

Object Management Group

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Military Architecture Framework Standardization Request for Information (RFI)

Draft

Responses Due: May 30, 2005

OMG Document # **ad**/[2004-12-01](#)

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Introduction

This Request for Information (RFI) solicits information on the nature and utility of an architecture framework that prescribes a standard for architecture modeling of large scale military systems based on UML, SysML and related profiles. The military architecture framework (MAF) will specify modeling conventions and conformance points similar to the United States' Department of Defense Architecture Framework (DoDAF) and other military domain architecture frameworks.

Target Audience

This information is being requested of practitioners from industry, academia, and government/agencies, involved in the application of a MAF in the systems engineering process. Practitioners sought include:

- ?? individuals and organizations that use MAFs to model systems and their architectures
- ?? tool vendors who might implement a MAF in their tools
- ?? methodologists and researchers involved with systems modeling and architecture frameworks

OMG encourages producers and users of architecture model development methodologies, tools, and metamodels to become involved with this process by responding to this RFI. OMG members and non-members may respond. The RFI response can be pre-existing documentation, but should be organized and presented in accordance with this RFI. The information being requested and the instructions for providing the inputs are included in the next two sections. Please contact the chair at the email below if you have any questions or comments. Additional information on the SE DISG is available at <http://syseng.omg.org>

Sanford Friedenthal, syseng-chair@omg.org

Context and Scope of the RFI

OMG's central mission is to enable distributed, integrated applications. Primary goals are the reusability, portability and interoperability of software components in distributed heterogeneous computing environments. Much of OMG's effort to date has been focused on establishing an enabling infrastructure based on open and standard interface definitions. This RFI seeks information to develop a standard for an architecture framework for the military domain that leverages UML 2.0/SysML. This standardization activity supports the broader goal for standards based architecture frameworks in the context of MDA. The standard is intended to support systems engineering processes; enable reusability of the work products created during the development of military domain architecture models, and to enable interoperability among the tools employed during that development. Conformant architecture models may describe systems of several types (software and information-intensive systems, hardware-intensive systems, hybrid systems, weapons systems, C4ISR systems, logistics systems), systems that may include various elements (hardware, software, data, personnel, procedures, and facilities), and the system-of-systems that are formed through combining system types and elements.

Objectives of the RFI

The goal of this RFI is to gather information in support of RFP development. The RFP goal is to specify a standard representation¹ for architecture models for the military domain, using UML2.0, SysML and other profiles, such as QoS. For example, a military system may be represented in SysML as an assembly, i.e., it takes on the semantics of that SysML element. The Systems Engineering (SE) DSIG will use responses to this RFI to define one or more RFPs that specify requirements for a MAF standard for the military domain, and to satisfy these requirements through the OMG technology adoption process.

¹ A standard representation for syntax and semantics should include:

- a domain metamodel e.g., define operational node, needline and relationship between the two

Benefits of a standards-based military domain architecture framework include:

- ?? Improved communications between system acquirers, developers, users, and other stakeholders
- ?? Tool interoperability
- ?? Potential for reuse of architecture artifacts and architecture patterns

Dependencies and Relationships with Other OMG Specifications

In addition to UML 2.0/SysML, the RFI responses may optionally include a discussion of the relationship of their application development lifecycle and metamodel responses to the following:

- ?? Core Architecture Data Model (CADM)
- ?? DoD Architecture Repository System (DARS)
- ?? Model Driven Architecture (MDA)
- ?? XML Meta data Interchange (XMI)

Information Being Requested

This RFI is seeking the information described below. Respondents are asked to address areas in which they have expertise and/or interest. A responder can respond to all or part of the questions. Respondents may also consider areas not explicitly asked for if they feel the information provides useful guidance to support the RFI objectives.

The information requested in this section is intended to describe your experiences in applying military architecture and similar frameworks. Such sources of experience may include:

- ?? projects by end users (from industry or government)
- ?? explorations by academic or other research groups looking at using a military domain architecture framework
- ?? activities by vendors to build tools that would support such usage
- ?? Initiatives by industry associations and standards groups that have already been formed or are being planned

For each such activity or group, we have the following specific questions (answers may apply to either past or ongoing activities):

1. Characterize the type of organization that this response represents. i.e., Which of the following do you represent
 - a. an end user,
 - b. academic or researcher,
 - c. tool vendor,
 - d. other
2. What are you modeling?
 - a. What is the domain of the model (e.g. C4ISR, weapon system, logistics, space system, real time system, administrative/business system, etc.)
 - b. What is the purpose of the model (e.g. capability analysis, C4I Support Plan)

- clear definitions for each entity in the domain metamodel,
- a mapping of each entity (elements and relationships) to UML/SysML syntax and semantics and any required extensions

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- c. Who are the stakeholders² of the model
 - d. What is the scope of your model
 - e. What level of the enterprise is being modeled (e.g., a mission, program, system of systems, a software component)
 - f. What part of the life cycle does the architecture framework address (e.g., operations, testing, production, deployment, sustainment, retirement...)
 - g. What level of detail is applied (concept, detailed design, etc)
 - h. How far in the modeling effort are you
3. How are architecture models and associated products being represented?
 - a. Which of the products listed in the table below do you use
 - b. How do you represent them
 - i. list all products in a table and specify the format used (e.g., UML, IDEF0, spreadsheets, text, schematic) for each
 - ii. if you use UML, identify the version of UML used and whether any extensions are used
 - iii. please provide examples of your products, especially if you are using UML, and include the reference to the figures
 - c. How are these products related to requirements and other system development artifacts
 4. How are architecture models being developed?
 - a. What disciplines are involved in developing architecture framework products and an architecture model (user domain experts, systems engineers, software engineers, hardware engineers, reliability, safety, etc.)
 - b. What type/amount of training have the developers received in architecture frameworks, modeling methodologies, modeling languages, or modeling tools used
 - c. How much experience does this response reflect in applying architecture frameworks to systems engineering (total man-months, multiple large projects, small pilot project, etc.)
 - d. What aspects of systems engineering are addressed (e.g., system requirements, architecture, software requirements, hardware requirements, simulation and analysis, design and implementation, verification, etc.)
 - i. What tools do you use to support the architecture modeling effort
 - ii. To what extent are the tools you use interoperable - Are you able to effectively exchange models/information among tools
 - e. Do you have a shared repository for your architecture models and products
 - i. What is the nature of the repository (a relational DB, OODB, flat files)
 - ii. Is the repository proprietary or standards-based (e.g., CADM, MOF, XML)
 - f. Can products be automatically generated from the architecture repository
 5. What are the benefits from the architecture modeling effort for each of the stakeholders?
 - a. What are the anticipated benefits
 - b. What are the observed benefits and added value
 - i. Improve communications among stakeholders
 - ii. Improved quality
 - iii. Improved efficiencies
 - iv. Earlier identification of issues and risks
 - v. System interoperability
 - vi. Other
 - c. How does an architecture framework affect the overall success of the project
 6. Discuss the limitations and issues perceived by each of the stakeholders, e.g.,:
 - a. Modeling capabilities to support scope of systems engineering life cycle
 - b. Limitations of syntax, semantics, usability, understanding, or representation
 - c. Stakeholder participation
 - d. The usefulness of the model to the developers (e.g., systems, hardware and software, testers)

² Stakeholders are identified as acquisition staff, providers (Program Managers, Systems Engineers), tool vendors, users of systems (warfighters), system developers and integrators, and other typical users of architecture information such as those identified in IEEE 1471-2000.

- e. Tool interoperability
 - f. What other issues or limitations did you encounter relative to questions 2-4 above
 - g. Other issues or limitations
7. What are the potential solutions for addressing the limitations/issues? Please provide references as appropriate.
 8. What are related standards, initiatives that should be considered as part of the near and long term MAF standardization effort?
 9. What is your level of interest in support of MAF standardization?
 - a. Would you like to participate in the SE DISG effort to develop requirements for MAF standardization RFP, if so, please provide contact information
 - b. Would you respond to an RFP to implement the requirements for MAF standardization
 - c. Would you be likely to use the results from the MAF standardization effort in your future architecture modeling activity

Table 1. Table Summary of DODAF Views and Products

Applicable View	Framework Product	Framework Product Name	General Description	Suggested UML Representation In DODAF V 1.0	Notation/Format Used To Develop Product	Comment On Format Used	Reference To Examples
All Views	AV-1	Overview and Summary Information	Scope, purpose, intended users, environment depicted, analytical findings	Produced from diagram and element annotations			
All Views	AV-2	Integrated Dictionary	Architecture data repository with definitions of all terms used in all products	Produced from diagram and element annotations			
Operational	OV-1	High-Level Operational Concept Graphic	High-level graphical/textual description of operational concept	N/A or Use Case Diagrams			
Operational	OV-2	Operational Node Connectivity Description	Operational nodes, connectivity, and information exchange needlines between nodes	Collaboration Diagrams			
Operational	OV-3	Operational Information Exchange Matrix	Information exchanged between nodes and the relevant attributes of that exchange	N/A. Produced from OV-2 diagram and element annotations			
Operational	OV-4	Organizational Relationships Chart	Organizational, role, or other relationships among organizations	Class diagrams			

Applicable View	Framework Product	Framework Product Name	General Description	Suggested UML Representation In DODAF V 1.0	Notation/Format Used To Develop Product	Comment On Format Used	Reference To Examples
Operational	OV-5	Operational Activity Model	Capabilities, operational activities, relationships among activities, inputs, and outputs; overlays can show cost, performing nodes, or other pertinent information	Use case diagrams + activity diagrams			
Operational	OV-6a	Operational Rules Model	One of three products used to describe operational activity—identifies business rules that constrain operation	N/A. Produced from OV-5, OV-6b, OV-6c diagram and element annotations			
Operational	OV-6b	Operational State Transition Description	One of three products used to describe operational activity—identifies business process responses to events	StateChart Diagrams			
Operational	OV-6c	Operational Event-Trace Description	One of three products used to describe operational activity—traces actions in a scenario or sequence of events	Sequence Diagrams and Activity Diagrams.			
Operational	OV-7	Logical Data Model	Documentation of the system data requirements and structural business process rules of the Operational View	Class Diagrams			
Systems	SV-1	Systems Interface Description	Identification of systems nodes, systems, and system items and their interconnections, within and between nodes	Deployment + Component Diagrams			
Systems	SV-2	Systems Communications Description	Systems nodes, systems, and system items, and	N/A or deployment diagrams			

Applicable View	Framework Product	Framework Product Name	General Description	Suggested UML Representation In DODAF V 1.0	Notation/Format Used To Develop Product	Comment On Format Used	Reference To Examples
			their related communications lay-downs				
Systems	SV-3	Systems - Systems Matrix	Relationships among systems in a given architecture; can be designed to show relationships of interest, e.g., system-type interfaces, planned vs. existing interfaces, etc.	N/A			
Systems	SV-4	Systems Functionality Description	Functions performed by systems and the system data flows among system functions	Use Case and Class Diagrams within packages			
Systems	SV-5	Operational Activity to Systems Function Traceability Matrix	Mapping of systems back to capabilities or of system functions back to operational activities	N/A. Produced from OV-5 and SV-4 diagram and element annotations.			
Systems	SV-6	Systems Data Exchange Matrix	Provides details of system data elements being exchanged between systems and the attributes of that exchange	N/A. Produced from SV-1 and SV-4 diagram and element annotations.			
Systems	SV-7	Systems Performance Parameters Matrix	Performance characteristics of Systems View elements for the appropriate time frame(s)	N/A			
Systems	SV-8	Systems Evolution Description	Planned incremental steps toward migrating a suite of systems to a more efficient suite, or toward evolving a current system to a future implementation	N/A. Produced from diagram and element annotations			
Systems	SV-9	Systems Technology	Emerging technologies and	N/A			

Applicable View	Framework Product	Framework Product Name	General Description	Suggested UML Representation In DODAF V 1.0	Notation/Format Used To Develop Product	Comment On Format Used	Reference To Examples
		Forecast	software/hardware products that are expected to be available in a given set of time frames and that will affect future development of the architecture				
Systems	SV-10a	Systems Rules Model	One of three products used to describe system functionality— identifies constraints that are imposed on systems functionality due to some aspect of systems design or implementation	N/A. Produced from SV-4 diagram and element annotations and constraints			
Systems	SV-10b	Systems State Transition Description	One of three products used to describe system functionality— identifies responses of a system to events	StateChart Diagrams			
Systems	SV-10c	Systems Event-Trace Description	One of three products used to describe system functionality— identifies system-specific refinements of critical sequences of events described in the Operational View	Sequence Diagrams			
Systems	SV-11	Physical Schema	Physical implementation of the Logical Data Model entities, e.g., message formats, file structures, physical schema	Class Diagrams			
Technical	TV-1	Technical Standards Profile	Listing of standards that apply to Systems View elements in a given architecture	N/A			
Technical	TV-2	Technical	Description of	N/A			

Applicable View	Framework Product	Framework Product Name	General Description	Suggested UML Representation In DODAF V 1.0	Notation/Format Used To Develop Product	Comment On Format Used	Reference To Examples
		Standards Forecast	emerging standards and potential impact on current Systems View elements, within a set of time frames				

Instructions for Responding to this RFI

Companies responding to this RFI shall designate a single contact within that company for receipt of all subsequent information regarding this RFI, RFI responses and the forthcoming series of Request for Proposals (RFP's) The name of this contact will be made available to all OMG members.

Responses to this RFI must be received at OMG no later than 5:00 PM US Eastern Time (22:00 UTC) May 30, 2005. (See below for more details on receipt dates and addresses). However, earlier responses are encouraged. Respondents are strongly encouraged to notify the Systems Engineering (SE) DSIG chair of their intent to submit a response in a brief e-mail sent to syseng-chair@omg.org. Documentation submitted in response to this RFI will be available to all OMG members and should not include classified or proprietary information

Format of RFI Responses

The following outline is offered to assist in the development of your response. You should include:

- ?? A cover letter -- the cover letter should include a brief summary of your response such as indicating which areas you are responding to and indicate if supporting documentation is included in your response.
- ?? Your response to any or all of the areas of information requested by this RFI.
- ?? If required, a glossary that maps terminology used in your response to OMG standard terminology. (See OMG modeling specifications [UML, MOF, XMI] and a description of OMG's Model Driven Architecture [MDA] for OMG's standard terminology.)

Although the OMG does not limit the size of responses, you are asked to consider that the OMG will rely upon volunteer resources with limited time availability to review these responses. In order to assure that your response receives the attention it deserves, you are asked to consider limiting the size of your response (not counting any supporting documentation) to approximately 25 pages. If you consider supporting documentation to be necessary, please indicate which portions of the supporting documentation are relevant to this RFI.

NOTE: According to the Policies and Procedures of the OMG Technical Committee, proprietary and confidential material may not be included in any response to the OMG. Responses become public documents of the OMG. If copyrighted, a statement waiving that copyright for use by the OMG is required and a limited waiver of copyright that allows OMG members to make up to at least twenty-five copies for review purposes is required.

How to Submit

One electronic copy in machine-readable format (typically ASCII, MS Word, or WordPerfect format) should be sent to omg-documents@omg.org. One confirming paper copy of all documents should be sent to the OMG postal address below. Other communication regarding this RFI should also be sent to the email address below.

OMG:

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Email responses to this RFI must be received at OMG no later than 5:00 PM US Eastern Time (22:00 GMT) May 30, 2005 and the confirming paper copy must arrive at OMG shortly thereafter. The outside of packages/envelopes containing responses or any other communication regarding this RFI should be clearly marked " MAF Standardization RFI RESPONSE".

NOTE: Your organization should be prepared to handle requests for additional copies of your response and supporting documentation.

Reimbursements

The OMG will not reimburse submitters for any costs in conjunction with their responses to this RFI.

Response Review Process and Schedule

Process

RFIs such as this one are issued with the intent to survey industry to obtain information that provides guidance, which will be used in the preparation of RFPs. The OMG membership, specifically the SE DISG, will review responses to this RFI. Based on those responses, SE DISG will augment its roadmap and prepare one or more RFPs.

Clarification of Responses

To fully comprehend the information contained within a response to this RFI, the reviewing group may seek further clarification on that response. This clarification may be requested in the form of brief verbal communication by telephone; written communication; electronic communication; or a presentation of the response to a meeting of SE DISG. Therefore, SE DISG requests that submitters attend the SE DISG meeting at which their response will be considered prepared to present and clarify their responses.

Schedule

The schedule for responding to this RFI is as follows. Please note that early responses are encouraged.

Draft RFI published on OMG Web site	January 10, 2005
RFI issued	February 4, 2005
RFI responses due (For consideration at the June 20, 2005 SE DISG meeting)	May 30, 2005

The tentative schedule for the RFI evaluation process is:

Review of RFI responses	June 20-24, 2005
Draft RFP published on OMG Web site	August 22, 2005
RFP issued	September 12, 2005

NOTE: This schedule is subject to change based on the number of RFI responses received and the information acquired from the responses.

References

Object Management Group Documents

[MDA] Model Driven Architecture (MDA), <http://www.omg.org/mda/specs.htm>

[MOF] Meta-Object Facility (MOF), <http://www.omg.org/technology/documents/formal/meta.htm>

[OMA] Object Management Architecture (OMA) Guide,
http://www.omg.org/technology/documents/formal/object_management_architecture.htm

[OMG Formal] OMG Formal Documentation, <http://www.omg.org/technology/documents/formal/index.htm>

[UML] Unified Modeling Language (UML),
http://www.omg.org/technology/documents/formal/unified_modeling_language.htm

[UML for SE] Object Management Group, Systems Modeling Language Draft Specification V0.85, OMG Document ad/2004-10-02, October, 2004 or latest revision
UPDATE TO V0.9 dated January 10, 2005.

[XMI] XML Metadata Interchange (XMI),
http://www.omg.org/technology/documents/formal/xml_metadata_interchange.htm

Other Related Documents

DoD Core Architecture Data Model (CADM), Office of the Assistant Secretary of Defense (NII), November, 2004

Bailey, I., Dandashi, F., Ang, H., Hardy, D. "Using Systems Engineering Standards in an Architecture Framework," INCOSE Insight Magazine, Vol. 7, Issue 2, July 2004

Department of Defense Architecture Framework (DODAF), Published by Office of the Assistant Secretary of Defense (NII), February, 2004
<http://www.defenselink.mil/nii/doc/>

Friedenthal, S., Kobryn, C. "Extending UML to Support a Systems Modeling Language," Proceedings of the INCOSE 2004 International Symposium, June, 2004

IEEE 1471-2000, IEEE Recommended Practice for Architectural Description of Software-Intensive Systems

Web Sites

DODAF: <http://www.defenselink.mil/nii/doc/>

CADM

http://www.ndia.org/Content/ContentGroups/Divisions1/Systems_Engineering/PDFs18/Modeling_Committee_PDFs/OASD_NII_Briefing_DoD_Architecture_Support.pdf

International Council on Systems Engineering (INCOSE): <http://www.incose.org>

Object Management Group: <http://www.omg.org/>.

OMG's Model Driven Architecture: <http://www.omg.org/mda/>.

Systems Engineering DSIG: <http://syseng.omg.org/>

ACROYNMS

AF	Architecture Framework
C4ISP	Command, Control, Communications, Computers, and Intelligence Support Plan
C4ISR Reconnaissance	Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance
CADM	Core Architecture Data Model
DARS	DoD Architecture Repository System
DoD	Department of Defense
DoDAF	DoD Architecture Framework
IDEF0	Integrated Definition for Activity Modeling