



ECC – Information
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Session 3

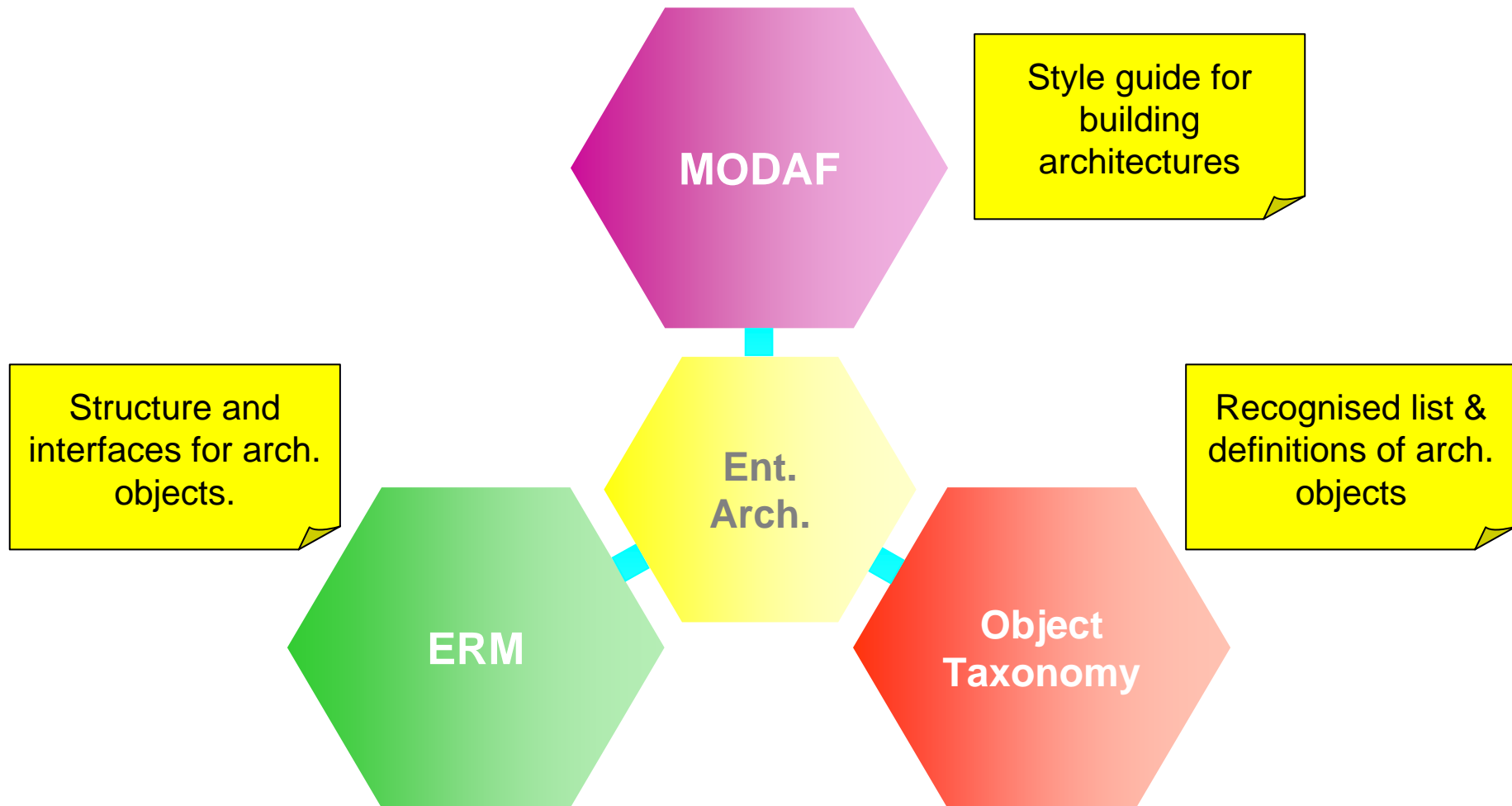
Enterprise Reference Model

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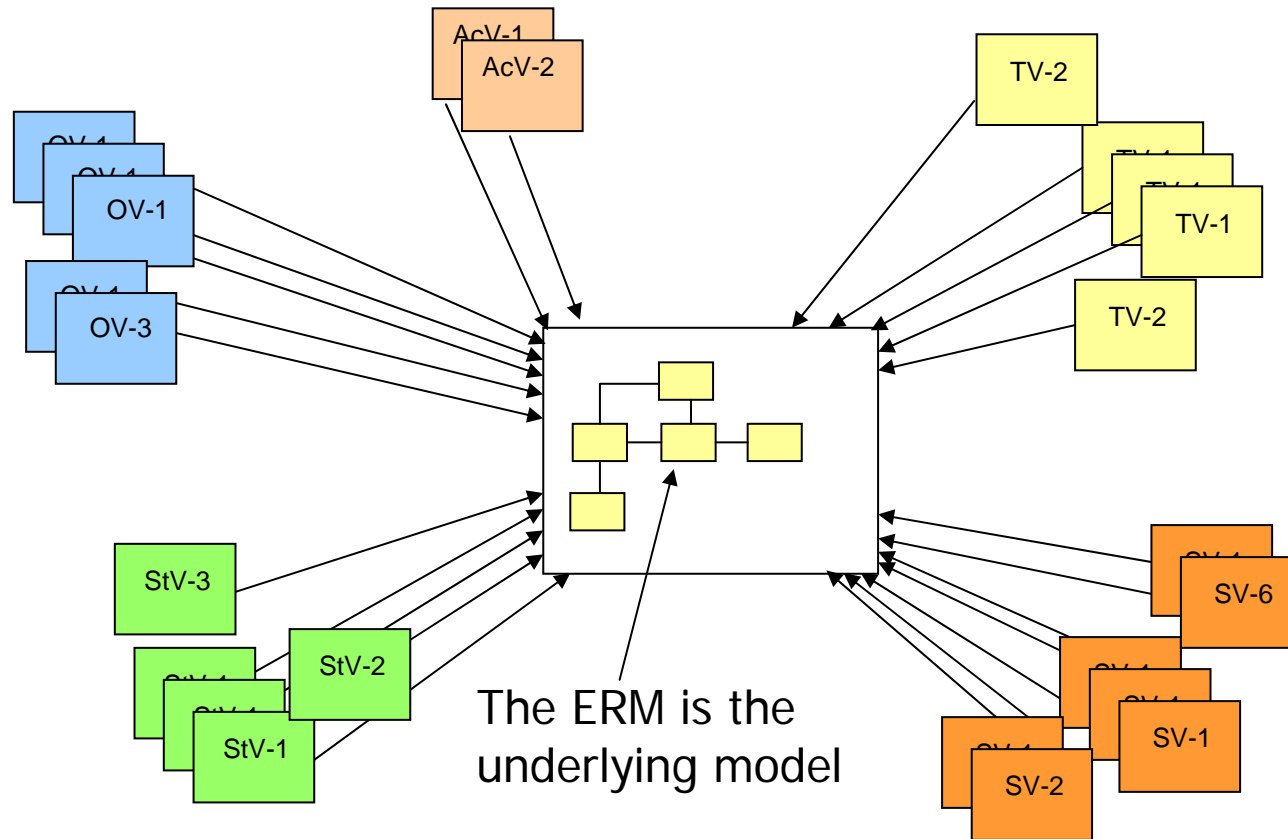
Agenda

- Aims and Objectives
- MODAF progress update
- MODAF development
- • Enterprise Reference Model
- Facilitated discussion

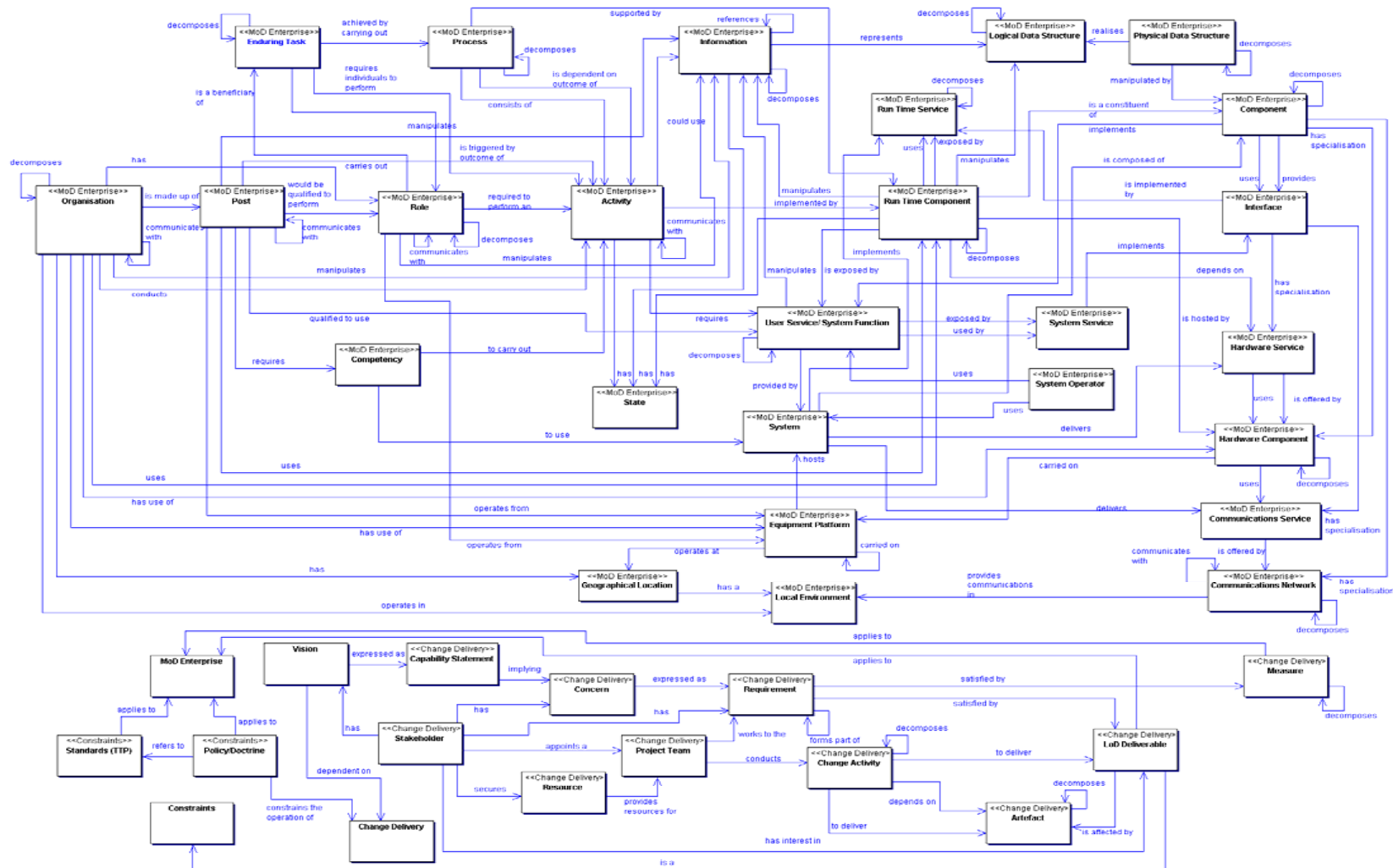
Foundations of MoD Architecture



What is the ERM ?



The ERM



The Need for a Reference Model

Without a Reference Model each of the different views would be independent:

- It would be impossible to validate consistency or completeness of a set of views
- It would be difficult to create new, consistent views based on the same underlying model
- Only individual views could be transferred between tool sets.

Furthermore, different groups might interpret the definitions of the views in different ways, leading to difficulty in communication.

Benefits of a Reference Model

- Consistent models can be built, rather than a series of unconnected views, allowing validation across the set
- Organisations involved with modelling will be able to form a deeper understanding of each others' models from seeing the views
- Provides a common language for modelling architectures
- It could form the basis of a model-exchange protocol between the different modelling tools, allowing the models to be manipulated and extended once they had been moved
- It could provide the structure around which a Taxonomy is built.

Work to date

- The current baseline of the ERM is a 'consensus' one based on the interests of three stakeholders:
 - DCBM(A)
 - Qinetiq (ARP work on modelling interoperability)
 - IA
- GII and ISTAR communities have also been involved.
- A Concept of Use has been developed.
- The Change Management Process has been developed
- Early Taxonomy Workshop held

Main Types of Usage

- Underpinning MODAF views to add rigour to their definition, and allow different views in a 'standalone set' to be tied back to a common model
- Exchange of standalone models between different teams across the MoD and Suppliers
- In conjunction with a taxonomy, to help define common 'catalogues' of objects to be used in models, helping rigour
- Searching an MoD-wide directory of models (again in conjunction with a taxonomy)
- Integration of separately developed models
- True collaborative modelling, with different groups contributing to common models, sequentially or in parallel.

Next Steps

There are still a number of areas to be addressed:

- Mapping to MODAF Views.
- The level of detail will need to be improved to be made consistent with the intended 'Concept of Use'.
- The relationships will need to be rationalised, or translations found between different styles of modelling, consistent with the concept of use.
- ERM Changes to process (Rationalisation).
- Suggested MODAF View modifications impact on ERM
- Tool Support with Vendors
- Continuing Taxonomy Work
- Use in Pilots
- Mapping to SysML and XMI

SysML Metamodel and XMI

The eventual aim will be to make the ERM a profile / extension of SysML.

Consistency between the ERM and the SysML will help in a number of ways:

- The ERM is a ML for architectures and has requirements which build on the requirements for SysML
- Re-use of language constructs from SysML
- ERM can concentrate on specific architecture concerns
- Easier to implement support for MODAF if the ERM relates to the SysML Metamodel
- Consistency would facilitate the adoption of XMI as a protocol for the exchange of models between tools.



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ERM Mapping to MODAF Views

Aims of the Work

- To provide a rigorous underpinning for the MODAF diagrams
- To identify any changes and enhancements that need to be made to the ERM to allow this to happen
- To map the ERM or MODAF views to UML/SysML and its metamodel.

Achieved to Date

- 'Indicative' mappings proposed for all of the diagrams, based on a number of assumptions.
- Areas of further work required on the ERM have been highlighted.
- Mapping to UML/SysML and Metamodel under way.

It will be necessary to agree changes to the ERM before the definitive mapping can be published.

Why a new model is required



- The CADM is seen as overly cumbersome – good for when it was produced, but modelling ideas have since moved on.

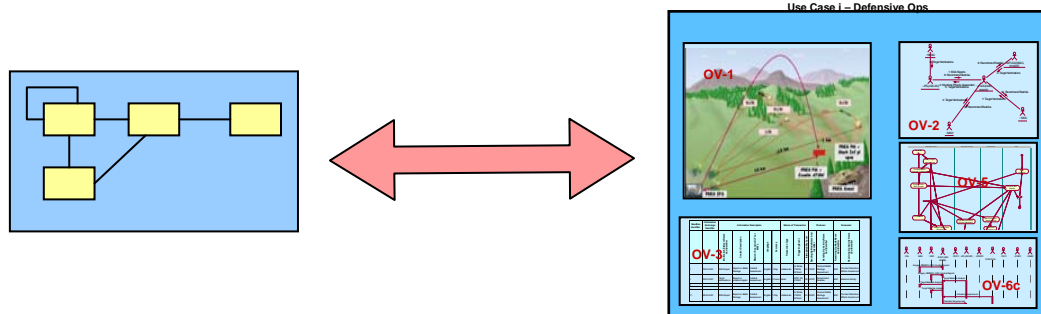


- SysML needs extending to provide an architectural modelling language which addresses architecture concepts, enables consistent modelling of MOD architectures and which enables queries across a wide range of architecture models.



- The model must attempt to bring together existing modelling approaches in an evolutionary rather than revolutionary fashion – a product that can be accepted by modellers across the MoD.

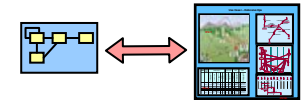
Why are mappings 'indicative'?



They are based on assumptions that still need to be tested:

- They have been based on an assumed Technical Concept of Use for the MODAF and the ERM
- Proposed changes to the ERM will need to be progressed through the change control procedure
- The implications of a number of the assumptions will need to be agreed with the MODAF Management Team.

A demanding Technical Concept of Use has been assumed

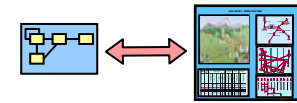


A demanding Technical Concept of Use has been assumed for the time being. This is that:

- the ERM will underpin a protocol for exchanging models between tools
- modelling will be highly collaborative, with the need to merge and extend each other's models
- the modelling tools will eventually need to support a high level of functionality – e.g. modelling the behaviour of types of actor and using this to validate that models using them are correct, and predicting emergent behaviour
- catalogues of re-usable elements will need to be shared between models and modelling tools.

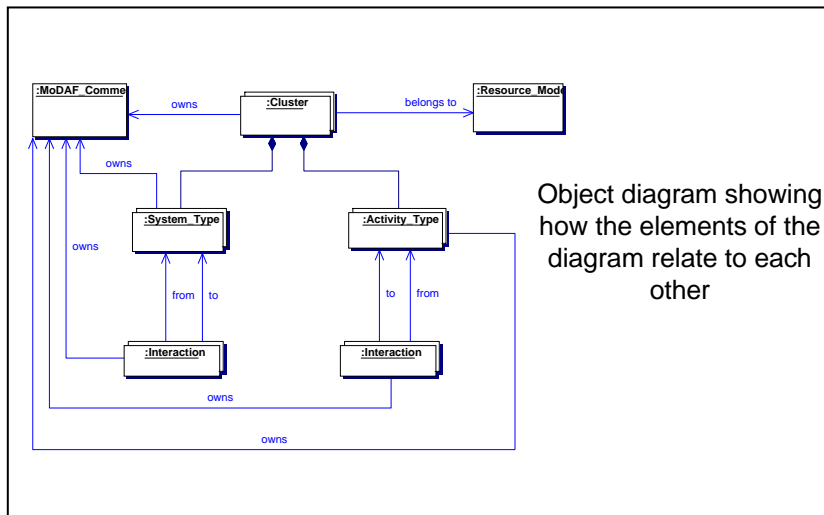
In order to be used in this way the ERM definition needs to be both rigorous and sophisticated.

Typical Mapping



Evolution	Resource	Scenario/Plan	Vignette/Outcome
✓	✓	x	x

Types of model that the diagram could illustrate



Element	ERM Equivalent	Comment
Node		
System Type	None	
Activity Type	None	
Change Activity	Change Activity	Used on diagrams showing tracking and interdependence of Delivery Progresses (is this sufficiently different to the ACV/IT?)
Cluster	None	
MoDAF Comment	None	
Line		
Interaction (Node Node)	See Section on Line Abstraction	
Technology Dependence		
Change Delivery (or Dependence between Change Activities)	Change Delivery	
None Graphical		
Technology	None	Used to show a technology dependence (but how are nodes on the diagram interdependently dependent on each other – do change activities define technologies as well as MOD elements?)

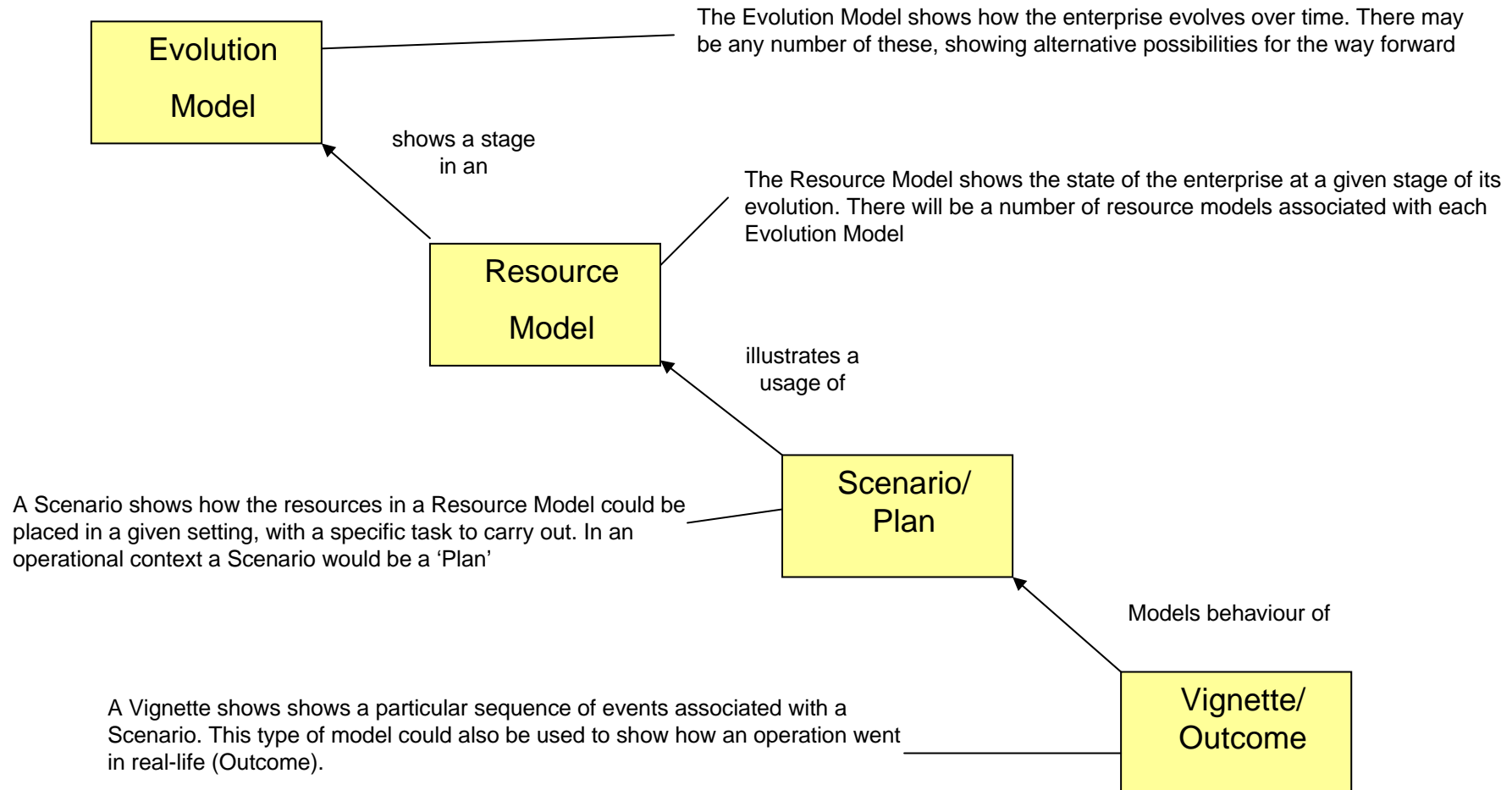
Table listing the elements and their relationship to ERM entities

A number of enhancements to the ERM are being proposed

- Introducing the different types of model that can be represented in a MODAF diagram
- Making a rigorous distinction between entities that represent classes, and those that represent instances or roles
- Introduction of some additional entities into the ERM to provide complete coverage for MODAF diagrams.



Support for four types of model



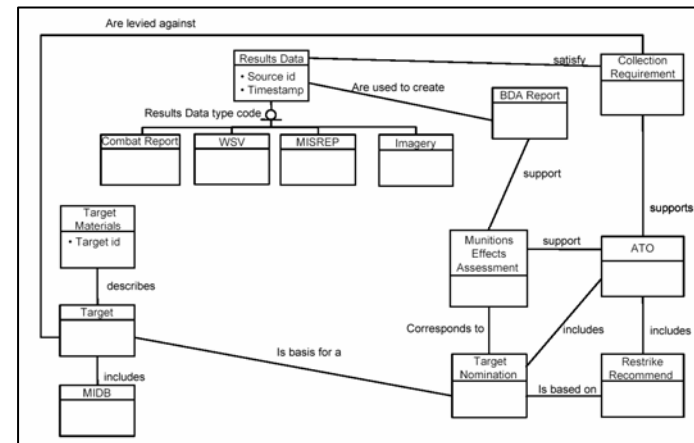
Examples of views on the different model types (I)



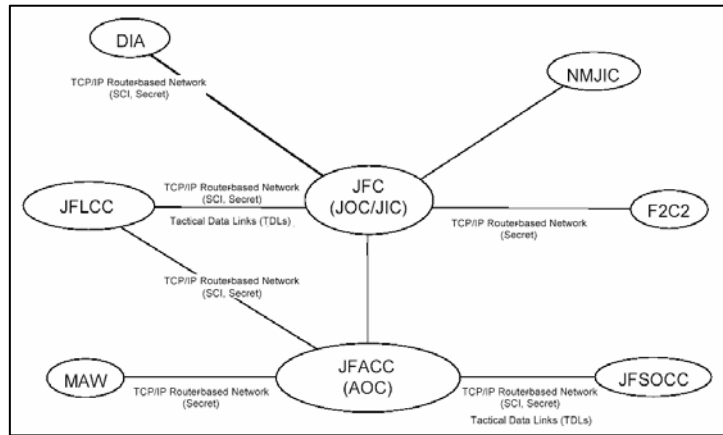
CAPABILITY FUNCTIONS	Epoch 1 (New - 2008)	Epoch 2 (2004-2007)	Epoch 3 (2008-2011)	Epoch 4 (NEC enabled 2008-2012)
COMMAND BATTLESPACE MANAGEMENT				
Decision Support	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Op Planning	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Operational Analysis	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Mission Rehearsal	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Situational Awareness	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Intelligence	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Decision Support: Interoperability	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Joint Strategic Intelligence	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Operational Intelligence	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Food Logistics	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
NATO C2 & It	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
NATO Comms	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Joint IS Location	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Naval Interoperability	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Maritime	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Air C2/Coord	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Functional Planning Support				
Info Op Planning	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Logistic Planning	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Medical	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Aviation Logistics Sp	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Personnel Planning	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
EW Planning	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Air Defence Planning	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Artery Zone Planning	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Air Planning	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Engineer/EOD Planning	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
IS Planning	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Comms Management	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
IS Management	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Functional Planning Support: Interoperability				
NATO AD	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Allied Fire Support	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S
Medical	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN CCS	JCCS (PM only) GP3HQ ARRC only/RAFCCIS/RN	JCCS/ComBAT/OP3 HQ ARRC only/RAFCCIS/RNCS/JCSSF	JCSSF/JTOC/ComBAT/ARRC C2S

StV-3 (Capability Phasing) Shows how resources available to the MoD are expected to **evolve** over time

OV-7 (Logical Data Model) Illustrates an aspect of the design of a **resource**

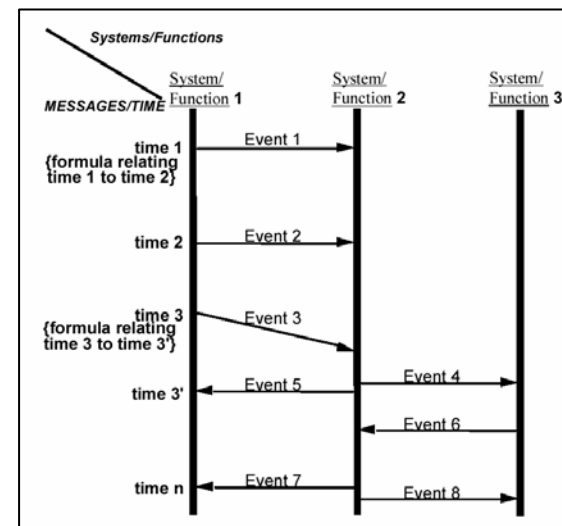


Examples of views on the different model types (II)



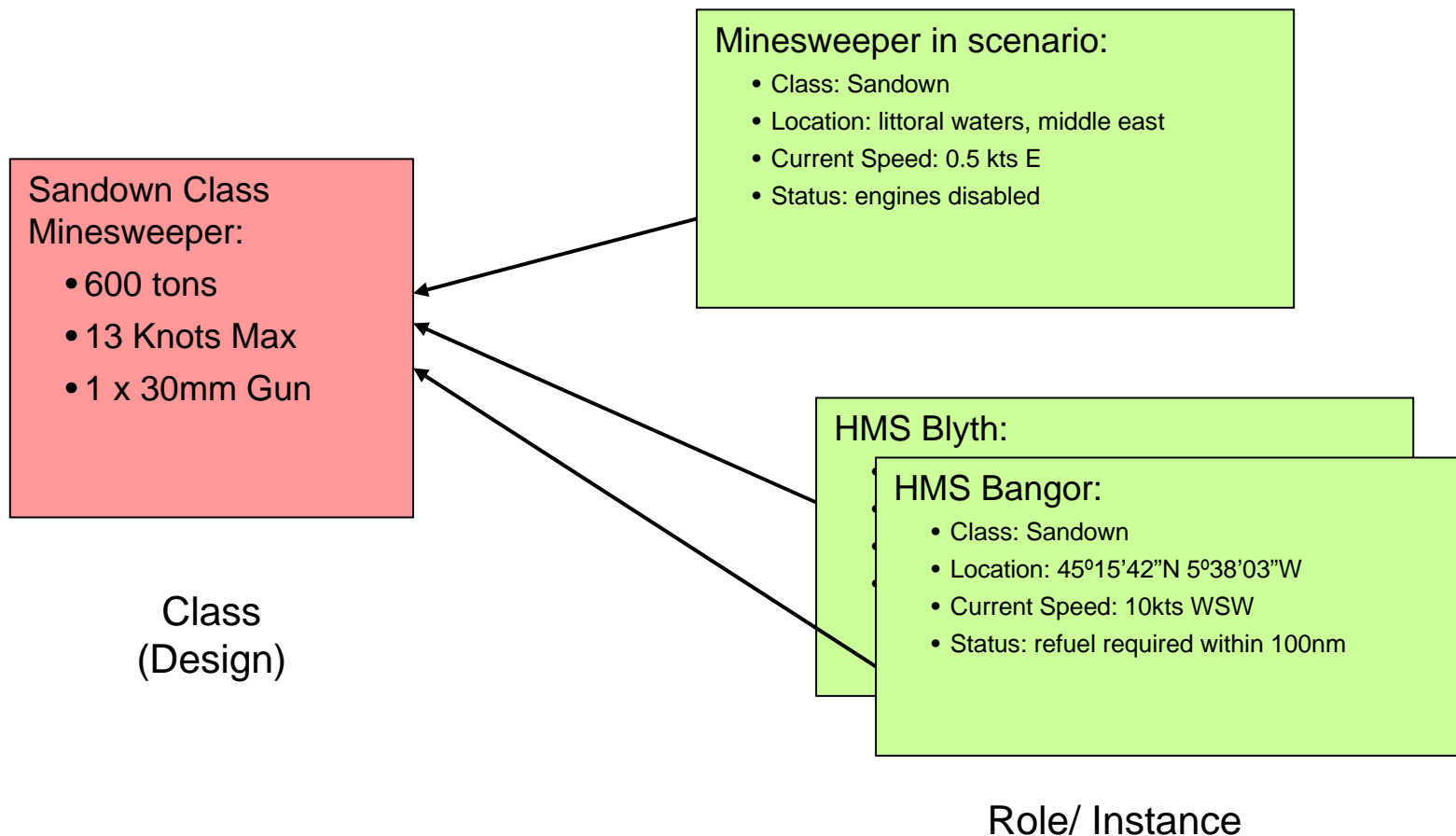
SV-2 (Systems Communications Description) Shows how Resources communicate with each other in a given **Scenario**

SV-10c (System Event Trace Description) Shows the sequence and timing of events in a 'Vignette'





Differences in the levels of abstraction



Other ERM enhancements



- Architectural Packages
- Epochs
- External Participants
- Physical Effects
- State Machines, Events and Triggers
- Communications Paths

Next Steps

- Your Views?
- Carry on with UML/SysML Mapping work
- Draft change requests for the ERM, and implement those that are approved
- Work with a group who will carry out the modelling in order to refine the definition of the diagrams that they need
- Re-work mapping document to be consistent with the updated ERM and the refined view definitions
- Iteratively improve model and mapping by working with users of MODAF.



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MODAF Change Management Process

Change Management

- Through-life management of all elements of MODAF definition
 - Views, ERM, taxonomy, etc
- Applies from when an element is issued

Change process objectives

- Make change management transparent to defence architecture community
 - MoD, Industry, Tool Vendors
- Consensus based change adoption process
- Enable process when consensus not achievable

Based on W3C change process

Actors

- Architecture Community Member
 - government and industry organisation with interest in architecture and MODAF
- Stakeholder
 - government organisation with voting rights in MODAF change management process
- Integration Authority
 - co-ordinates technical progress of MODAF
 - Technical Advisory Board
- Working Group

Key Elements

- News group
 - forum for technical discussion
- IA Technical Advisory Board
 - provides technical expertise for through life support of MODAF
- Working Groups
 - stakeholders can nominate one voting member
 - other members selected as required
 - develop change proposals *or* undertake proposal adoption
- Change proposal
 - mechanism for change

Processes

- Manage development of MODAF
- Resolve minor issues and corrections
- Form working group
- Develop a change proposal to MODAF
- Propose change to MODAF
- Adopt change to MODAF
- Participate in MODAF news group

Manage development of MODAF

- Organise workshops, monitor news groups, receive change requests or suggestions for new requirements
- Develop proposal for technical development
- Stakeholders review technical proposal
- Develop change proposal
- Seek funding/approval to address proposal
- Set up WG to address proposal
- Facilitate the WG's activities

Minor issues and corrections

- Formulate change proposal
- Change proposal reviewed by stakeholders and community
- Review objections & revises proposal if possible
- Ask stakeholder representatives to vote on change
- Either change proposal rejected or accepted

Form a working group

- Invite community members to nominate representatives
- Select working group members and chair
- WG creates a charter
- Approve charter
- WG starts work

WG either develops a change proposal or adopts / rejects a change proposal

Adopt change activity

- Consult architecture community on proposed change
- Resolve any issues if possible
- WG votes on change proposal
- Objectors submit written objections
- Revise proposal to resolve objections if possible
- Send substantive responses to objectors
- WG votes on change proposal
- Proposal adopted or rejected
- WG chair reports on outcome

Majority and no votes against

Simple majority

Way Forward

- Establish who the stakeholders are
- Establish news group
- Model of process available for review on CD

Questions?

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