UPDM – Unified Profile for DoDAF/MODAF

Matthew Hause
UPDM Co-Chair
Atego Chief Consulting Engineer

UPDM Group

Adaptive
Artisan Software
ASMG
BAE Systems
DoD
DND
Generic
General Dynamics
IBM
Lockheed Martin Co
Mega
Mitre

Northrop Grumman
L3 Comms
MOD
NoMagic
Raytheon
Rolls Royce
Sparx Systems
VisumPoint
Selex SI
Thales
Unisys

January, 2011
What is UPDM? - Summary

• UPDM 1.0 is a standardized way of expressing DoDAF 1.5 and MODAF 1.2 artefacts using UML and SysML
  – UPDM is **NOT** a new Architectural Framework
  – UPDM is not a methodology or a process

• UPDM 1.0 was developed by members of the OMG with help from industry and government domain experts.

• UPDM 1.0 has been implemented by multiple tool vendors.
  – Tools supporting UPDM 1.0 are available now.

• UPDM 2.0 supports DoDAF 2.0, MODAF 1.2, NAF 3.x, and DNDAF 1.7
Outline

• Why?
  – The need for UPDM.
• When?
  – The history and projected timetable for UPDM.
• Who and Where?
  – Who is in the UPDM RFC Group?
• How?
  – How was the specification created?
• What?
  – What is UPDM in general?
  – A detailed look at a few things.
• Questions and answers?
Why? The need for UPDM.

• Motivation
  – US DoD and UK MOD interested in leveraging commercial standards for their Military Architecture Framework
  – Military Architecture Framework Tool Interoperability
    • Key Goal for DoD, MOD, Enterprise and System Architects and Engineers
  – Formal MetaModel basis for the Military Architecture Framework
    • Critical to Interoperability Objectives
    • Critical to Understanding Profile Requirements

• Proliferation of Military Architectural frameworks
  – DoDAF, MODAF, DNDAF, NAF, AGATE, ADOAF, MDAF, etc.
  – Defence organizations, contractors and tool vendors are hoping to find a way out of the alphabet soup.
Why and When: Historical Development of AF’s.

- **1996**: C4ISR Architecture Framework v1.0
- **1997**: C4ISR Architecture Framework v1.0
- **2003**: DoDAF v1.0
- **2005**: MODAF v1.0
- **2005**: NAF v1.0
- **2007**: MODAF v1.1
- **2007**: MODAF v1.2
- **2007**: NAF v3.1
- **2008**: MODAF v1.5
- **2008**: DoDAF v1.7
- **2008**: DoDAF v1.2
- **2009**: DNDAF v1.7
- **2008**: NAF v3.1
- **2007**: DoDAF v1.1

**Scope of UPDM 1.0**
- Approved Sept 2008
- **Scope of UPDM 2.0**
- Started Sept 2009
**Why: Architecture Interchange Requirements**

- **What is Interchange? (Many different viewpoints)**
  - Across Lifecycle Transformation (UPDM ↔ SysML ↔ UML ↔ Code)
    - Enterprise Architecture ↔ Segment Architectures
  - DoD Interchange with Partners, Subcontractors and Customers
    - Common Single Tool
    - Predefined Tool Pairs (Import/Export)
    - Range of Different Tools (Import/Export)
  - Tool (and Tool Vendor) Migration, Delivering on the Promise

- **What is Interchanged?**
  - Requirements
  - Model Meta-Data
  - Meta-Data and Diagrams for UPDM (clone and own?)
  - Tools Working Together – Transform and/or Trace
Why: Architecture Interchange

• XMI Standards Compliance is a good foundation, but not enough
  – Real Interchange is Being Proven by the OMG MIWG
• Range of 9 Different UML/SysML/UPDM Tools
• Founding Member OMG Model Interchange Working Group
  – XMI basis
  – Test Cases from Basic UML, through SysML to UPDM
  – Public OMG Connect-a-thon (March 2011)
• Leveraging Physical Exchange Specification (PES)
  – Investigating translation to/from PES-XMI
Who and Where: UPDM Team Members

- US DoD Liaison - DoD/DISA, OSD CIO, Mitre, Silver Bullet
- UK MOD Liaison - UK MOD, ModelFutures
- Canada DND Liaison – DND and ASMG Ltd
- NATO – Generic AB on behalf of SwAF and on contract by FMV
- Tool Vendors – Adaptive, Atego (Co-Chair), EmbeddedPlus, IBM (Co-Chair), Mega, NoMagic (Co-Chair), Sparx Systems, Visumpoint
- Aerospace – BAE Systems, General Dynamics, L3 Communications, Lockheed Martin, Northrop Grumman, Raytheon, Rolls-Royce, Selex SI, Thales, Unisys
- Advisors – Decisive Analytics
- Distributed multi national team (US, UK, France, Sweden, Lithuania, Australia, Canada, Thailand, Italy)
How: UPDM 1.0 Requirements

• Mandatory Requirements
  – Domain Metamodel
  – Metamodel (abstract syntax and constraints)
  – Profile
  – Notation (concrete syntax)
  – DoDAB 1.5 and MODAF 1.2 artifacts
  – Support for custom views and viewpoints
  – Element taxonomy reference
  – Data interchange

• Optional Requirements
  – Extensibility to Other Architecture Frameworks
  – Representation of Architectural Patterns
How: UPDM Features

• Integrates with SoaML – The Service Oriented Architecture Modelling Language
• SysML Extensions with UPDM level 1
  – Facilitates integration of DoDAF and MODAF models for system of systems modeling with SysML models for systems modeling
  – Enables UPDM to fully leverage SysML features
How: UPDM Level 1 Compliance SysML Extensions

• Enables UPDM to leverage SysML features
  – SysML blocks to represent structural elements such as operational nodes, artifacts (systems), capability configurations, which enable the use of flow ports, item flows, and value properties with units and distributions
  – SysML activities to support continuous flow modeling, activity hierarchies, and support for enhanced functional flow block diagrams
  – SysML parametrics to enable the integration of engineering analysis with the architecture models (e.g., performance parameters in an SV-7 can be captured in parametric equations)
  – SysML allocations to support various types of mappings such as an SV-5 that maps system functions to operational activities

• Other SysML Features
  – SysML requirements enable text based requirements to be captured and traced to other model elements using the satisfy, derive, verify and refine relationships
  – SysML view and viewpoint enable provide for multiple perspectives of the model, and to manage, control, and organize information.
  – Callout notation
What is UPDM?

UPDM - Domain Meta Model
UPDM – Unified Profile for DoDAF and MODAF

UPDM RFC - Domain Meta Model Summary

**Layers**

- AcV
- AV
- OV
- SOV
- SV
- TV

**Legend**

- Individual
- Type
- Topic
- Thing

**Products**

- **TV**
  - TV-1
  - TV-2

- **AV**
  - AV-1
  - AV-2

- **OV**
  - OV-1
  - OV-2
  - OV-3
  - OV-4 (Typical, Actual)
  - OV-5

- **SOV**
  - SOV-1
  - SOV-2
  - SOV-3
  - SOV-4
  - SOV-5

- **SV**
  - SV-1
  - SV-2
  - SV-3
  - SV-4
  - SV-5
  - SV-6
  - SV-7
  - SV-8
  - SV-9
  - SV-10

**Auxiliary diagrams**

- Component Collaboration Model
- Information Product Element
- Operational Object Element
- NAV Measurable Properties
- Business Rule Element
- Component Element
- Capability Element
- NAV Requirements
- NAV Environment
- Process Element
- Enterprise/Phase
- Service Element
- NAV Effectivity
- Actor Element
- Computenomce
• Package structure organizes stereotypes by viewpoint
• Multiple viewpoints manage model complexity
UPDM – Unified Profile for DoDAF and MODAF

UPDM RFC - Domain Meta Model Summary (AV)
When: UPDM 2.0 Roadmap

• Signed and Released DoDAF 2.0 in June 2009
• Preparation of RFP for UPDM 2.0 (Next Slide)
• Issue UPDM 2.0 RFP Sept 2009
• ....
When: UPDM 2.0 Roadmap

• RFP for UPDM 2.0
  – Inclusion of DoDAF 2.0
  – Continuing support for MODAF 1.2
  – Support for NAF 3
  – Support for DNDAF including the Information and Security views
  – Human Factors Views based on MODAF and DNDAF
  – Business Motivational Modeling/SBVR profile integration
  – Business process Modeling Notation
    • UPDM v2 optionally could use BPMN to model operational views
  – Others?
UPDM - Profile Example
OV-1a: Operational Context Graphic

OV-1a [High Level Operational Concept] gjghgjhghjAssault [OV-1a]

«HighLevelOperationalConcept»
«block»

Planetary Assault

: Shield

protects

: Rebel Base

attacks

detects

: AT-AT

transmits data to

deploys

: Probe Droid

controls

: Star Destroyer
OV-1: Operational Context Graphic

For a non-graphic version see [High Level Operational Concept] gjghgjhghjAssault [OV-1a]
OV-2 Operational Nodes

OV-2 [Node] Planetary Assault [OV-2]

- **NodeRole**: RS : Shield
  - Shield characteristics : Sensor Data
  - Energy cannon fire : PetaWatts
  - Shield control data : Control Information
  - Power supply : PetaWatts

- **NodeRole**: Echo Base : Rebel Base
  - Base details : Sensor Data
  - Blaster fire : GigaWatts

- **NodeRole**: PG : Power Generator
  - Droid control data : Control Information

- **NodeRole**: RH : Hangar
  - Sensor data : Sensor Data
  - Droid control data : Control Information
  - Target strike request : Target Request
  - Ground command orders : Operational Orders

- **NodeRole**: PD : Probe Droid
  - Sensor data : Sensor Data
  - Droid control data : Control Information
  - Target strike request : Target Request
  - Squadron orders : Operational Orders

- **NodeRole**: SQD : Squadron
  - Energy cannon fire : PetaWatts
  - Shield characteristics : Sensor Data
  - Energy cannon fire : PetaWatts
  - Squadron orders : Operational Orders

- **NodeRole**: CI : Command Intelligence
  - Energy cannon fire : PetaWatts
  - Shield characteristics : Sensor Data
  - Energy cannon fire : PetaWatts
  - Target strike request : Target Request

- **NodeRole**: AT-AT : AT-AT
  - Energy cannon fire : PetaWatts
  - Shield characteristics : Sensor Data
  - Energy cannon fire : PetaWatts
  - Target strike request : Target Request

- **NodeRole**: GC : Ground Command
  - Energy cannon fire : PetaWatts
  - Shield characteristics : Sensor Data
  - Energy cannon fire : PetaWatts
  - Target strike request : Target Request
OV-2 Operational Nodes - Detail

- **OV-2 [Node] Planetary Assault [OV-2]**

  - **Planetary Assault**
    - **NodeRole**: part
    - **RS**: Shield
    - **shield control data**: Control Information
    - **shield characteristics**: Sensor Data
    - **energy cannon fire**: PetaWatts
    - **power supply**: PetaWatts

- **Echo Base / Rebel Base**
  - **NodeRole**: part
  - **PG**: Power Generator
  - **RH**: Hangar

- **Probe Droid**
  - **NodeRole**: part
  - **PD**: Probe Droid

- **Squadron**
  - **NodeRole**: part
  - **SQD**: Squadron

- **T0bs**
OV-5 Activity Diagram
OV-5 Activity Diagram
StV-2: Capability Taxonomy

- **Discovery of Enemy Resources**
  - **Destruction of Enemy Resources**
  - **Planetary Suppression**
  - **Planetary Destruction**
  - **Autonomous Detection of Enemy Resources**
  - **Operator-controlled Detection of Enemy Resources**

- **Rapid Deployment of Planetary Attack Forces**
  - **Govern Systems**
  - **Propaganda Dissemination**
  - **Convert Opposition**
  - **System Interdiction**

- **Rapid Deployment of Planetary Garrison**

- **Target Observations**
  - **Surface Probe Droid**
  - **Probe Droid**

- **Resource Artifacts**
  - Death Star II
  - Death Star

**Capability Configuration**
StV-4: Capability Dependencies

StV-4 [Capability] Govern Systems [StV-4]

- Convert: Convert Opposition
- Deploy: Rapid Deployment of Planetary Garrison
- Discover: Discovery of Enemy Resources
- Interdict: System Interdiction
- Attack: Rapid Deployment of Planetary Attack Forces
- Destroy: Destruction of Enemy Resources

Legend:
- Dotted arrows represent dependencies.
AcV-2 Project Views - Milestones

- **Tie Fighter: FleetOps**
  - startDate: 2007-12-31 00:00:00
  - responsibleResource: Imperial Defense Contractor

- **Star Destroyer Development: FleetOps**
  - responsibleResource: Kuat Drive Yards: Imperial Defence Contractor

- **Death Star: Planetary Suppression**
  - endDate: 2010-01-01 00:00:00

- **IncrementMilestone**
  - **Tie v1: Imperial Project Milestone**
    - endDate: 2008-01-01 00:00:00
    - themeValues:
      - Equipment: Not Started
      - Training: Not Started
      - Concepts & Doctrine: Not Started
      - Personnel: Not Started
      - Organization: Not Started
      - Infrastructure: Not Started
      - Logistics: Not Started
      - Interoperability: Not Started

- **IncrementMilestone**
  - **SD Mk1: Imperial Project Milestone**
    - endDate: 2008-01-01 00:00:00
    - resource: Star Destroyer

- **DeployedMilestone**
  - **SD Assessment: Imperial Project Milestone**
    - endDate: 2008-12-31 00:00:00

- **DeployedMilestone**
  - **Tie In-service: Imperial Project Milestone**
    - endDate: 2010-03-30 00:00:00
    - resource: Star Destroyer
    - usedBy:
      - Outer Rim PAG: Planetary Assault Group
      - 501st Legion: Ground Assault Legion
      - Blizzard Force: System Security Division

- **DeployedMilestone**
  - **SD In-service: Imperial Project Milestone**
    - endDate: 2010-03-30 00:00:00
    - resource: Star Destroyer
    - usedBy:
      - Outer Rim PAG: Planetary Assault Group
      - 501st Legion: Ground Assault Legion
      - Blizzard Force: System Security Division

- **OutOfServiceMilestone**
  - **DS OoS: Imperial Project Milestone**
    - endDate: 2011-12-31 00:00:00
    - resource: Death Star
## StV-3: Table/Gantt Chart

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
</table>

### Discovery of enemy resources

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
</table>

- **Operator-controlled detection of enemy resources**
  - Year 1: Discovery of enemy resources
  - Year 2: Probe Droid

- **Autonomous detection of enemy resources**
  - Year 1: Discovery of enemy resources
  - Year 3: Surface Probe Droid

### Destruction of enemy resources

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
</table>

- **Planetary suppression**
  - Year 1: Planetary suppression
  - Year 2: Star Destroyer

- **Planetary destruction**
  - Year 3: Death Star
AcV-2 Project Views - Milestones

[Architectural Description] Acquisition Timeline - Space Vehicles [AcV-2]

Death Star (Planetary Suppression)

Star Destroyer Development (FleetOps)

Tie Fighter (FleetOps)

2000-12-01


2010-01-25

2007-12-31 00:00:00 SD OoS
2007-01-25 00:00:00 SD Update

2003-06-30 00:00:00 Tie In-service
2001-12-31 00:00:00 Tie Assessment
2001-01-31 SD

2003-12 DS Mk II
2004-12 DS
2000-12-31 00:00:00 DS In-service

2008-02-12 00:00:00 DS Mk II OoS
2008-01-01 DS
2004-12 12
2001-12-31 00:00:00 SD Assessment
2001-01-31 SD


2005-01-30 00:00:00 SD OoS
2004-06-30 00:00:00 SD In-service
2001-12-31 00:00:00 Tie Assessment
2001-01-31 Tie

FleetOps

- Equipment
- Training
- Concepts & Doctrine
- Personnel
- Organisation
- Infrastructure
- Logistics
- Interoperability

Not Applicable
Complete
In Progress
Not Started
In Test
SoV-1: Service Taxonomy

SOV-1 [Architectural Description] Service Taxonomy [SOV-1]

- **Root Service**
  - **Intelligence Service**
    - **Intelligence Fusion**
      - **Target Observation**
        - **ServiceFunction** Observe Target()
        - **ServiceFunction** Initialise (in searchParams : Search Parameters)
        - **ServiceFunction** Transmit Data()
        - **ServiceFunction** Perform Preliminary Analysis()
      - **ServiceAttribute** Range : Kilometers
  - **Communication Service**
    - **Email Service**
    - **Military Messaging Service**
    - **SIGINT**
OV-2 Operational Nodes - Detail

OV-2 [Node] Planetary Assault [OV-2]

- RS: Shield
- Echo Base: Rebel Base
- PG: Power Generator
- RH: Hangar
- PD: Probe Droid
- TObS

- energy cannon fire: PetaWatts
- shield characteristics: Sensor Data
- shield control data: Control Information
- power supply: PetaWatts
- base details: Sensor Data

- SDD: Squadron
SV-2: System Detail
SysML Example: Requirements Traceability

- **Internal Probe Communications**
  - **Requirement**: UniverseStan XYZ shall be used for internal Probe Droid communications.
  - **Satisfy**: Battle of Hoth::Standards etc::Standards::UniverseStan XYZ

- **Star Destroyer Communications**
  - **Requirement**: ImpStan XYZ shall be used for communications with the Star Destroyer
  - **Satisfy**: Battle of Hoth::Standards etc::Standards::ImpStan XYZ

- **Probe to Ship Protocol**
  - **Requirement**: ProbeToShip protocol shall be used for all communications.
  - **Satisfy**: Battle of Hoth::Standards etc::Protocols::ProbeToShip
International Adoption of UPDM

• United States
  – DoD statements of support issued
  – Vendor presentations given to DoD, Industry, conferences
  – UPDM being used on both bids and projects

• Great Britain
  – MOD statements of support issued
  – Vendor presentations given to MOD, Industry, conferences
  – UPDM being used on both bids and projects

• France
  – DGA favoring NATO NAF over AGATE; investigating UPDM
  – Vendor presentations given to DGA, Industry, conferences
DoD at OMG

DoD and MOD Recommended the C4i TF to vote and recommend formal Issuance of the UPDM Request For Comment (RFC):

– Critical Role for Enterprise Architecture
– Time is now for Baseline Requirements
– Sound Methodology - UPDM RFC
– DoD long standing policy on standards
– Strong Inter-Governmental Support
DoD and MOD Position

- Joint Statement (18 Sep 08)
  - Brian G. Wilczynski, Director, Enterprise Architecture & Standards, Office of the Department of Defense Deputy Chief Information Officer
  - John Keefe, United Kingdom Ministry of Defence
  - “UK MOD fully endorses and supports the position stated by the US DoD”.
International Adoption of UPDM cont’d

• Sweden
  – FMV statements of support issued
  – Swedish SwAF have now adopted MODAF as standard
  – Vendor presentations given to SwAF, Industry

• Canada
  – DND participation in UPDM effort at OMG
  – Evaluating its use to support DNDAAF
  – Provided security views
  – Vendor presentations given to DND, Industry, conferences
  – Public safety looking to adopt (Homeland Security)

• Norway
  – Vendor presentations given to defence dept, industry
International Adoption of UPDM cont’d

• NATO
  – UPDM update presentation given at NATO C3A briefing
  – UPDM group coordinating with NATO C3A for UPDM 2.0 oversight and support

• Italy
  – Vendor presentations given to Italian Armed forces, Industry, conferences
  – UPDM being used on both bids and projects

• Holland
  – Vendor presentations given to Dutch Armed forces, Industry, conferences
International Adoption of UPDM cont’d

• Israel
  – Vendor presentations given to Israeli Armed forces, Industry, conferences

• Use of UPDM for non-military applications
  – Disaster planning, event planning, space missions: satellites, manned missions, non-military government departments, humanitarian relief operations, industry infrastructure planning, banking, etc.

• All of the above cited standardization and interchange as essential reasons for considering UPDM
Discussion

Questions?
IDEAS Recap - Top-Level Foundation

- Developed by an international group of computer scientists, engineers, mathematicians, and philosophers under defense sponsorship.
Performer

LocationType

System

Service

OrganizationType

Organization

PersonType

Skill

Resource

Materiel

IndividualType

activityPerformedByPerformer

typeInstance

activityPerformsByPerformer

overlapType

performPerformsAtLocationType

wholePartType

materialPartOfSystem

wholePartType

personTypePartOfSystem

wholePartType

skillPartOfPersonType

wholePartType

skillPartOfPersonType

powerTypeInstance

organizationPowerTypeInstanceOfOrganizationType

powerTypeInstance

skillPowerTypeInstanceOfSkill

Guidance

Rule

Condition

Individual Resource

IndividualPerformer

Individual Type

UPDM – Unified Profile for DoDAF and MODAF

A functionally, physically, and/or behaviorally related group of regularly interacting or interdependent elements.

INCOSE International Workshop 2011 Meeting  June, 2010 – Matthew Hause 44