OMG Model-based Acquisition (MBAcq) User Group:

A Government & Industry Collaboration
Reference Architecture and Patterns

NASA Quality Leadership Forum (QLF) 3/14/2024
Cape Canaveral, FL

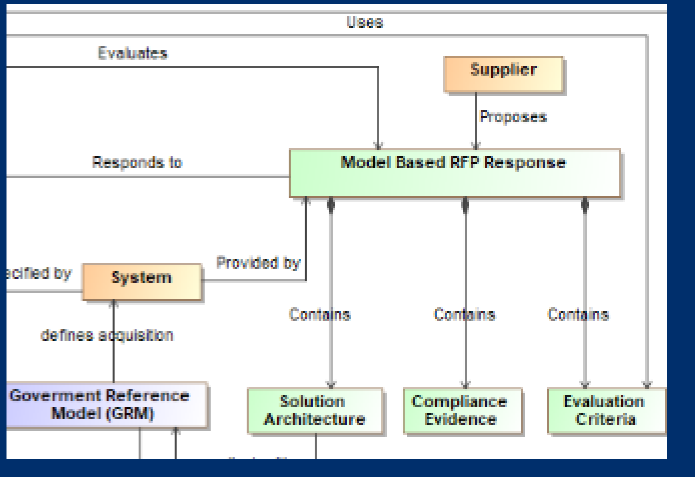
LAURA E HART LAURA.E.HART@LMCO.COM

MBACQ UG CO-CHAIR/OMG UAF CO-CHAIR

Model-Based Acquisition (MBAcq) User Group Introduction

About MBAcq

Model-based acquisition is the Technical approach to acquisition that uses models and other digital artifacts as the primary means of information exchange, rather than document-based information exchange.

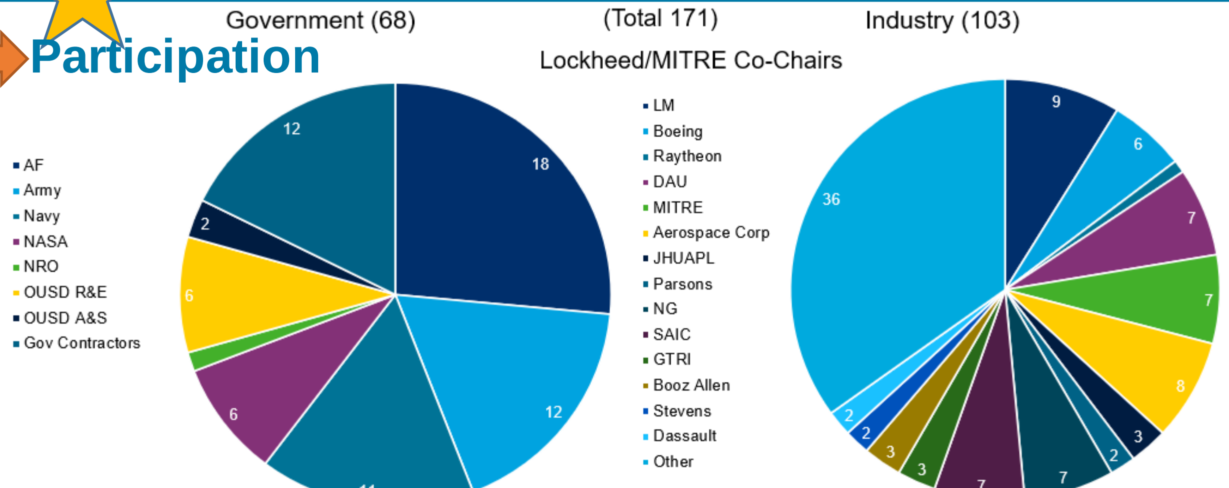

Uses
Evaluates
Supplier
Proposes
Responds to
Model Based RFP Response
ecified by
System
Provided by
Contains
Contains
Contains
defines acquisition
Goverment Reference Model (GRM)
Solution Architecture
Compliance Evidence
Evaluation Criteria

Why MBAcq Matters

Customers are increasingly specifying MBSE in RFPs
Customers are increasingly requiring models in proposals
Lack of standardization raises proposal learning curves & compliance risk

- **Model Based Acquisition will be disruptive**
- **Increased interest to organize around the MBAcq UG to define and standardize approach**
- **Broad government and industry participation**
- **Gov & Industry have an opportunity to shape future MB Acquisitions & Compliance together**

Participation



Last updated 6/9/2023

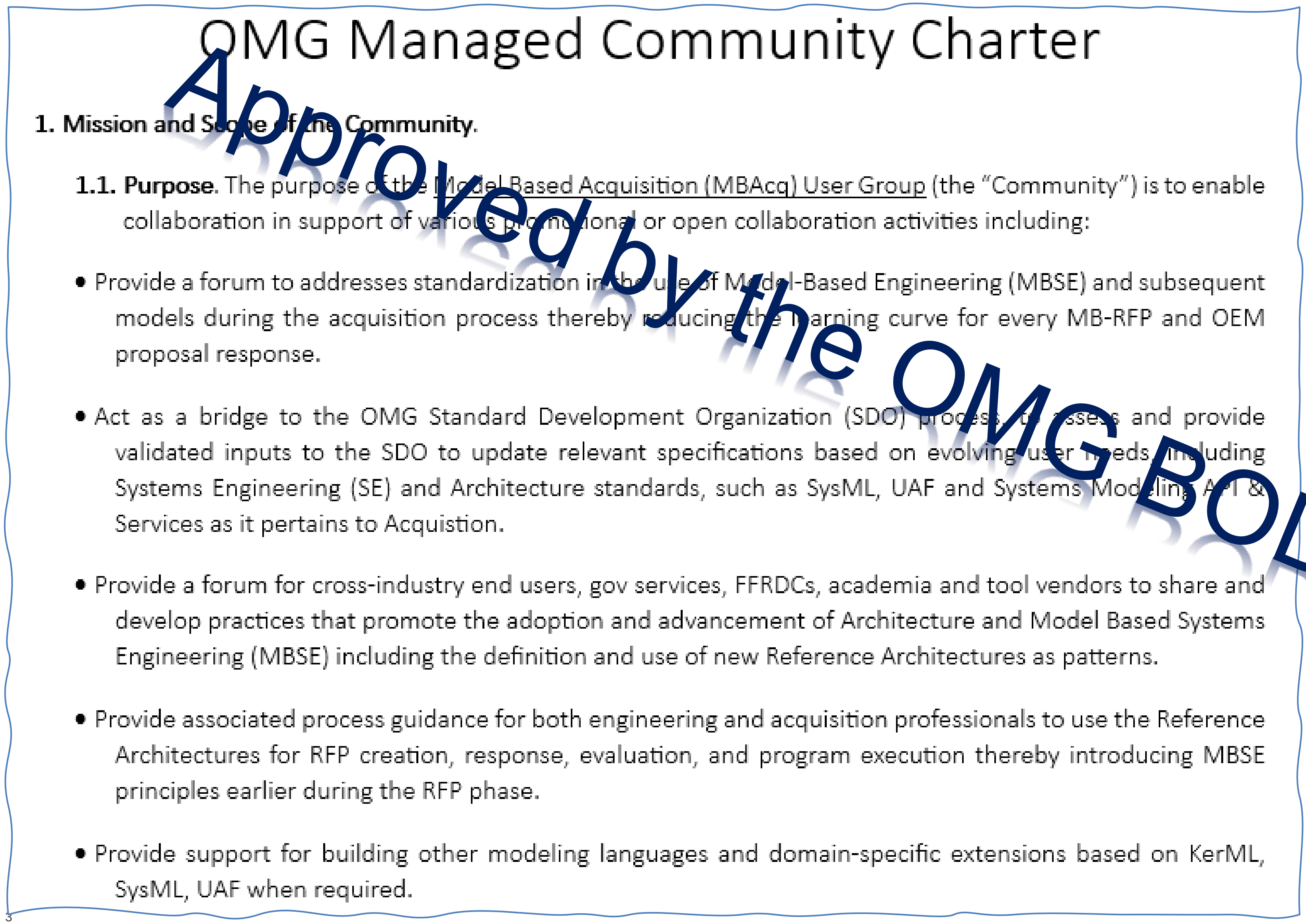
Expected Timeline

2022: Formed Team & Framework
2024: Q2 Govt Ref Arch
2024: Q4 Acquisition Users Guide
Q2/3 DAU Acquisition Training
Q4 Acquisition Model Example
Ongoing: Curate and Create Reusable Content
(Reference Architectures, Domain Overlays, …)

For more information contact:
laura.e.hart@lmco.com
rahaselden@mitre.org
toni.m.nolder@aero.org

Full lifecycle should be addressed during Acquisition!

MBAcq User Group is an OMG Managed Community



Approved by the OMG BOD 9/26/2023

OMG Managed Community Charter

1. Mission and Scope of the Community.

1.1. Purpose. The purpose of the Model Based Acquisition (MBAcq) User Group (the "Community") is to enable collaboration in support of various promotional or open collaboration activities including:

- Provide a forum to addresses standardization in the use of Model-Based Engineering (MBSE) and subsequent models during the acquisition process thereby reducing the learning curve for every MB-RFP and OEM proposal response.
- Act as a bridge to the OMG Standard Development Organization (SDO) process, to assess and provide validated inputs to the SDO to update relevant specifications based on evolving user needs, including Systems Engineering (SE) and Architecture standards, such as SysML, UAF and Systems Modeling API & Services as it pertains to Acquistion.
- Provide a forum for cross-industry end users, gov services, FFRDCs, academia and tool vendors to share and develop practices that promote the adoption and advancement of Architecture and Model Based Systems Engineering (MBSE) including the definition and use of new Reference Architectures as patterns.
- Provide associated process guidance for both engineering and acquisition professionals to use the Reference Architectures for RFP creation, response, evaluation, and program execution thereby introducing MBSE principles earlier during the RFP phase.
- Provide support for building other modeling languages and domain-specific extensions based on KerML, SysML, UAF when required.

- Approved by the OMG BOD 26 September 2023 as an enduring OMG Entity
- Founding Members
  - Lockheed Martin (Laura Hart)
  - The MITRE Corporation (Rae Anderson)
  - The Aerospace Corporation (Toni Nolder)

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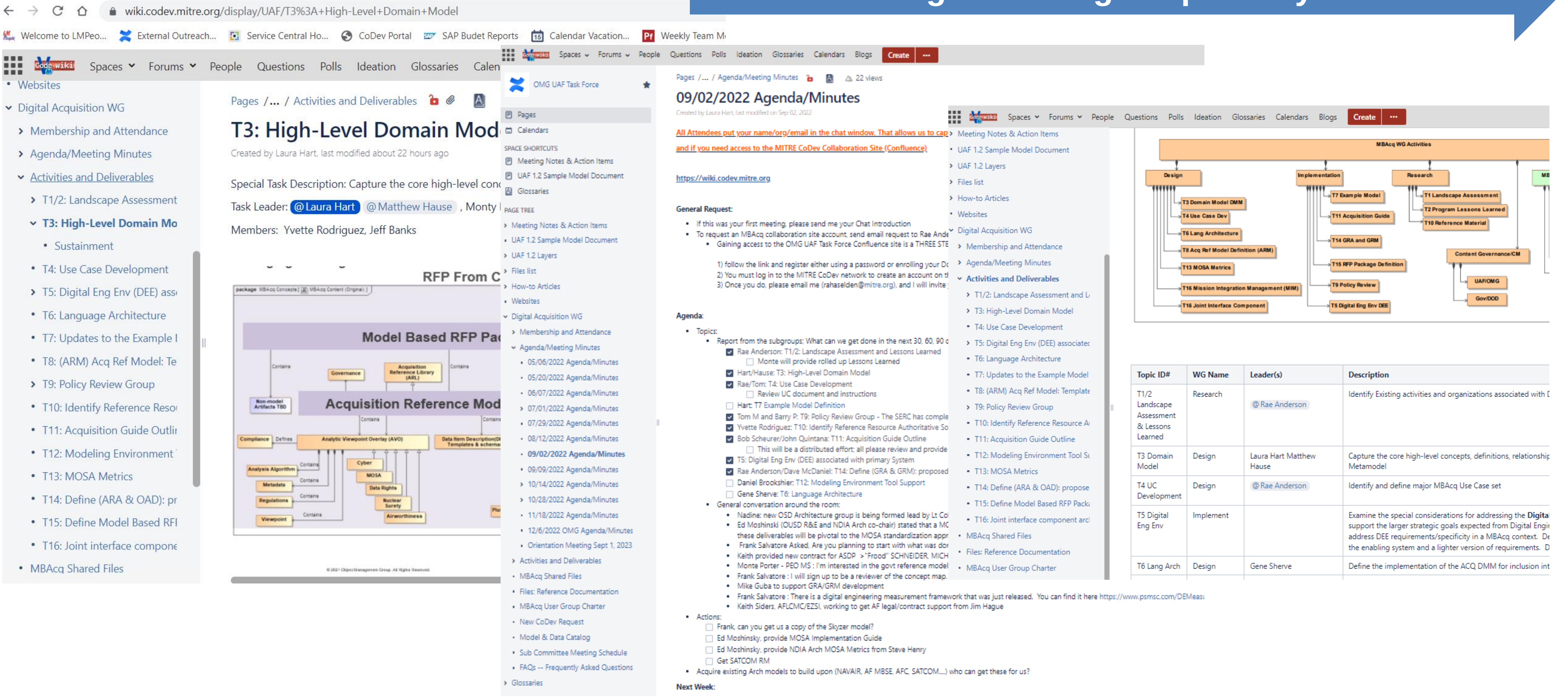
Collaboration and Transparency in an Open Env

Transitioning Knowledge Repository to OMG MC


wiki.codev.mitre.org/display/UAF/T3%3A+High-Level+Domain+Model
Welcome to LMPeo...
External Outreach...
Service Central Ho...
CoDev Portal
SAP Budet Reports
Calendar Vacation...
Weekly Team M
Spaces
Forums
People
Questions
Polls
Ideation
Glossaries
Calen
Calendars
Blogs
Create
OMG UAF Task Force
Pages
Calendars
SPACE SHORTCUTS
PAGE TREE

- Websites
- Digital Acquisition WG
  - Membership and Attendance
  - Agenda/Meeting Minutes
  - Activities and Deliverables
    - T1/2: Landscape Assessment
    - T3: High-Level Domain Mo
      - Sustainment
    - T4: Use Case Development
    - T5: Digital Eng Env (DEE) ass
    - T6: Language Architecture
    - T7: Updates to the Example I
    - T8: (ARM) Acq Ref Model: Te
    - T9: Policy Review Group
    - T10: Identify Reference Reso
    - T11: Acquisition Guide Outlir
    - T12: Modeling Environment
    - T13: MOSA Metrics
    - T14: Define (ARA & OAD): pr
    - T15: Define Model Based RFI
    - T16: Joint interface compone
- MBAcq Shared Files

Pages /... / Activities and Deliverables

T3: High-Level Domain Mod

Created by Laura Hart, last modified about 22 hours ago

Special Task Description: Capture the core high-level conc

Task Leader: @Laura Hart @Matthew Hause , Monty

Members: Yvette Rodriguez, Jeff Banks

RFP From C
package MBAcq Concepts [MBAcq Content (Original)]
Model Based RFP Pac
Contains
Governance
Acquisition Reference Library (ARL)
Non-model Artifacts TBD
Acquisition Reference Mod
Compliance
Defines
Analytic Viewpoint Overlay (AVO)
Data Item Description(D Templates & schema
Analysis Algorithm
Metadata
Regulations
Viewpoint
Cyber
MOSA
Data Rights
Nuclear Surety
Airworthiness
Plu
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OMG UAF Task Force

- Pages
- Calendars

SPACE SHORTCUTS

- Meeting Notes & Action Items
- UAF 1.2 Sample Model Document
- Glossaries

PAGE TREE

- Meeting Notes & Action Items
- UAF 1.2 Sample Model Document
- UAF 1.2 Layers
- Files list
- How-to Articles
- Websites
- Digital Acquisition WG
  - Membership and Attendance
  - Agenda/Meeting Minutes
    - 05/06/2022 Agenda/Minutes
    - 05/20/2022 Agenda/Minutes
    - 06/07/2022 Agenda/Minutes
    - 07/01/2022 Agenda/Minutes
    - 07/29/2022 Agenda/Minutes
    - 08/12/2022 Agenda/Minutes
    - **09/02/2022 Agenda/Minutes**
    - 09/09/2022 Agenda/Minutes
    - 10/14/2022 Agenda/Minutes
    - 10/28/2022 Agenda/Minutes
    - 11/18/2022 Agenda/Minutes
    - 12/6/2022 OMG Agenda/Minutes
    - Orientation Meeting Sept 1, 2023
  - Activities and Deliverables
  - MBAcq Shared Files
  - Files: Reference Documentation
  - MBAcq User Group Charter
  - New CoDev Request
  - Model & Data Catalog
  - Sub Committee Meeting Schedule
  - FAQs -- Frequently Asked Questions
- Glossaries

Pages /... / Agenda/Meeting Minutes 22 views

09/02/2022 Agenda/Minutes

Created by Laura Hart, last modified on Sep 02, 2022

All Attendees put your name/org/email in the chat window. That allows us to cap

and if you need access to the MITRE CoDev Collaboration Site (Confluence)

https://wiki.codev.mitre.org

General Request:

- If this was your first meeting, please send me your Chat Introduction
- To request an MBAcq collaboration site account, send email request to Rae Ande
  - Gaining access to the OMG UAF Task Force Confluence site is a THREE STE

    1) follow the link and register either using a password or enrolling your Do
    2) You must log in to the MITRE CoDev network to create an account on t
    3) Once you do, please email me (rahaselden@mitre.org), and I will invite

Agenda:

- Topics:
  - Report from the subgroups; What can we get done in the next 30, 60, 90 d
    - ☑ Rae Anderson: T1/2: Landscape Assessment and Lessons Learned
      - ☐ Monte will provide rolled up Lessons Learned
    - ☑ Hart/Hause: T3: High-Level Domain Model
    - ☑ Rae/Tom: T4: Use Case Development
      - ☐ Review UC document and instructions
    - ☐ Hart: T7 Example Model Definition
    - ☑ Tom M and Barry P: T9: Policy Review Group - The SERC has comple
    - ☑ Yvette Rodriguez: T10: Identify Reference Resource Authoritative So
    - ☑ Bob Scheurer/John Quintana: T11: Acquisition Guide Outline
      - ☐ This will be a distributed effort; all please review and provide
    - ☑ T5: Digital Eng Env (DEE) associated with primary System
    - ☑ Rae Anderson/Dave McDaniel: T14: Define (GRA & GRM): proposed
    - ☐ Daniel Brookshier: T12: Modeling Environment Tool Support
    - ☐ Gene Sherve: T6: Language Architecture
  - General conversation around the room:
    - Nadine: new OSD Architecture group is being formed lead by Lt Col
    - Ed Moshinski (OUSD R&E and NDIA Arch co-chair) stated that a MC these deliverables will be pivotal to the MOSA standardization appr
    - Frank Salvatore Asked, Are you planning to start with what was dor
    - Keith provided new contract for ASDP >"Frood" SCHNEIDER, MICH
    - Monte Porter - PEO MS : I'm interested in the govt reference model
    - Frank Salvatore : I will sign up to be a reviewer of the concept map.
    - Mike Guba to support GRA/GRM development
    - Frank Salvatore : There is a digital engineering measurement framework that was just released. You can find it here https://www.psmsc.com/DEMeas
    - Keith Siders, AFLCMC/EZSI, working to get AF legal/contract support from Jim Hague
- Actions:
  - ☐ Frank, can you get us a copy of the Skyzer model?
  - ☐ Ed Moshinsky, provide MOSA Implementation Guide
  - ☐ Ed Moshinsky, provide NDIA Arch MOSA Metrics from Steve Henry
  - ☐ Get SATCOM RM
- Acquire existing Arch models to build upon (NAVAIR, AF MBSE, AFC, SATCOM....) who can get these for us?

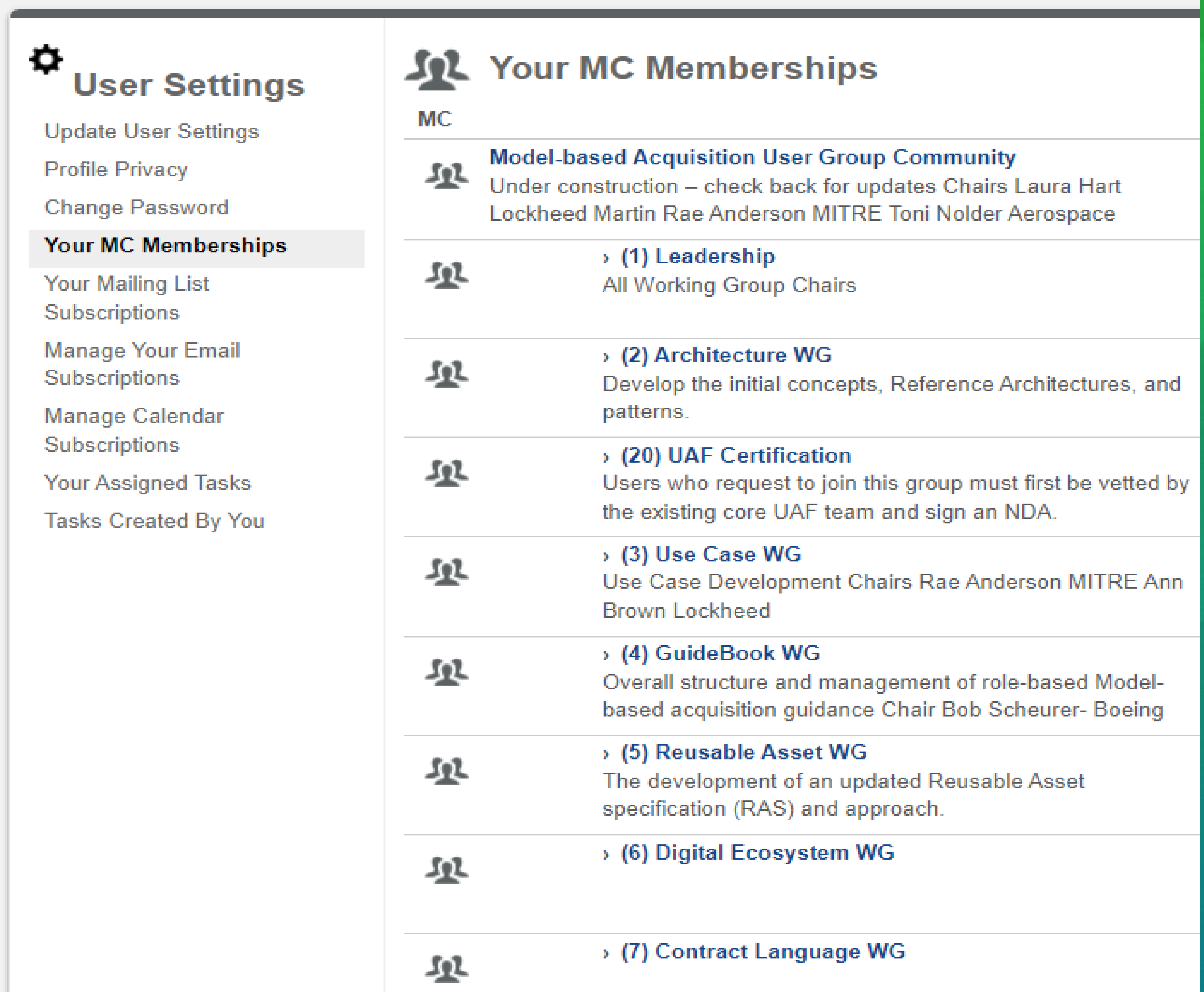
Next Week:

- Meeting Notes & Action Items
- UAF 1.2 Sample Model Document
- UAF 1.2 Layers
- Files list
- How-to Articles
- Websites
- Digital Acquisition WG
  - Membership and Attendance
  - Agenda/Meeting Minutes
  - **Activities and Deliverables**
    - T1/2: Landscape Assessment and L
    - T3: High-Level Domain Model
    - T4: Use Case Development
    - T5: Digital Eng Env (DEE) associatec
    - T6: Language Architecture
    - T7: Updates to the Example Model
    - T8: (ARM) Acq Ref Model: Template
    - T9: Policy Review Group
    - T10: Identify Reference Resource A
    - T11: Acquisition Guide Outline
    - T12: Modeling Environment Tool Su
    - T13: MOSA Metrics
    - T14: Define (ARA & OAD): propose
    - T15: Define Model Based RFP Pack
    - T16: Joint interface component arc
  - MBAcq Shared Files
  - Files: Reference Documentation
  - MBAcq User Group Charter

MBAcq WG Activities
Design
Implementation
Research
MB
T3 Domain Model DMM
T4 Use Case Dev
T6 Lang Architecture
T8 Acq Ref Model Definition (ARM)
T13 MOSA Metrics
T16 Mission Integration Management (MIM)
T16 Joint Interface Component
T7 Example Model
T11 Acquisition Guide
T14 GRA and GRM
T15 RFP Package Definition
T9 Policy Review
T5 Digital Eng Env DEE
T1 Landscape Assessment
T2 Program Lessons Learned
T10 Reference Material
Content Governance/CM
UAF/OMG
Gov/DOD

Topic ID#	WG Name	Leader(s)	Description
T1/2 Landscape Assessment & Lessons Learned	Research	@Rae Anderson	Identify Existing activities and organizations associated with D
T3 Domain Model	Design	Laura Hart Matthew Hause	Capture the core high-level concepts, definitions, relationship Metamodel
T4 UC Development	Design	@Rae Anderson	Identify and define major MBAcq Use Case set
T5 Digital Eng Env	Implement		Examine the special considerations for addressing the **Digita** support the larger strategic goals expected from Digital Engi address DEE requirements/specificity in a MBAcq context. De the enabling system and a lighter version of requirements. D
T6 Lang Arch	Design	Gene Sherve	Define the implementation of the ACQ DMM for inclusion int

https://communities.omg.org/workgroup/index



User Settings

- Update User Settings
- Profile Privacy
- Change Password
- **Your MC Memberships**
- Your Mailing List Subscriptions
- Manage Your Email Subscriptions
- Manage Calendar Subscriptions
- Your Assigned Tasks
- Tasks Created By You

Your MC Memberships

MC
Model-based Acquisition User Group Community Under construction – check back for updates Chairs Laura Hart Lockheed Martin Rae Anderson MITRE Toni Nolder Aerospace
› **(1) Leadership** All Working Group Chairs
› **(2) Architecture WG** Develop the initial concepts, Reference Architectures, and patterns.
› **(20) UAF Certification** Users who request to join this group must first be vetted by the existing core UAF team and sign an NDA.
› **(3) Use Case WG** Use Case Development Chairs Rae Anderson MITRE Ann Brown Lockheed
› **(4) GuideBook WG** Overall structure and management of role-based Model-based acquisition guidance Chair Bob Scheurer- Boeing
› **(5) Reusable Asset WG** The development of an updated Reusable Asset specification (RAS) and approach.
› **(6) Digital Ecosystem WG**
› **(7) Contract Language WG**

Standards
Development
Organization.

- **Object Management Group Announces Model-Based Acquisition User Community**

Community influences the future of Model-Based Systems Engineering specifications and architectures

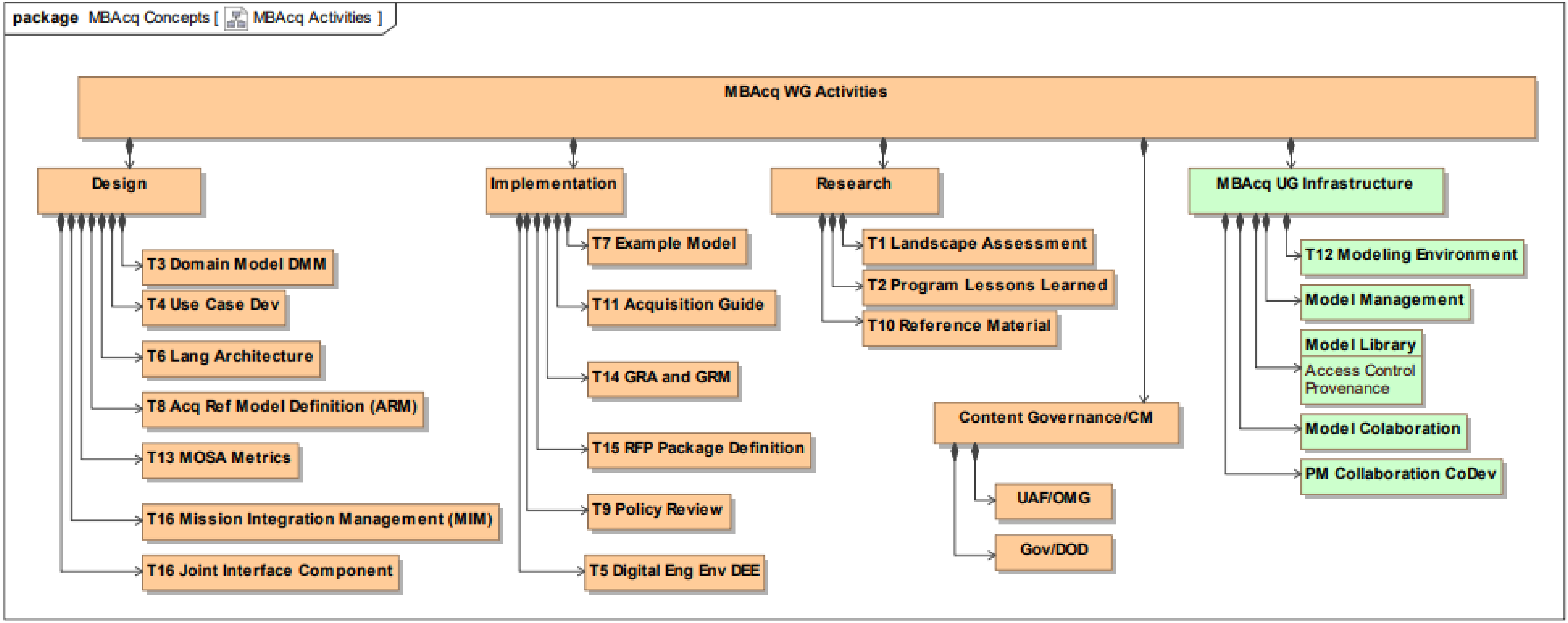
-January 18, 2024

https://www.omg.org/news/releases/pr2024/01-18-24.htm

OMG Q1 Conf in Reston VA 3/18- 3/22
https://www.eventbrite.com/e/omg-model-based-acquisition-user-group-community-q1-2024-meeting-registration-817420204837

UAF Summit (Free) 3/20
https://www.omg.org/events/2024Q1/special-events/UAF-Summit.htm

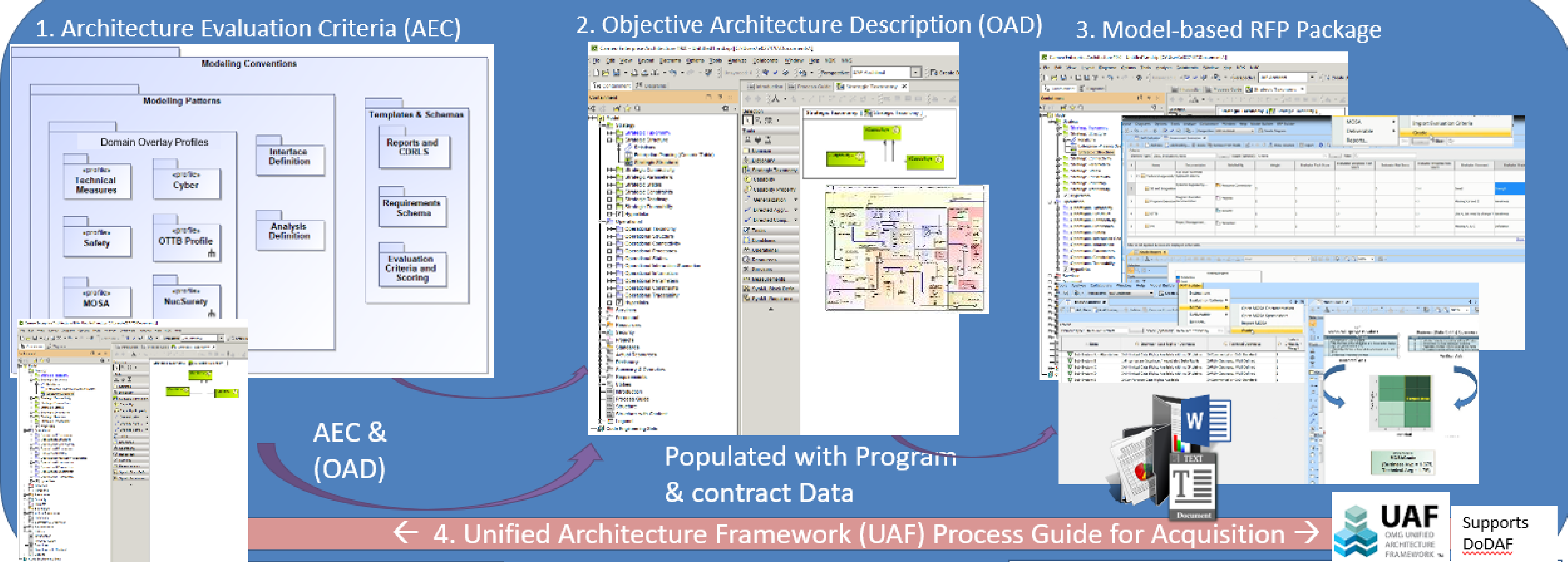
MBACQ – UG ACTIVITIES



package MBAcq Concepts [MBAcq Activities]

- **MBAcq WG Activities**
  - **Design**
    - T3 Domain Model DMM
    - T4 Use Case Dev
    - T6 Lang Architecture
    - T8 Acq Ref Model Definition (ARM)
    - T13 MOSA Metrics
    - T16 Mission Integration Management (MIM)
    - T16 Joint Interface Component
  - **Implementation**
    - T7 Example Model
    - T11 Acquisition Guide
    - T14 GRA and GRM
    - T15 RFP Package Definition
    - T9 Policy Review
    - T5 Digital Eng Env DEE
  - **Research**
    - T1 Landscape Assessment
    - T2 Program Lessons Learned
    - T10 Reference Material
  - **Content Governance/CM**
    - UAF/OMG
    - Gov/DOD
  - **MBAcq UG Infrastructure**
    - T12 Modeling Environment
    - Model Management
    - Model Library
Access Control
Provenance
    - Model Colaboration
    - PM Collaboration CoDev

Model-Based Acquisition



1. Architecture Evaluation Criteria (AEC)

Modeling Conventions
Modeling Patterns
Domain Overlay Profiles
«profile» Technical Measures
«profile» Cyber
«profile» Safety
«profile» OTTB Profile
«profile» MOSA
«profile» NucSurety
Interface Definition
Analysis Definition
Templates & Schemas
Reports and CDRLS
Requirements Schema
Evaluation Criteria and Scoring

2. Objective Architecture Description (OAD)

3. Model-based RFP Package

AEC & (OAD)

Populated with Program & contract Data

← 4. Unified Architecture Framework (UAF) Process Guide for Acquisition →

UAF
OMG UNIFIED ARCHITECTURE FRAMEWORK

Supports DoDAF

1. The AEC provides model structure for RFP content and evaluation tools:

- Modeling Patterns
  - DO Profiles (i.e. MOSA, Data Rights, certs)
  - Interface & Analysis Definitions
- Templates & Schemas
  - Evaluation Criteria & Scoring (Section K, L, M)
  - Reports & CDRLS

2. The OAD is a descriptive model containing the program requirements, constraints and context

- High-level Capabilities, mapped to Operational scenarios, traced to requirements (e.g. CDD, SRD, Conops)
- Technical performance measures (i.e. KPPs, KSAs, MOEs..)
- Any required architectural partitioning including structural and functional

(Based on UAF acquisition process guide and template)

3. The Model-based RFP model contains the populated OAD&AC providing **RFP evaluation content**, **CDRL definitions** for documentation generation and **scoring tools** for solution validation and evaluation

4. UAF Process Guide provides the Acquisition Guidance for using MBAcq **to create, respond and evaluate a Model-based RFP.**

SOURCE: Laura Hart, MITRE 2017

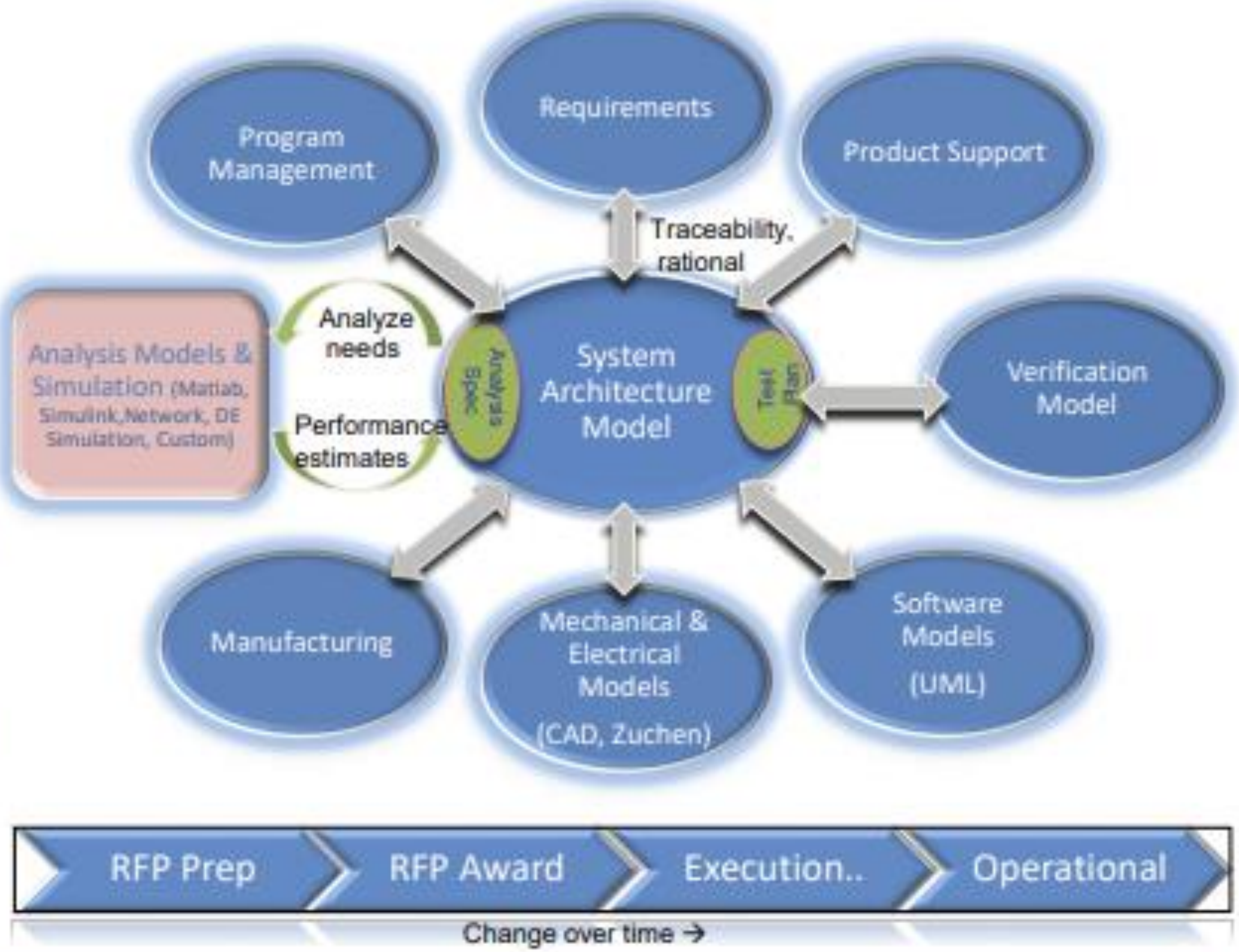
Descriptive vs Analytical Models

System Architecture Model (SAM)

- Descriptive in nature
- Emphasizes how pieces fit together into a *consistent* whole
- Provides context for analysis

Analysis Models and Simulation Models

- Emphasize specific aspects of performance, *consistent* with the Architecture Model.
- Mathematically-based computation or simulation
- Reduces risks thru analysis, validation and optimization of:
  - MOE, MOP, KPP, TPM timing, probability of hit/survival reliability/availability, MTBF cost, total cost of ownership
- A vehicle to solve some problem or verify a solution


Program Management
Requirements
Product Support
Traceability, rational
Analysis Models & Simulation (Matlab, Simulink,Network, DE Simulation, Custom)
Analyze needs
Performance estimates
Analysis Spec
System Architecture Model
Test Plan
Verification Model
Manufacturing
Mechanical & Electrical Models (CAD, Zuchen)
Software Models (UML)
RFP Prep
RFP Award
Execution..
Operational
Change over time →

SAM provides a "hub" for data integration and transformation across the product lifecycle

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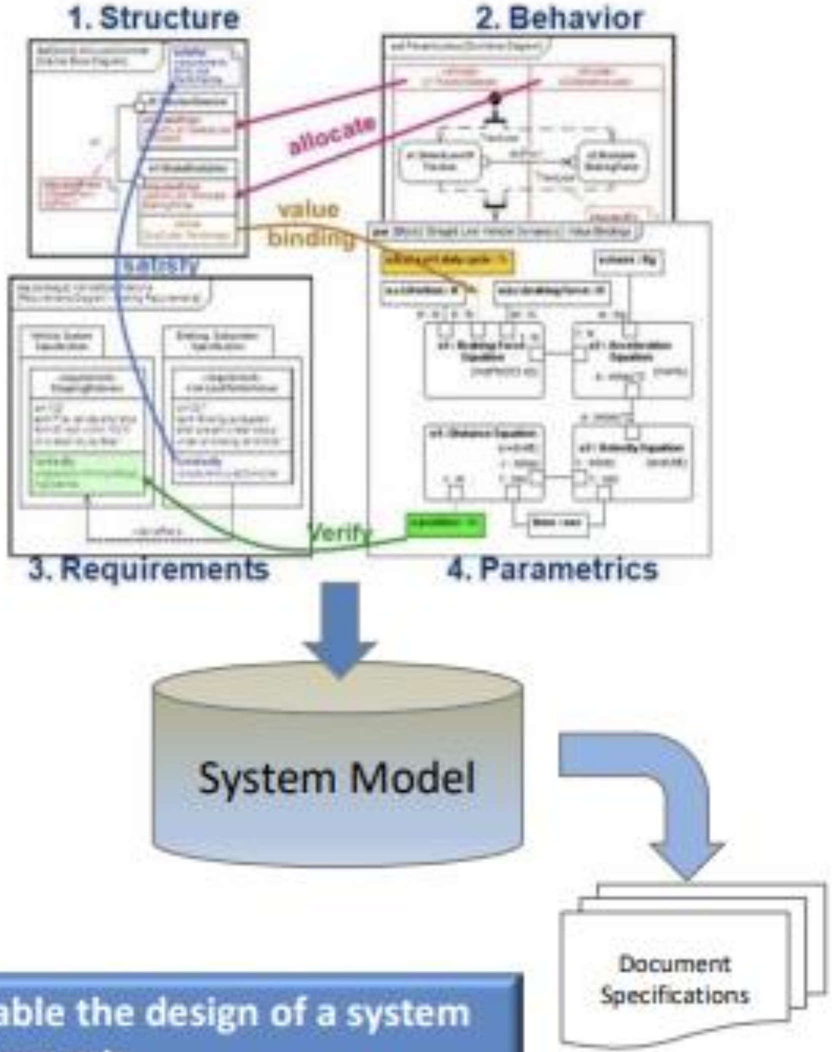
What's in the System Architecture Model

- **A System Architecture Model is an Integrated Structured Representation of the Requirements, Behaviors, Structure, Properties, and Interconnections**
  - Requirements
    - What are the mission operations, stakeholders' goals, purposes, and success conditions for the system?
  - Behavior
    - What the system needs to do to meet requirements
    - Transformation of inputs to outputs
    - Responses to External stimulus
  - Structure
    - The parts of the system that are responsible for the behaviors
    - The component hierarchy, elements and stores
  - Properties
    - The performance, physical characteristics and governing rules that constrain the structure and behaviors
  - Interconnections
    - The ability of the structured elements to exchange information and achieve their required behaviors


1. Structure
2. Behavior
allocate
value binding
satisfy
Verify
3. Requirements
4. Parametrics
System Model
Document Specifications

Primary use of the system model is to enable the design of a system that satisfies its requirements

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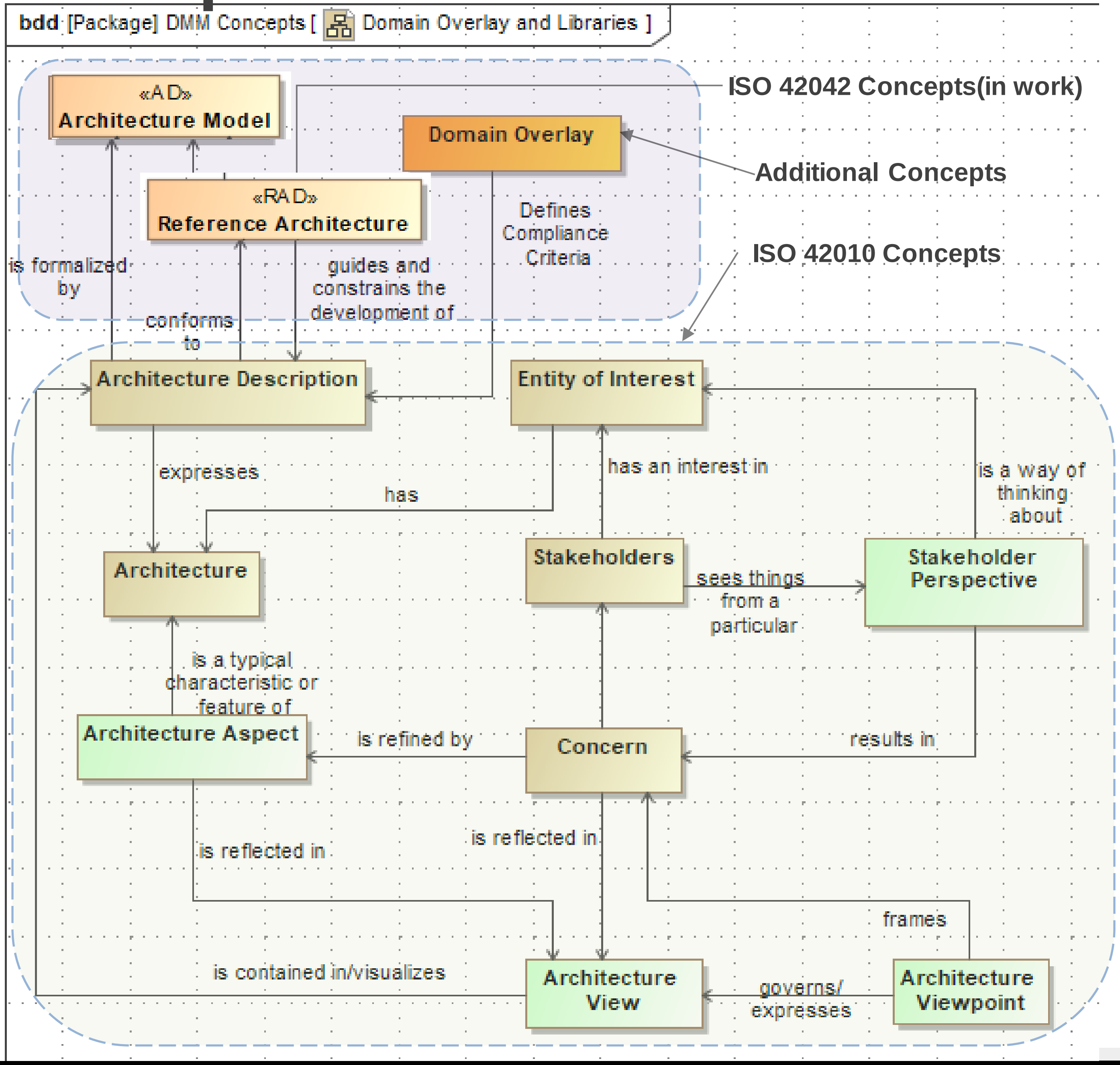
Standardized Concepts for Reusable Content


bdd [Package] DMM Concepts [Domain Overlay and Libraries]
«AD»
Architecture Model
Domain Overlay
«RAD»
Reference Architecture
Defines Compliance Criteria
is formalized by
guides and constrains the development of
conforms to
Architecture Description
Entity of Interest
expresses
has
has an interest in
is a way of thinking about
Architecture
Stakeholders
sees things from a particular
Stakeholder Perspective
is a typical characteristic or feature of
Architecture Aspect
is refined by
Concern
results in
is reflected in
is reflected in
frames
is contained in/visualizes
Architecture View
governs/ expresses
Architecture Viewpoint

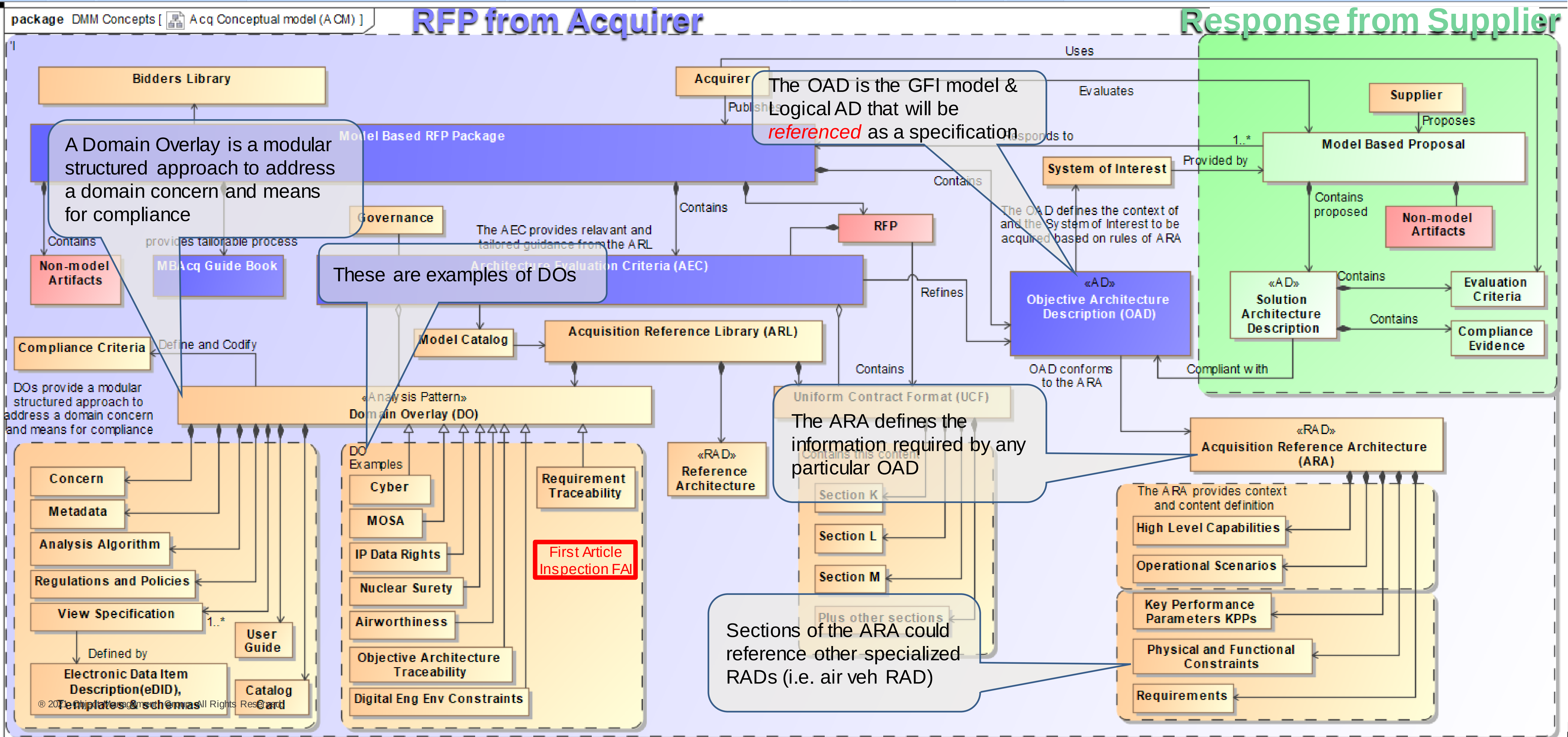
ISO 42042 Concepts(in work)

Additional Concepts

ISO 42010 Concepts

MBAcq Future State

Bringing it all together!


package DMM Concepts [Acq Conceptual model (ACM)]
RFP from Acquirer
Response from Supplier
Uses
Bidders Library
Acquirer
Publishes
Evaluates
Supplier
Proposes
Responds to
1..*
Model Based RFP Package
Model Based Proposal
Provided by
System of Interest
Contains
Contains proposed
Non-model Artifacts
Governance
RFP
provides tailorable process
The AEC provides relavant and tailored guidance from the ARL
The OAD defines the context of and the System of Interest to be acquired based on rules of ARA
Contains
Non-model Artifacts
MBAcq Guide Book
Architecture Evaluation Criteria (AEC)
Refines
«AD» Objective Architecture Description (OAD)
«AD» Solution Architecture Description
Contains
Evaluation Criteria
Contains
Compliance Evidence
Compliance Criteria
Define and Codify
Model Catalog
Acquisition Reference Library (ARL)
Contains
OAD conforms to the ARA
Compliant with
DOs provide a modular structured approach to address a domain concern and means for compliance
«Analysis Pattern» Domain Overlay (DO)
Uniform Contract Format (UCF)
«RAD» Acquisition Reference Architecture (ARA)
«RAD» Reference Architecture
Contains this content
Concern
Metadata
Analysis Algorithm
Regulations and Policies
View Specification
1..*
User Guide
Defined by
Electronic Data Item Description(eDID), Templates & schemas
Catalog Card
DO Examples
Cyber
MOSA
IP Data Rights
Nuclear Surety
Airworthiness
Objective Architecture Traceability
Digital Eng Env Constraints
Requirement Traceability
First Article Inspection FAI
Section K
Section L
Section M
Plus other sections
The ARA provides context and content definition
High Level Capabilities
Operational Scenarios
Key Performance Parameters KPPs
Physical and Functional Constraints
Requirements

A Domain Overlay is a modular structured approach to address a domain concern and means for compliance

The OAD is the GFI model & Logical AD that will be *referenced* as a specification

These are examples of DOs

The ARA defines the information required by any particular OAD

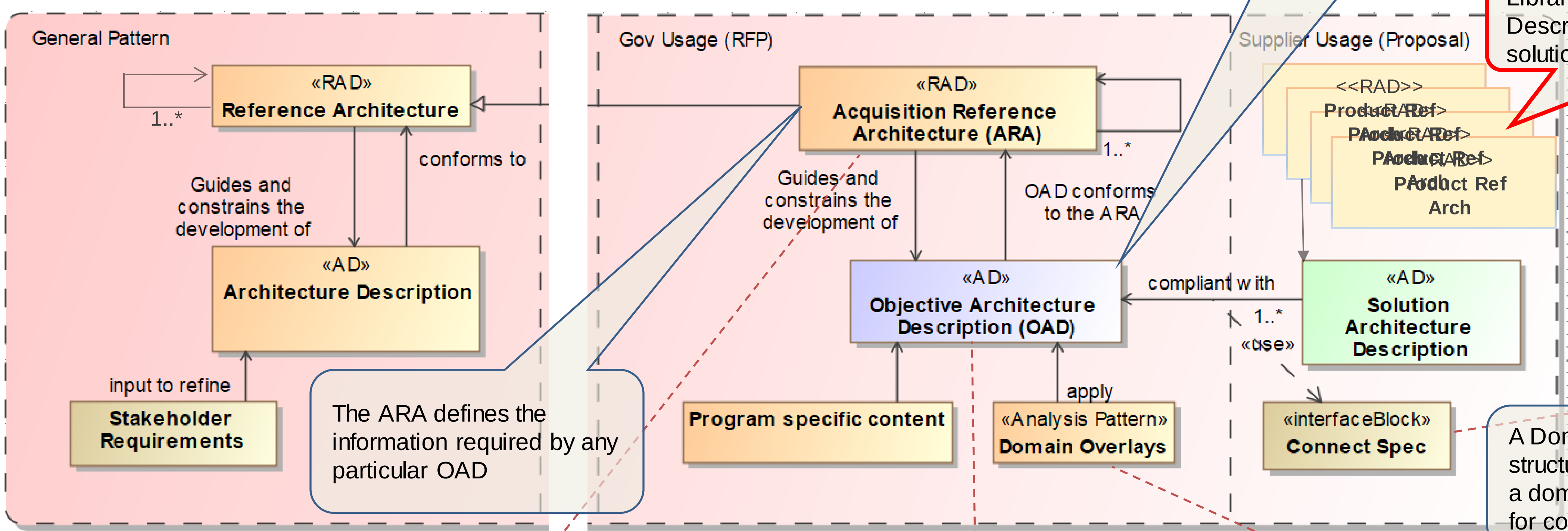
Sections of the ARA could reference other specialized RADs (i.e. air veh RAD)

Usage of Standardized Concepts (2)

OMG
Object
Management
Group.

The OAD is the GFI model & Logical AD that will be *referenced* as a specification

Library of Product Ref Architecture Descriptions used to guide solution AD response



General Pattern

«RAD»
Reference Architecture

1..*

Guides and constrains the development of

conforms to

«AD»
Architecture Description

input to refine

Stakeholder Requirements

The ARA defines the information required by any particular OAD

Gov Usage (RFP)

«RAD»
Acquisition Reference Architecture (ARA)

1..*

Guides and constrains the development of

OAD conforms to the ARA

«AD»
Objective Architecture Description (OAD)

Program specific content

apply

«Analysis Pattern»
Domain Overlays

Supplier Usage (Proposal)

<<RAD>>
Product Ref Arch

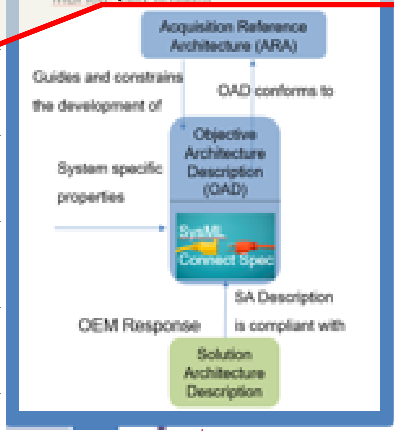
compliant with

1..*

«use»

«AD»
Solution Architecture Description

«interfaceBlock»
Connect Spec



Acquisition Reference Architecture (ARA)

Guides and constrains the development of

OAD conforms to

Objective Architecture Description (OAD)

System specific properties

SysML Connect Spec

SA Description is compliant with

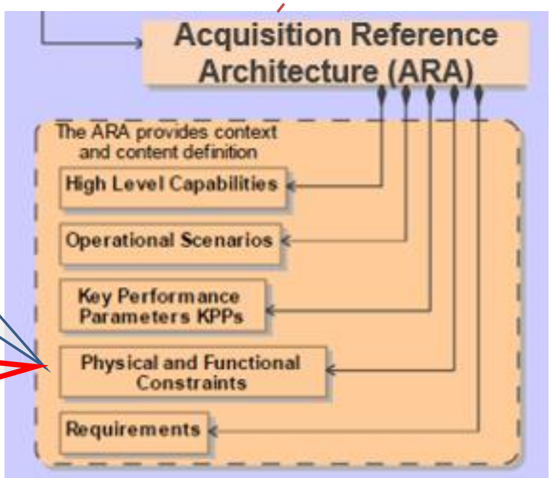
OEM Response

Solution Architecture Description

A Domain Overlay is a modular structured approach to address a domain concern and means for compliance

Sections of the ARA could reference other specialized RADs (i.e. air veh RAD)

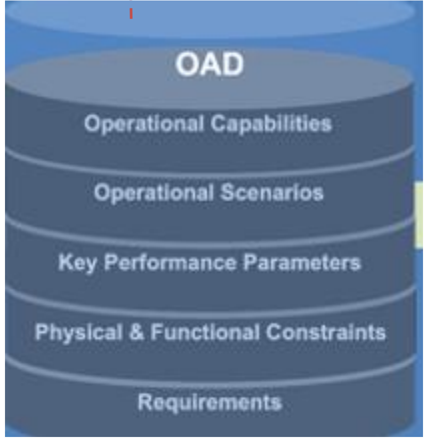
Example, AF AV RAD



Acquisition Reference Architecture (ARA)

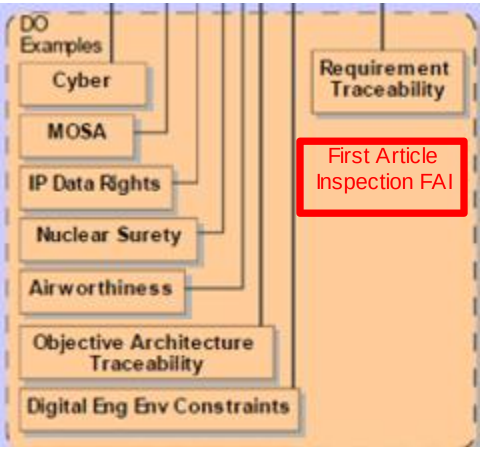
The ARA provides context and content definition

- High Level Capabilities
- Operational Scenarios
- Key Performance Parameters KPPs
- Physical and Functional Constraints
- Requirements



OAD

- Operational Capabilities
- Operational Scenarios
- Key Performance Parameters
- Physical & Functional Constraints
- Requirements



DO Examples

- Cyber
- MOSA
- IP Data Rights
- Nuclear Surety
- Airworthiness
- Objective Architecture Traceability
- Digital Eng Env Constraints
- Requirement Traceability
- First Article Inspection FAI

Domain Overlay Application – First Article Inspection (FAI)

CQSDI Presentation 3/13/2024

Core Contributors

This CQSDI Presentation

Casey DeCarlis
Department of Defense

Hannah Ensor
Lockheed Martin Space

John Fordyce
Raytheon Technologies

Fred McMaier
Lockheed Martin Aeronautics

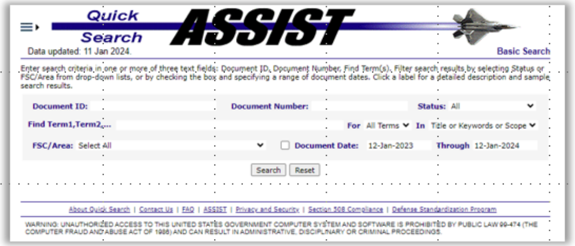
Joint Strategic Quality Council (JSQC) MBQ/MA Working Group Representation

- Department of Defense (DoD)
- Defense Contract Management Agency (DCMA)
- Elbit Systems of America
- Lockheed Martin
- Raytheon Technologies (RTX)
- National Aeronautics & Space Administration (NASA)
- Aerospace Industries Association (AIA)
- Pratt & Whitney
- Northrop Grumman
- University of Maryland

...and others

The Execution

- The JSQC's Model-Based Quality & Mission Assurance working group is drafting a Data Item Description (DID) document
- Goal of the DID is to require contractors to submit FAI data via a CDRL in the standardized DID-defined model format
- Plan is to get this DID on a pilot contract by FY'25



Quick Search
ASSIST

Data updated: 11 Jan 2024.

Basic Search

Enter search criteria in one or more of three text fields: Document ID, Document Number, Find Term(s). Filter search results by selecting Status or FSC/Area from drop-down lists, or by checking the box and specifying a range of document dates. Click a label for a detailed description and sample search results.

Document ID:
Document Number:
Status: All
Find Term1,Term2,...
For: All Terms
In: Title or Keywords or Scope
FSC/Area: Select All
☐ Document Date: 12-Jan-2023
Through: 12-Jan-2024

Search
Reset
About Quick Search | Contact Us | FAQ | ASSIST | Privacy and Security | Section 508 Compliance | Defense Standardization Program

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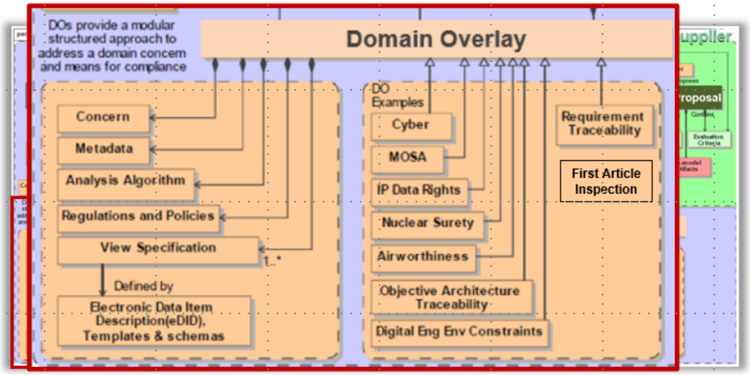
DLA DID Repository: https://quicksearch.dla.mil/qsSearch.aspx

The DID will be structured to allow for integration into the Object Management Group (OMG) Model-Based Acquisition (MBAcq.) efforts as a Domain Overlay



DOs provide a modular structured approach to address a domain concern and means for compliance
Domain Overlay
Concern
Metadata
Analysis Algorithm
Regulations and Policies
View Specification
1..*
Defined by
Electronic Data Item Description(eDID), Templates & schemas
DO Examples
Cyber
MOSA
IP Data Rights
Nuclear Surety
Airworthiness
Objective Architecture Traceability
Digital Eng Env Constraints
Requirement Traceability
First Article Inspection

Ongoing work from the Object Management Group (OMG) Model-Based Acquisition (MBAcq.) effort

Definitions

We make a distinction between a Reference Architecture Description and an Architecture Description that is being “referenced” such as the OAD.

- A reference architecture description (RAD) is a set of templates, models, or document sets that provides common concepts, vocabulary, reusable designs, best practices, and standards for a domain or a category of solutions[1][2][3][4][5]. It is used to organize and guide how to apply specific patterns and/or practices to solve particular classes of problems related to domain concepts[2][4]. It defines the fundamental components of the domain and the relations between them[4][5].

  Summarized from 5 sources and the web with modifications leh-10/2/2023

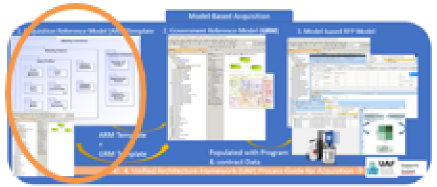
- Acquisition Reference Architecture (ARA:) (Description) Common guidance and constraints to start the development of a specific (OAD) Objective Architecture Description. Set of reusable model conventions, patterns, profiles, schemas, and templates used to govern model-based RFP activities, artifacts, and system lifecycle. Think of it as the rules for providing the system specific properties for defining an OAD.

- Objective Architecture Description (OAD): Descriptive model containing the requirements and constraints for the system to be acquired as tailored from the Acquisition Reference Architecture (ARA) and a chosen set of Domain Overlays. Tailored integrated set of model patterns a program provides in a request for proposal and on contract, in model form, that they want responded to in model form, as a solution architecture description, including digital traceability back to the OAD.

- Domain Overlay (DO): A pattern and collection of constructs needed to support analysis of a domain specific concern using a standardized approach.

Standards Development Organization.

Domain Overlays (DOs)



Domain Overlay (DO) Description: A collection of constructs needed to support analysis for a **domain specific concern** using a standardized modular approach. Typical construct elements include:

Previously called Aspect Viewpoint Overlays (AVO)

- A set of regulations, constraints, rules…. driving the analysis (i.e. MOSA, safety, certification, airworthiness, Space …)These could be provided as an instrumented lib
- A set of Data/Metadata required to address or support analysis, compliance or fit-for-purpose. Implementation example (Domain model/profile)
- Logic/algorithm needed to perform analysis using the metadata and regulations
- A set of Viewpoints to support various analysis (Certification plan, coverage, design trades, schedule and resources…)

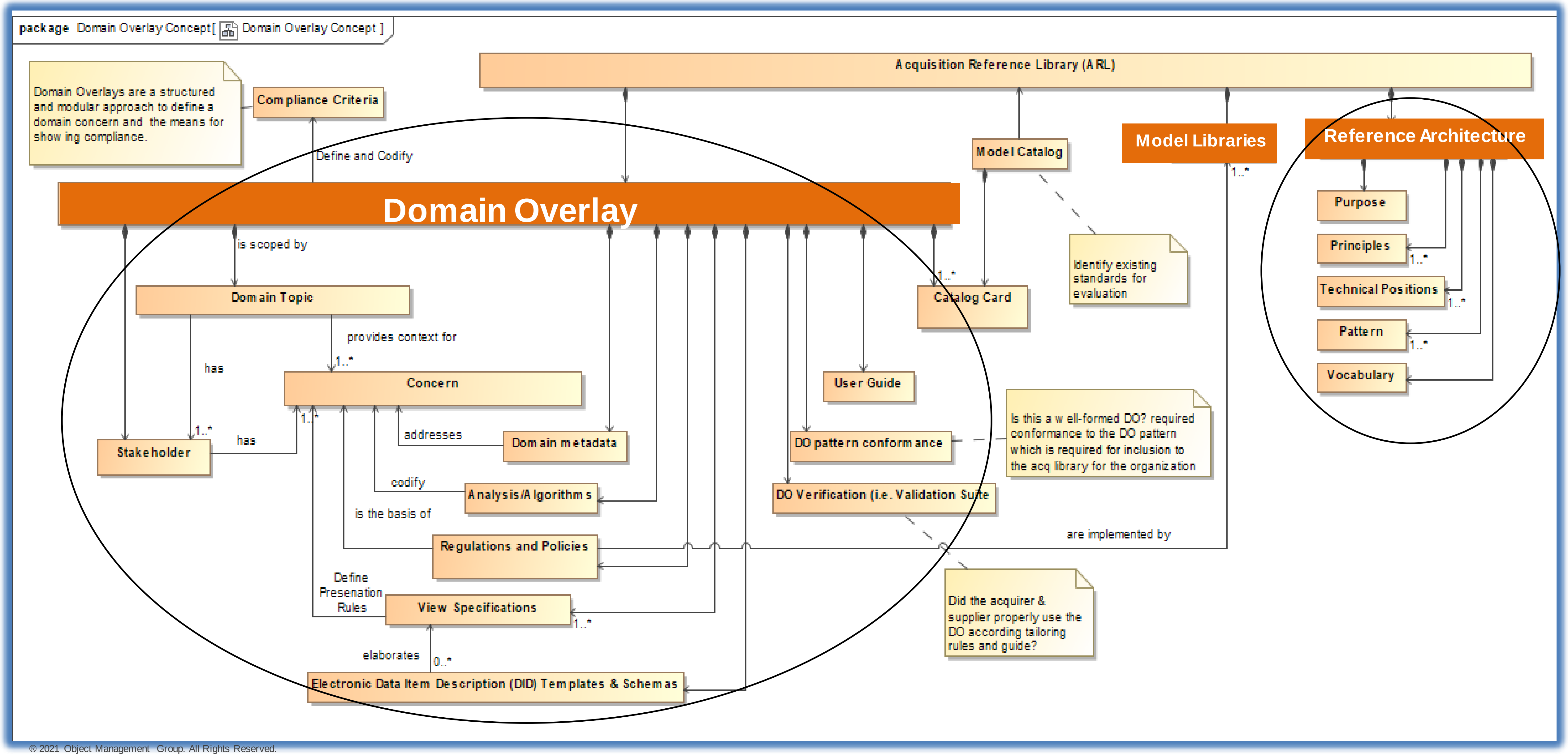
Characteristics

- Usually has associated regulations, governance that can be treated as pseudo requirements or constraints
- Cross-cutting both viewpoints/rows & aspects/columns
- Supports specific analysis associated with a Domain-Specific concern
- Can be created independent of a specific solution architecture description
- Can be applied or removed from a specific architecture description without impacting the AD, hence an overlay

Based on NDIA Actionable Architecture Using Aspect Modeling, L Hart 2018

Modular structured pattern to support standardization

Standardized Concepts for Reusable Content


package Domain Overlay Concept [Domain Overlay Concept]
Compliance Criteria
Acquisition Reference Library (ARL)
Define and Codify
Model Catalog
Model Libraries
Reference Architecture
Domain Overlay
1..*
Purpose
Principles
1..*
is scoped by
1..*
Catalog Card
Technical Positions
1..*
Domain Topic
Pattern
1..*
provides context for
1..*
has
Concern
User Guide
Vocabulary
1..*
1..*
has
addresses
Domain metadata
DO pattern conformance
Stakeholder
codify
Analysis/Algorithms
DO Verification (i.e. Validation Suite
is the basis of
are implemented by
Regulations and Policies
Define Presenation Rules
View Specifications
1..*
elaborates
0..*
Electronic Data Item Description (DID) Templates & Schemas

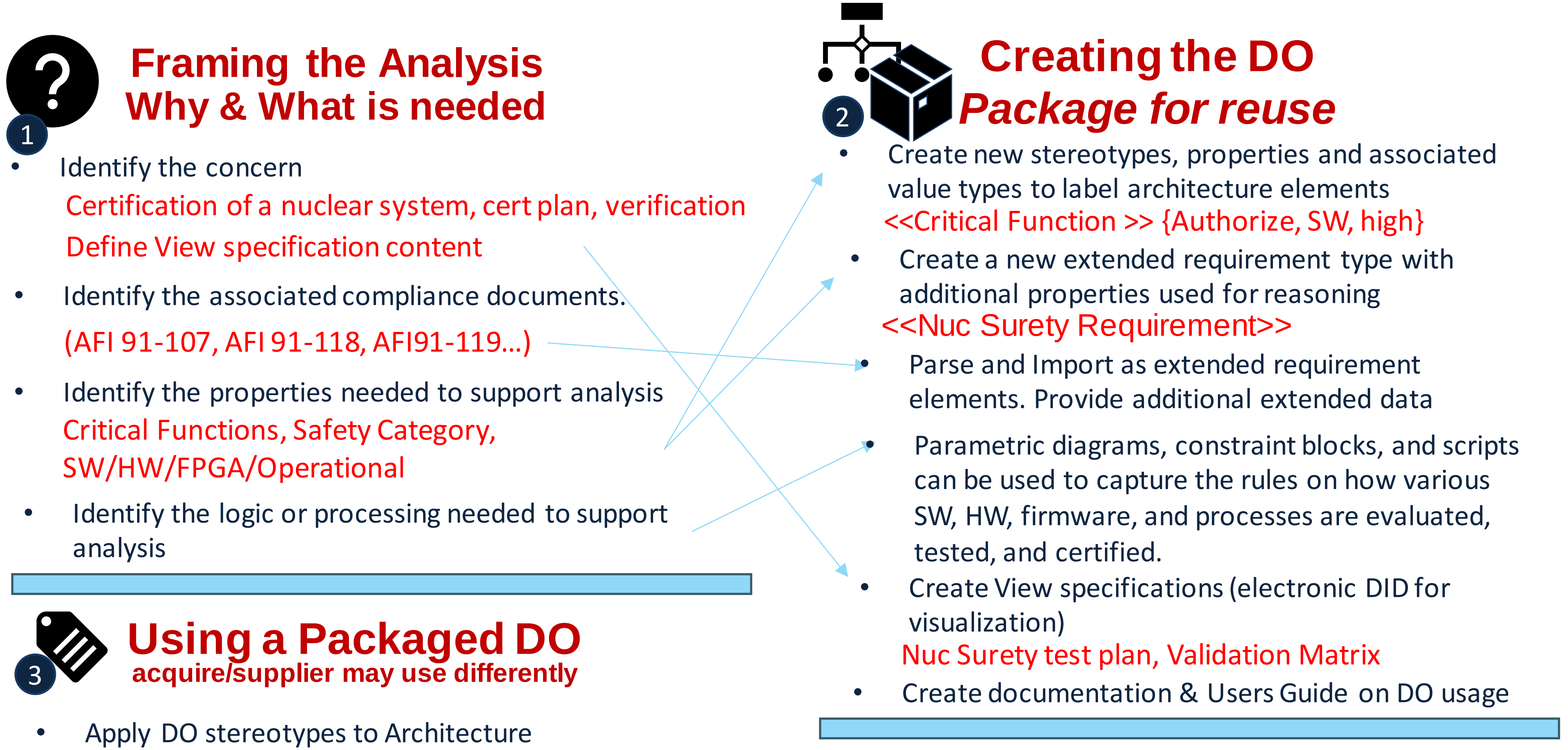
Domain Overlays are a structured and modular approach to define a domain concern and the means for showing compliance.

Identify existing standards for evaluation

Is this a well-formed DO? required conformance to the DO pattern which is required for inclusion to the acq library for the organization

Did the acquirer & supplier properly use the DO according tailoring rules and guide?

Domain Overlay (DO) Lifecycle - animated



1 Framing the Analysis
Why & What is needed

- Identify the concern
  Certification of a nuclear system, cert plan, verification
  Define View specification content
- Identify the associated compliance documents.
  (AFI 91-107, AFI 91-118, AFI91-119…)
- Identify the properties needed to support analysis
  Critical Functions, Safety Category, SW/HW/FPGA/Operational
- Identify the logic or processing needed to support analysis

2 Creating the DO
Package for reuse

- Create new stereotypes, properties and associated value types to label architecture elements
  <<Critical Function >> {Authorize, SW, high}
- Create a new extended requirement type with additional properties used for reasoning
  <<Nuc Surety Requirement>>
- Parse and Import as extended requirement elements. Provide additional extended data
- Parametric diagrams, constraint blocks, and scripts can be used to capture the rules on how various SW, HW, firmware, and processes are evaluated, tested, and certified.
- Create View specifications (electronic DID for visualization)
  Nuc Surety test plan, Validation Matrix
- Create documentation & Users Guide on DO usage

3 Using a Packaged DO
acquire/supplier may use differently

- Apply DO stereotypes to Architecture Model as directed
  <Critical Function>> Launch Console
- Provide additional attribute values
  Crtitical function = Launching
  Type=SW; Safety=3

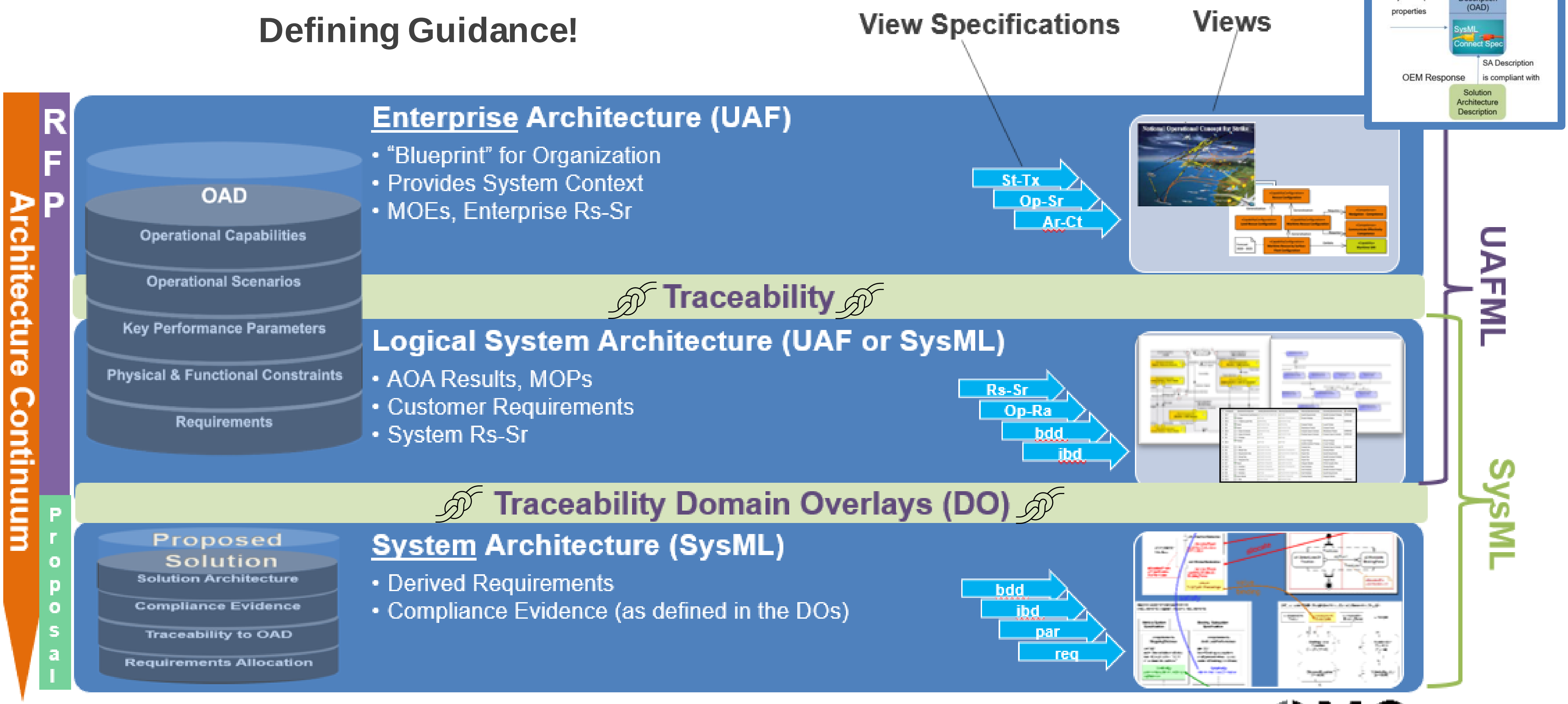
4 Evaluating the Results

Execute analysis, review populated views.
Follow guidance for success criteria.

*DO is a pattern for creating modular profiles

The Architecture Continuum

Defining Guidance!



View Specifications

Views

MBAcq: Gov creates

Acquisition Reference Architecture (ARA)

Guides and constrains the development of

OAD conforms to

Objective Architecture Description (OAD)

System specific properties

SysML Connect Spec

SA Description is compliant with

OEM Response

Solution Architecture Description

Architecture Continuum

RFP

Proposal

OAD

- Operational Capabilities
- Operational Scenarios
- Key Performance Parameters
- Physical & Functional Constraints
- Requirements

Enterprise Architecture (UAF)

- "Blueprint" for Organization
- Provides System Context
- MOEs, Enterprise Rs-Sr

St-Tx

Op-Sr

Ar-Ct

Traceability

Logical System Architecture (UAF or SysML)

- AOA Results, MOPs
- Customer Requirements
- System Rs-Sr

Rs-Sr

Op-Ra

bdd

ibd

Traceability Domain Overlays (DO)

Proposed Solution

- Solution Architecture
- Compliance Evidence
- Traceability to OAD
- Requirements Allocation

System Architecture (SysML)

- Derived Requirements
- Compliance Evidence (as defined in the DOs)

bdd

ibd

par

req

UAFML

SysML

MB Acquisition Summary

- MBSE can be inserted earlier in the acquisition lifecycle to facilitate agile response to change during the acquisition lifecycle and beyond.
- Government enterprises can respond to opportunities and risks grounded in well-formed models based on data driven decisions
- Formalize the development, integration, and use of models to inform enterprise and program decision making.
- Existing processes will need to be examined to determine where and how MBE/MBSE can be inserted, adopted and improved.
- Prototype processes to determine which work best, find issues, and socialize results.
- Stable mature patterns can be incorporated into existing standards/frameworks such as UAF, SysML
- New patterns can be considered as an independent standards

MBAcq is not just a Proposal Packaging Choice. It's about applying Effective SE practices!

Focus on Solutions Instead of Reinventing Modeling and Process!

Moving towards "Born Digital"

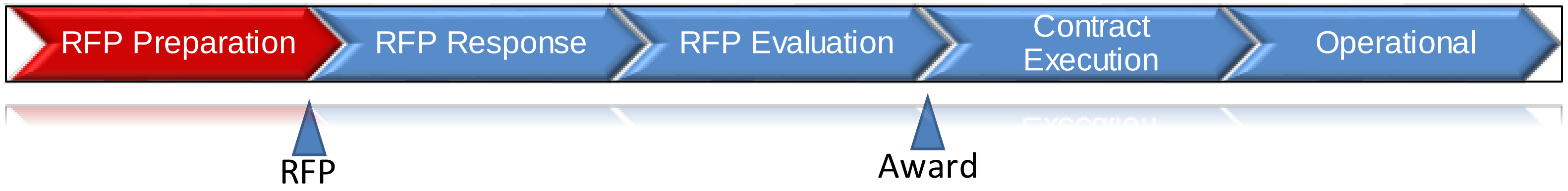
Standards
Development
Organization

Questions?

Standards
Development
Organization

Backup

MBACQ: RFP PREPARATION AND PLANNING

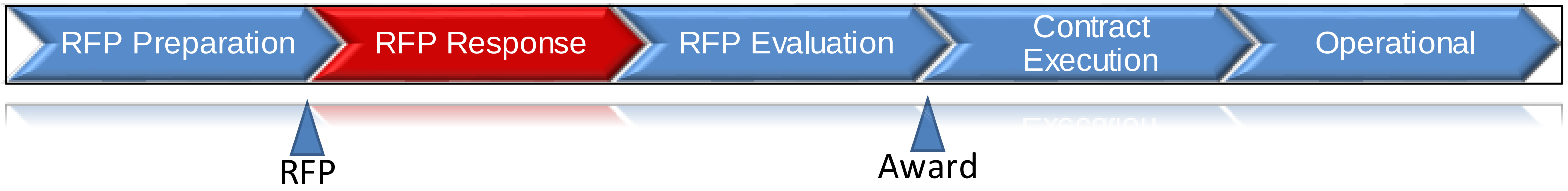


During RFP Preparation and Planning phase, the acquirer (**GOV**) can use **MBAcq** process to:

- Get a clear understanding of the system being acquired through the creation of the Objective Arch Description (OAD) addressing:
  - Operational context, capabilities, requirements, constraints…
- Determine what information will be needed for evaluation & validation of a supplier response such as:
  - MOSA, Certification properties, Data Rights, KPPs
- Determine and codify the supplier instructions expected for a model based response in the Arch Evaluation Criteria (AEC)
  - Use of gov furnished profiles (Domain Overlays), and supplier guidance
- Determine any implications to contract language (i.e. Tagging a component with certain data rights)
- Communicate the RFP content unambiguously to the supplier with a precise RFP Model (handoff or collaboratively)

Identify what is needed, know where to find it, how to use it and how to evaluate it!

MBACQ: RFP RESPONSE BY SUPPLIERS



RFP Preparation
RFP Response
RFP Evaluation
Contract Execution
Operational

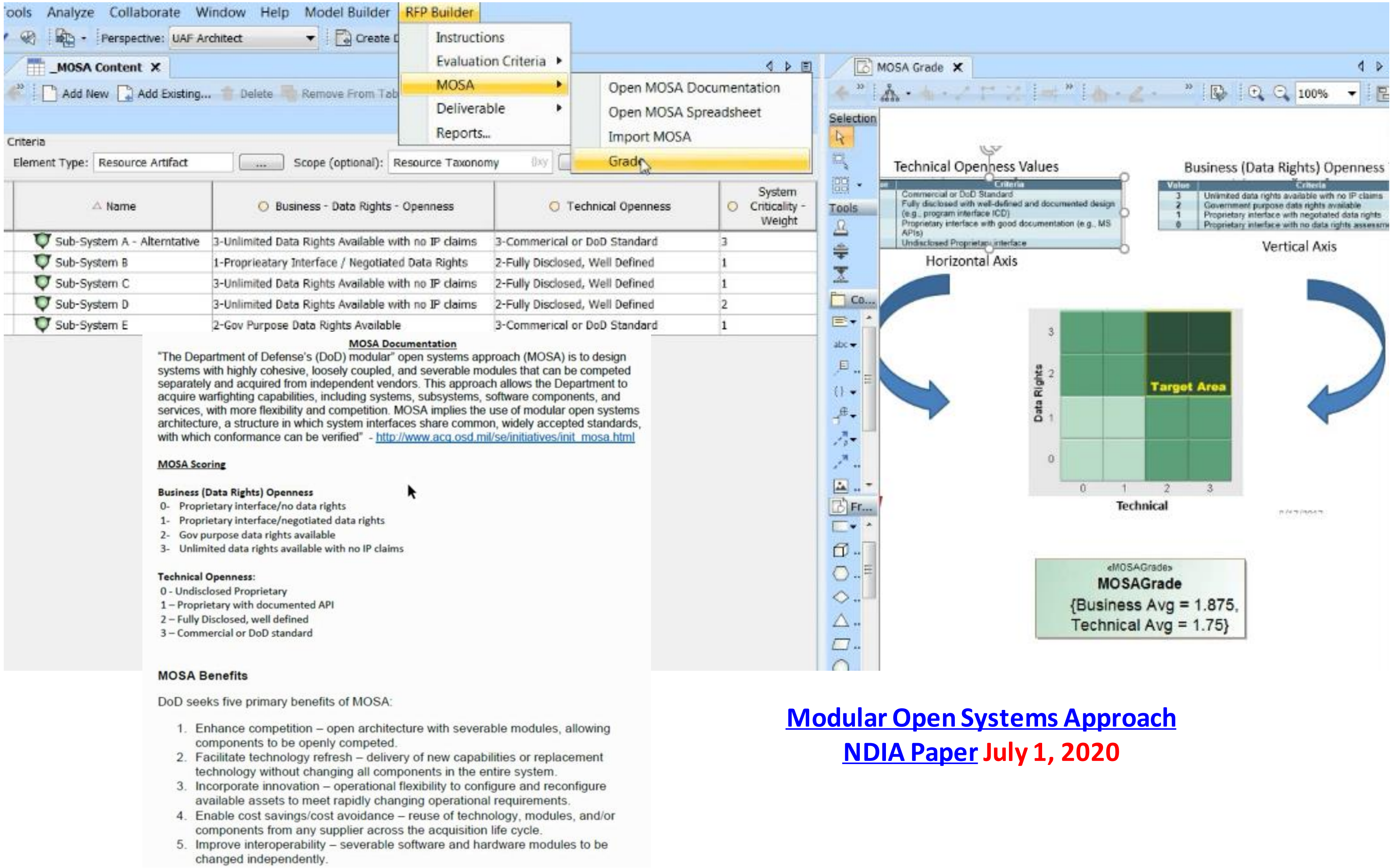
RFP
Award

During the RFP Supplier Response phase, the **supplier** will use the **MBAcq** process to:

- Get a clear understanding of the system being acquired within the operational environment context
- Respond to the RFP with supplier value added approach supporting analysis
- Get a clear understanding of expected modeling response using the provided Arch Evaluation Criteria (AEC)
- Utilize built-in self evaluation methods to support compliance

Focus is on Response and less on process mechanics

MODULAR OPEN SYSTEMS APPROACH (MOSA) EVALUATION


ools
Analyze
Collaborate
Window
Help
Model Builder
RFP Builder
Perspective: UAF Architect
Create
Instructions
Evaluation Criteria
MOSA
Deliverable
Reports...
Open MOSA Documentation
Open MOSA Spreadsheet
Import MOSA
Grade
_MOSA Content
Add New
Add Existing...
Delete
Remove From Tab
MOSA Grade
100%
Selection
Tools
Co...
Fr...

Criteria

Element Type: Resource Artifact

Scope (optional): Resource Taxonomy

Name	Business - Data Rights - Openness	Technical Openness	System Criticality - Weight
Sub-System A - Alterntative	3-Unlimited Data Rights Available with no IP claims	3-Commerical or DoD Standard	3
Sub-System B	1-Proprieatary Interface / Negotiated Data Rights	2-Fully Disclosed, Well Defined	1
Sub-System C	3-Unlimited Data Rights Available with no IP claims	2-Fully Disclosed, Well Defined	1
Sub-System D	3-Unlimited Data Rights Available with no IP claims	2-Fully Disclosed, Well Defined	2
Sub-System E	2-Gov Purpose Data Rights Available	3-Commerical or DoD Standard	1

MOSA Documentation

"The Department of Defense's (DoD) modular" open systems approach (MOSA) is to design systems with highly cohesive, loosely coupled, and severable modules that can be competed separately and acquired from independent vendors. This approach allows the Department to acquire warfighting capabilities, including systems, subsystems, software components, and services, with more flexibility and competition. MOSA implies the use of modular open systems architecture, a structure in which system interfaces share common, widely accepted standards, with which conformance can be verified" - http://www.acq.osd.mil/se/initiatives/init_mosa.html

MOSA Scoring

Business (Data Rights) Openness

0- Proprietary interface/no data rights
1- Proprietary interface/negotiated data rights
2- Gov purpose data rights available
3- Unlimited data rights available with no IP claims

Technical Openness:

0 - Undisclosed Proprietary
1 – Proprietary with documented API
2 – Fully Disclosed, well defined
3 – Commercial or DoD standard

MOSA Benefits

DoD seeks five primary benefits of MOSA:

1. Enhance competition – open architecture with severable modules, allowing components to be openly competed.
2. Facilitate technology refresh – delivery of new capabilities or replacement technology without changing all components in the entire system.
3. Incorporate innovation – operational flexibility to configure and reconfigure available assets to meet rapidly changing operational requirements.
4. Enable cost savings/cost avoidance – reuse of technology, modules, and/or components from any supplier across the acquisition life cycle.
5. Improve interoperability – severable software and hardware modules to be changed independently.

Technical Openness Values

Criteria
Commercial or DoD Standard
Fully disclosed with well-defined and documented design (e.g., program interface ICD)
Proprietary interface with good documentation (e.g., MS APIs)
Undisclosed Proprietary interface

Horizontal Axis

Business (Data Rights) Openness

Value	Criteria
3	Unlimited data rights available with no IP claims
2	Government purpose data rights available
1	Proprietary interface with negotiated data rights
0	Proprietary interface with no data rights assessme

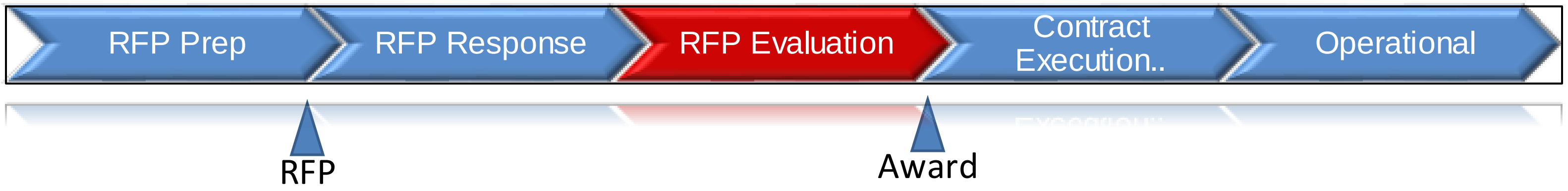
Vertical Axis

Data Rights
3
2
1
0
Target Area
0
1
2
3
Technical

«MOSAGrade»
MOSAGrade
{Business Avg = 1.875,
Technical Avg = 1.75}

[Modular Open Systems Approach](#)
[NDIA Paper](#) July 1, 2020

MBACQ: EVALUATION (SUPPLIER/GOV)


RFP Prep
RFP Response
RFP Evaluation
Contract Execution..
Operational
RFP
Award

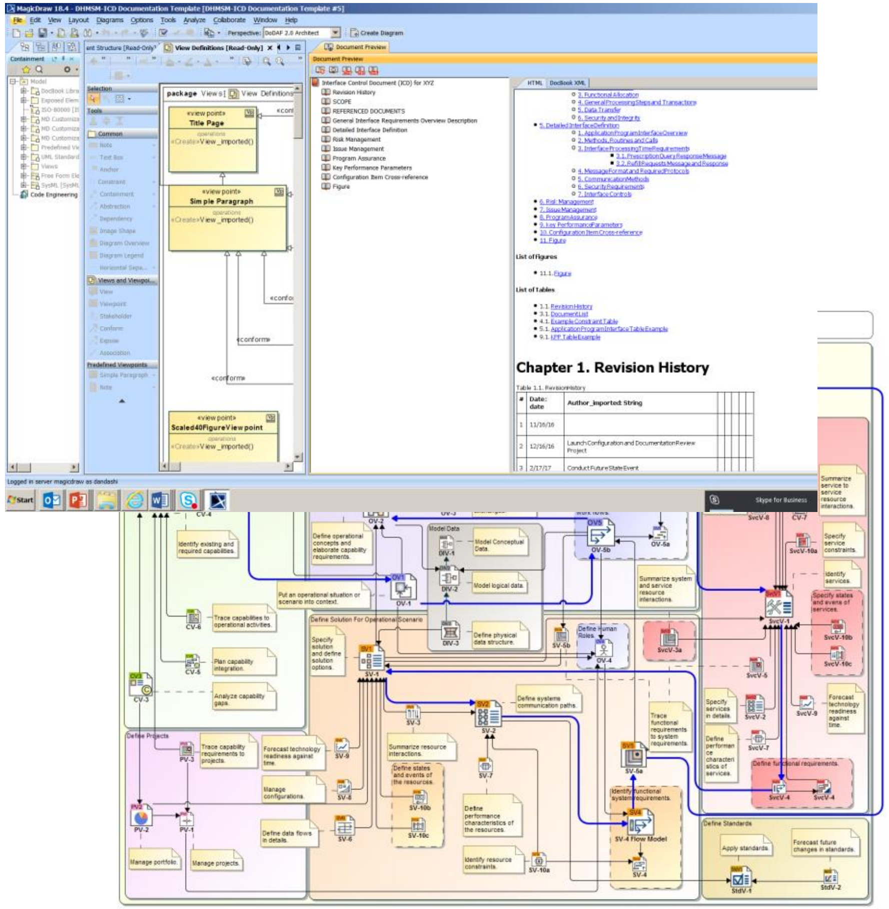
During RFP Evaluation phase, the **Supplier** & **GOV** can use **MBAcq** process to:

- Assist the evaluation process for compliance and scoring using built in evaluation criteria
- Assist in the assessment of key concerns such as MOSA, Security, survivability though the use of Domain Overlays(DOs) provided in the Arch Evaluation Criteria (AEC)
- Capture scoring and rational with standard metrics for future evidence

Grading Rubrics and Scoring are captured in the Model

DOCUMENT GENERATION FROM MODEL

Define Reusable document templates (CDD, AoA Plan…)


MagicDraw 18.4 - DHMSM-ICD Documentation Template [DHMSM-ICD Documentation Template #5]

Document Preview

Interface Control Document (ICD) for XYZ
- Revision History
- SCOPE
- REFERENCED DOCUMENTS
- General Interface Requirements Overview Description
- Detailed Interface Definition
- Risk Management
- Issue Management
- Program Assurance
- Key Performance Parameters
- Configuration Item Cross-reference
- Figure

- 3. Functional Allocation
- 4. General Processing Steps and Transactions
- 5. Data Transfer
- 6. Security and Integrity
- 5. Detailed Interface Definition
  - 1. Application Program Interface Overview
  - 2. Methods, Routines and Calls
  - 3. Interface Processing Time Requirements
    - 3.1. Prescription Query Response Message
    - 3.2. Refill Requests Message and Response
  - 4. Message Format and Required Protocols
  - 5. Communication Methods
  - 6. Security Requirements
  - 7. Interface Controls
- 6. Risk Management
- 7. Issue Management
- 8. Program Assurance
- 9. Key Performance Parameters
- 10. Configuration Item Cross-reference
- 11. Figure

List of Figures

- 11.1. Figure

List of Tables

- 1.1. Revision History
- 3.1. Document List
- 4.1. Example Constraint Table
- 5.1. Application Program Interface Table Example
- 9.1. KPP Table Example

Chapter 1. Revision History

Table 1.1. RevisionHistory

#	Date: date	Author_imported: String
1	11/16/16	
2	12/16/16	Launch Configuration and Documentation Review Project
3	2/17/17	Conduct Future State Event

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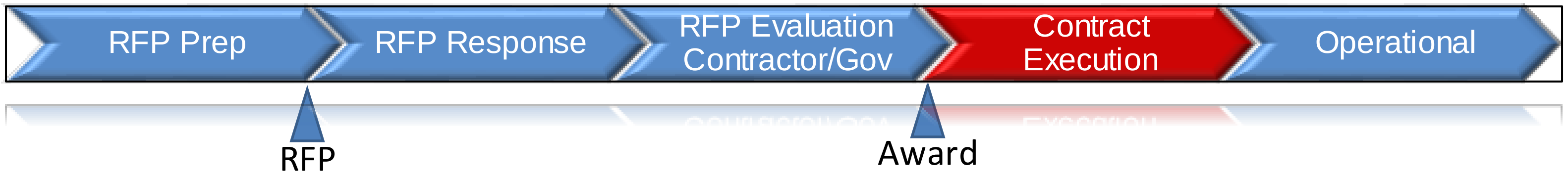
Generate Required Documents

and Reports

W
TEXT
Document

(Source: Laura Hart, MITRE 2017)

MBACQ: CONTRACT EXECUTION

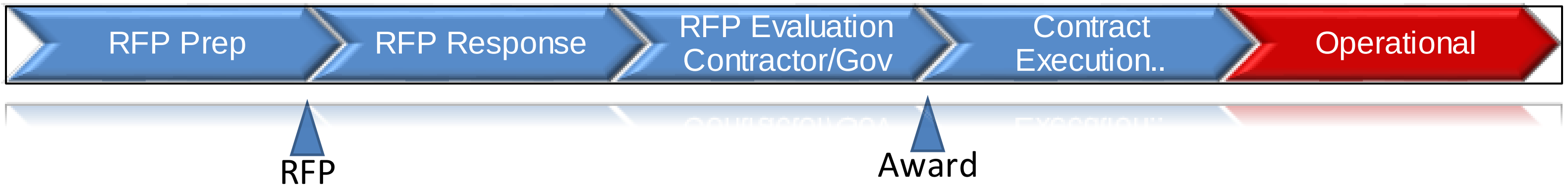

RFP Prep
RFP Response
RFP Evaluation Contractor/Gov
Contract Execution
Operational
RFP
Award

During the RFP Contract Execution phase, the **GOV** will use the **MBAcq** process and evolving model(s) to:

- Collaboration with suppliers
- Monitor progress, maturity
- Assess change impact and manage risks

The evolving model is a source of collaboration

MBACQ: OPERATIONAL SYSTEM


RFP Prep
RFP Response
RFP Evaluation Contractor/Gov
Contract Execution..
Operational
RFP
Award

During the Operational phase, the **GOV** and **supplier** will use the matured evolving set of models to:

- Support knowledge management and training
- Assess change impact and manage risks
- Provide the foundation for a digital twin

Living Knowledge Repository Supporting Data-driven decisions