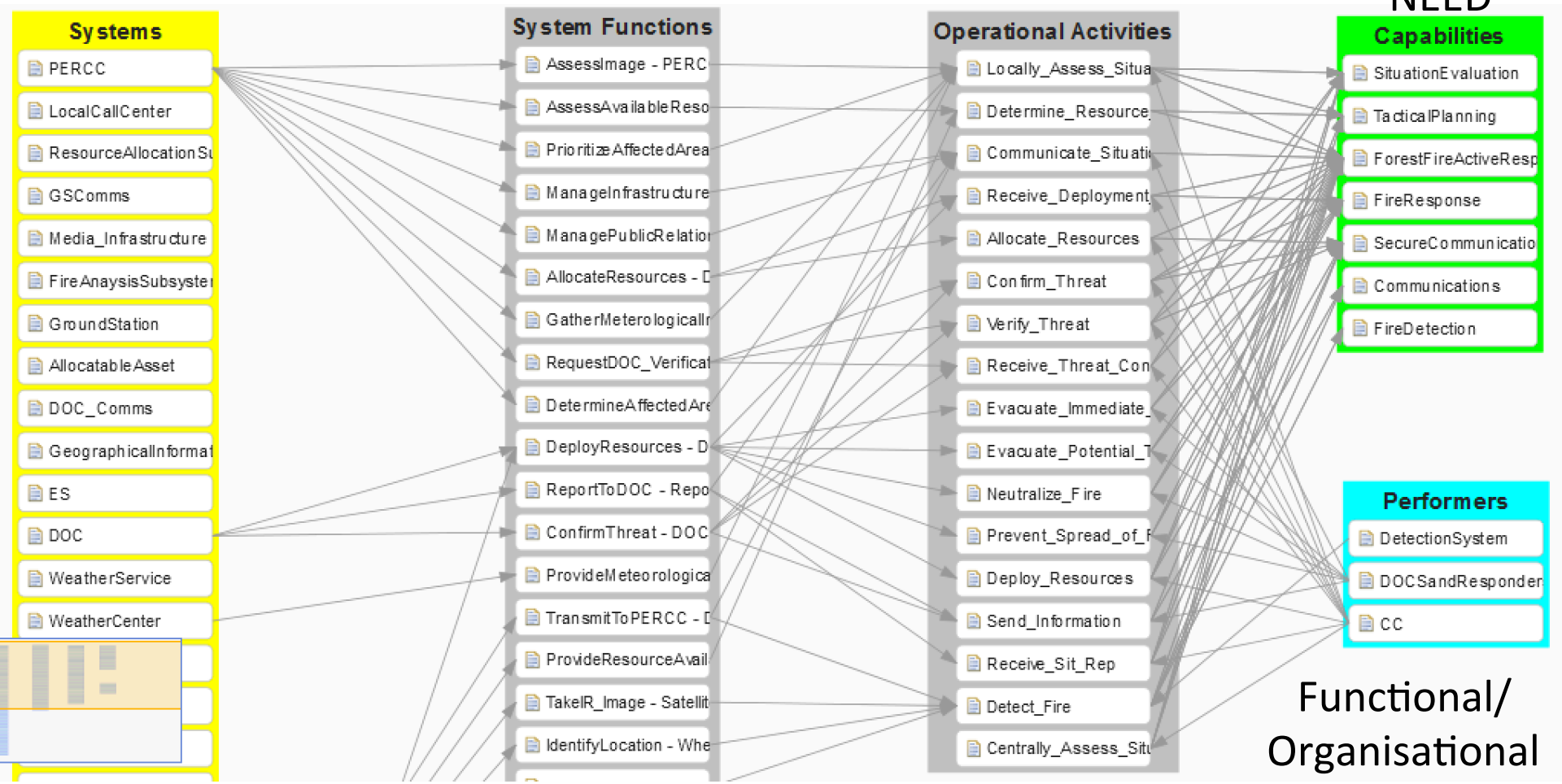
How
Physical

High Level Operational Concept

Capability Taxonomy



UAF on one Page and a bit



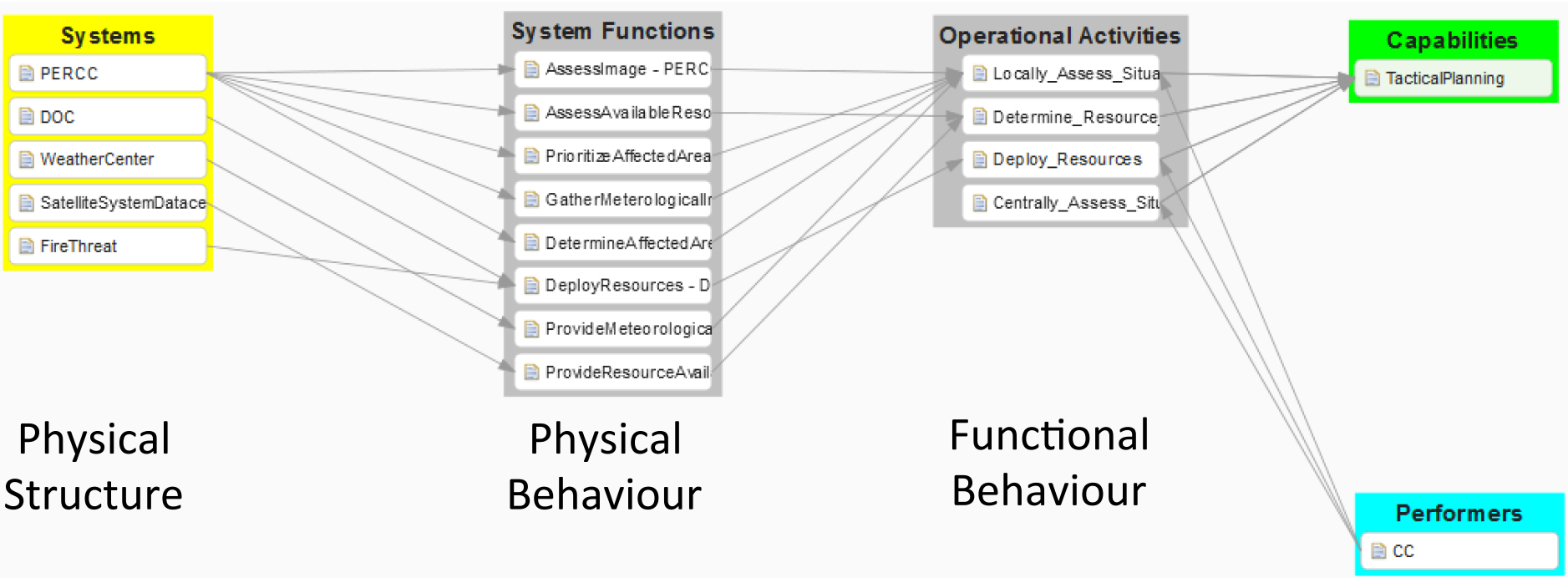
Physical Structure

Physical Behaviour

Functional Behaviour

Capability to Systems

NEED



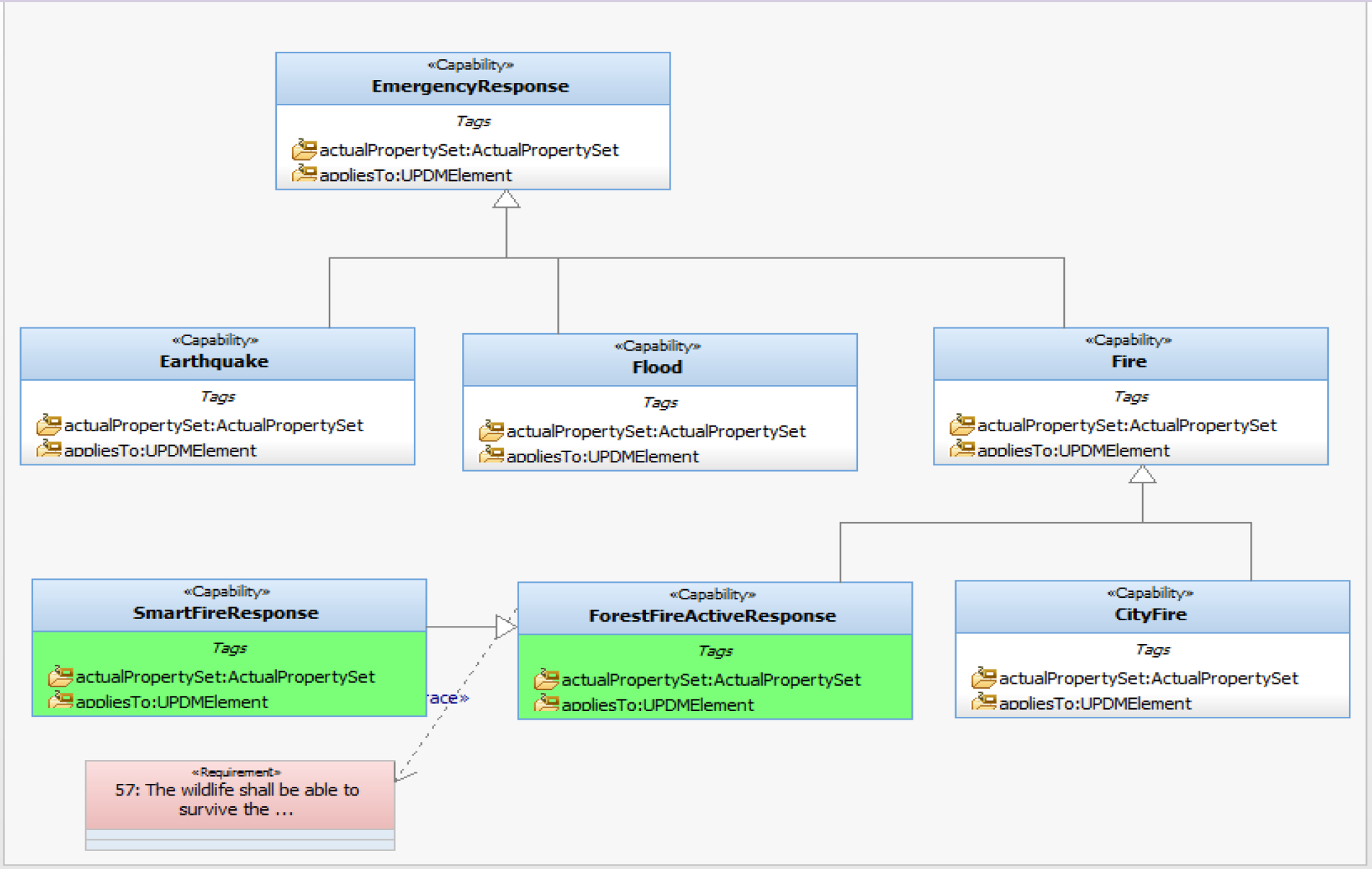
Physical Structure

Physical Behaviour

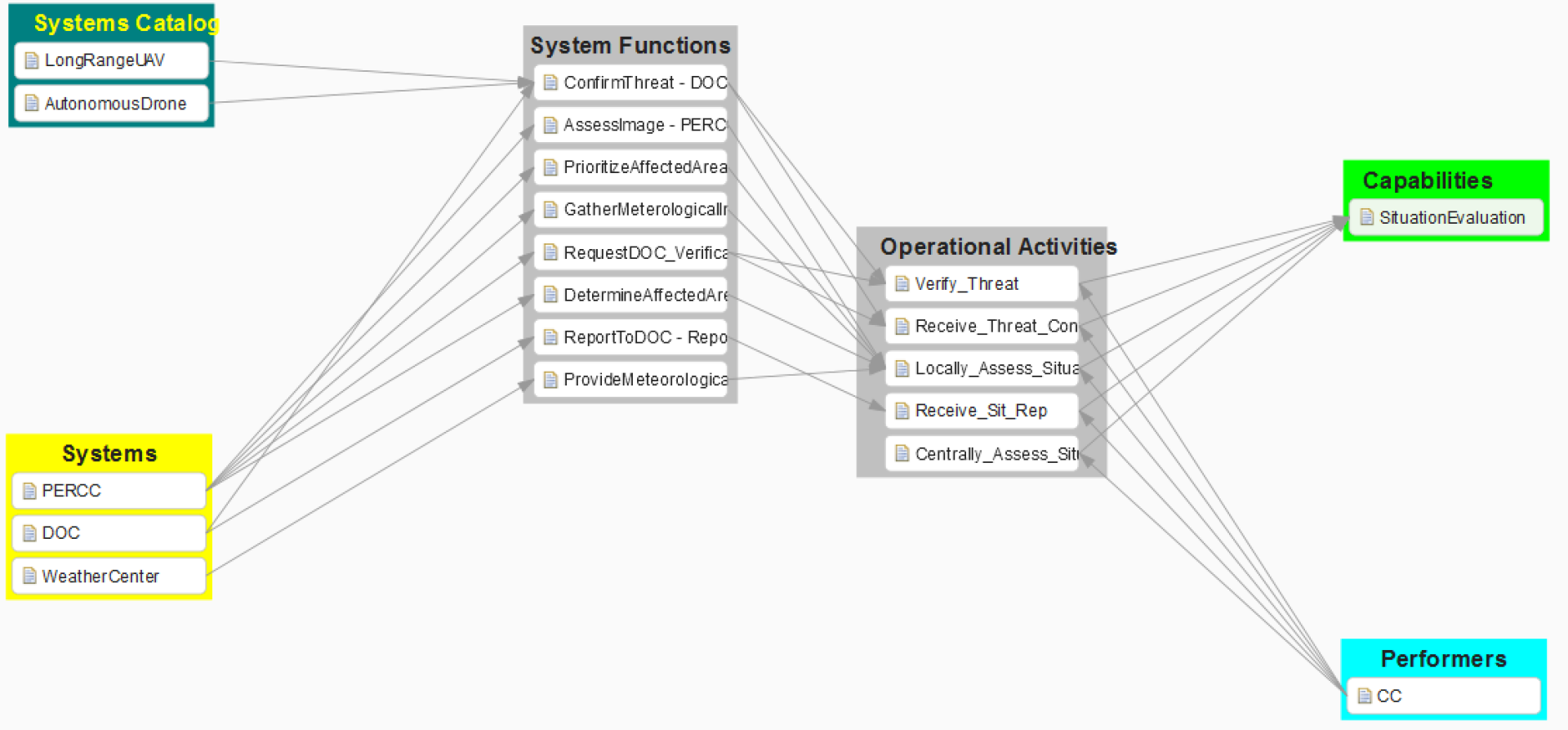
Functional Behaviour

Functional/ Organisational Structure

Capability Taxonomy V2



New RELM View from smart capabilities



UAF/P Roadmap

- Voted for acceptance at June 2016 OMG technical meeting
- Specification consists of 4 major parts
  - UAFP, Profile and Metamodel specification
  - UAF, Domain Metamodel
  - Traceability to donor frameworks and metamodels
  - Sample problem based on Search and Rescue
- Finalization Task Force expected to complete at June 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

UAF
OMG UNIFIED ARCHITECTURE FRAMEWORK™

Thank You!

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