# There's more than one way to skin a framework

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## ABSTRACT

Today's architecture modeling environment suffers from being an effort to satisfy milestone decisions. Typically, the architecture effort is separated from the Systems Engineering (SE) leading to a lack of traceability from the systems requirements to the architecture resulting in interoperable systems. Due to the way that the Architecture models are created they generally consist of static diagrams and provide limited analytical support to the decision maker.

Applying the Unified Architecture Framework (UAF), previously known as Unified profile for MODAF and DoDAF (UPDM), using a Model-based Systems Engineering (MBSE) approach moves the architecture modeling effort to one that is an integral part of SE, helping the systems integrator to develop interoperable systems, with traceability to requirements and across views, using one integrated architecture model that enables impact analysis, gap analysis, trade studies, simulations (what-if scenarios), and engineering analysis.

Why UPDM? There are three major architecture frameworks used for defense architectures these days. It is Department of Defense architecture framework (DoDAF), Ministry of Defense architecture framework (MODAF) and NATO architecture framework (NAF). The practice of cross-organizational and cross-country projects within NATO countries showed a clear evidence that without unification and interoperability, successful use of architectures is hard to achieve. This was a motivator for UPDM to start its existence.

In March 2008, the UPDM Group was formed by members of INCOSE and the OMG to create the Unified Profile for DoDAF and MODAF (UPDM) using UML/SysML. Members of the UPDM group were tool vendors, members of industry and representatives from the US DoD, British MOD, NATO, Canadian and Swedish armed forces. Members of the DoDAF 2.0 taskforce were heavily involved to ensure that DoDAF 2.0 and UPDM converged as much as possible. Tools supporting UPDM have been available for some time and are in use on multiple government and industry projects.

Why UAF? Six years passed and the period of paradigm shift from document-centric systems engineering approach to model-based systems engineering (MBSE) revealed gaps of MBSE approach. Where one of the gaps was no standardized methodology available. Belief in Systems Modeling Framework as a savior did not come true. Language by its definition provides syntax and a bit of semantics, however, not pragmatics. To successfully apply language like SysML, questions like how to structure the model, what views to build, which artifacts to deliver and in what sequence need to be answered. Every company deals with this issue differently. Organizations not complying with the standardized approach end up having differently structured models with different set of views. It results in the loss of capability to interexchange, loss of capability to communicate with other teams, overhead in tool customization, and specific trainings need. Moreover, the models become impossible to integrate and reuse.

Taking industry demand in account and addressing changing landscape of defense architecture frameworks (adoption of IDEAS ontology for DoDAF and MODAF), in September of 2013, a Request for Proposal for UPDM 3.0 (later renamed to UAF) was created with the following preface: "The scope of UPDM V3.0 includes support for modeling architectures, heretofore referred to as Architecture Descriptions (ADs) as defined in [ISO/IEC/IEEE 42010:2011], based on SysML v1.3, where such an AD consists of a collection of views and constituent models that represent a set of UPDM-specified governing viewpoints (stakeholders' concerns). The scope of UPDM v3.0 also includes mechanisms for developing custom views to represent user-specified viewpoints. The intent is to use the UPDM V3.0 to provide a standard representation for AD support for Defense Organizations. Another intent is to improve the ability to exchange architecture data between related tools that are UML/SysML based and tools that are based on other standards.

The profile should include support for developing an AD for a set of viewpoints such as project, operational, capability, services, systems, standard, security and performance viewpoints, to include modeling and relating such elements as activities, nodes, system functions, ports, protocols, interfaces, systems' physical properties, and units of measure as defined by the architecture frameworks DoDAF, MODAF/ MODEM, NAF, and the Security Viewpoint from DNDAF. In addition, the profile should allow for the modeling of related domain concepts such as DoD's Doctrine, Organization, Training, Materiel, Leadership & education, Personnel, and Facilities [DOTMLPF], the UK Ministry of Defence Lines of Development [DLOD] elements which are: Training, Equipment, Personnel, Information, Concepts and Doctrine, Organization, Infrastructure, Logistics (TEPID OIL), and the NATO equivalent." (OMG, 2013).

Since the issue of RFP, UPDM 3.0 group identified the list of mandatory requirements:

- Provide Domain Metamodel (Abstract Syntax and Constraints)

- An Architecture Framework Profile Using SysML

- Enable the Expression of Business Process Models

- Architecture Modeling Support for Defense, Industry, and government Organizations

- Use of SysML Requirements Elements and Diagrams

- Use of SysML Parametric Elements and Diagrams Mapped to Measurements

- Support for Data and Information Viewpoints: Conceptual, Logical, and Physical Schema Views and Constituent Models

- Traceability Matrix for Backward Compatibility with UPDM 2.x

- Requirements Traceability Matrix to Supported Defense Architecture Frameworks

- Example Architecture Description

- Matrix of Applicable Elements and Relationships for Each Presentation Artifact

- Model Interchange

- Extensibility to Enable the Definition of Custom Viewpoints

- And a list of optional requirements. Mentioning few of the complete list:

- Viewpoints in Support of SoS Life Cycle Processes and Analyses

- Human Systems Integration (HSI);

- Support of Security Domain.

The author of the presentation in behalf of other submitters of the UPDM 3.0 specification, believes that the UPDM 3.0 submission meets the requirements listed above. For the reason to support civil engineering needs, domains that are beyond the scope of defense frameworks and many other reasons outlined in this paper, we have renamed UPDM 3.0 to UAF 1.0.

The Alpha version of UAF specification is accepted by OMG in June 2016. The final version of UAF 1.0 specification very likely to be published in June 2017.

This presentation introduces to a brand new UAF and explores how to leverage MBSE with architecture modeling in an integrated and disciplined approach, enabling the modernization of complex systems (Systems of Systems, C4I systems, and heavy industry systems).

## REFERENCES

[1] Object Management Group (OMG), 2015, OMG Systems Modeling Language (OMG SysML™), V1.4, OMG Document Number: formal/2015-06-03, URL: http://www.omg.org/spec/SysML/1.4/PDF, Accessed October, 2016

[2] Object Management Group (OMG), 2009, Unified Profile for the Department of Defense Architecture Framework (DoDAF) and the Ministry of Defence Architecture Framework (MODAF), available at http://www.omg.org/spec/UPDM/

[3] Object Management Group (OMG), 2009c, Unified Profile for DoDAF/MODAF (UPDM) 2.0 Request for Proposal), available at http://www.omg.org/cgi-bin/doc?c4i/2009-09-02.

[4] Object Management Group (OMG), 2013, Unified Profile for DoDAF/MODAF (UPDM) 3.0 Request for Proposal), available at http://www.omg.org/cgi-bin/doc.cgi?c4i/2013-9-11.

[5] ISO/IEC/IEEE 42010:2011 - Systems and software engineering - Architecture description. Iso.org. 2011-11-24. Accessed 2013.

[6] Mazeika, D., Morkevicius, A., and Aleksandraviciene, A., 2016, MBSE driven approach for defining problem domain, 11th System of Systems Engineering Conference (SoSE), Kongsberg, 2016, pp. 1-6.

[7] Hause, M., Bleakley, G. and Morkevicius, A. 2016, Technology Update on the Unified Architecture Framework (UAF). INCOSE International Symposium, 26: 1145–1160.

[8] Bleakley, G. and Morkevicius, A. 2016, Transitioning from UPDM to the Unified Architecture Framework (UAF). Integrated Enterprise Architecture 2016.

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**Aurelijus Morkevicius** is OMG® Certified UML, Systems Modeling and BPM professional. Currently he is a Head of Solutions Department at No Magic Europe. He has the expertise of model-based systems engineering (mostly based on SysML) and defense architectures (DoDAF, MODAF, NAF). Aurelijus is working with companies such as General Electric, Bombardier Transportation, Deutsche Bahn, ZF, Ford, SIEMENS, BMW, etc. He is also a chairman and one of the leading architects for the current OMG UAF (previously known as UPDM) standard development group. In addition, Aurelijus is actively involved in educational activities. He received a PhD in Informatics Engineering from the Kaunas University of Technology in 2013. Aurelijus is also a lecturer, author of multiple articles, and conference speaker.