MODAF-M04-010

MINISTRY OF DEFENCE

MOD Architectural Framework

White Paper on Systems View 1 (OV-2): *Operational Node Connectivity Description*

Version 1.0
29 March 2005

Prepared by:- MODAF partners

Approved by:-

RECORD OF CHANGES

This page will be updated and re-issued with each amendment. It provides an authorisation for the amendment and a checklist to the current amendment number.

Issue No.	Date	Revision Details
Draft 0.1	30 November 2004	First draft for review
Draft 0.2	20 January 2004	ERM Excerpt Removed for release
Draft 0.3	27 January 2005	Final revision prior to release
Version 1.0	29 March 2005	Examples revised, MODAF Meta Model excerpt added, and UML example derived from US example

Introduction

The purpose of this paper is to describe the initial content and layout of the modified OV-2 view in a way which would allow peer review from stakeholders. With the exception of this section, the rest of the paper follows the layout of the DODAF volume II document. The intention is that this format will be retained and used in the final MODAF documentation, currently scheduled to be published July 2005.

The MOD Architectural Framework (MODAF) is being developed with the intention of providing a rigorous way to specify systems of systems, and is a key enabler to NEC[1]. The framework will predominantly be used for acquisition purposes, and a key driver for its adoption is the need to improve interoperability between systems. However, MODAF could equally well be used to analyse existing, operational systems and better enable their integration with other systems (both new and existing).

An architectural framework defines a set of key business and technical information for describing a system of systems architecture. The purpose of an architectural framework is to define the operational context (organizations, locations, processes, information flows, etc.), the system architecture (interfaces, data specifications, protocols, etc.), and the supporting standards and documents that are necessary to describe the system of systems. The information presented in an architectural framework is split into logical groupings – usually known as views. The same system and business elements may be present in more than one view, but the purpose of each view is different and so each provides a different viewpoint on the information.

The most mature and widely adopted architectural framework in the defence industry is the US DoD Architectural Framework (DoDAF). This framework has its origins in the C4ISR community and is seen as a fundamental part of the DoD's drive towards Network Centric Warfare. MODAF is to be based on the DoDAF specification, and will use many of the aspects of DoDAF without alteration. MODAF will also add a number of new views needed to support MOD-specific processes and structures. In addition, other views will be modified, based on lessons learned by users of DoDAF.

MODAF modifies the existing DoDAF OV-2 in two ways. First of all, it recommends that an OV-2 diagram (now OV-2a) shows the platforms or geographic locations at which operational nodes are deployed. Secondly it provides additional information (OV-2b) about each needline[2] in the form of a requirements specification.

[1] CM(IS) NEC Next Steps paper of April 2003
[2] A needline is a line on a diagram which represents the requirement for communication between operational nodes

Operational Node Connectivity Description (OV-2)

Overview of Operation Node Connectivity Description

The OV-2 view is split into two views which define the connectivity between operational nodes. The views are:

- **OV-2a Operational Node Connectivity Specification** – identifies the required or existing connectivity between operational nodes
- **OV-2b Operational Node Needline Specification** – defines the types of information to be communicated across each of the needlines identified in OV-2a.

Operation Node Connectivity Specification (OV-2a) – Product Description

Product Definition – The *Operational Node Connectivity Specification* (OV-2a) graphically depicts the operational nodes (or organizations) with needlines between those nodes that indicate a need to exchange information. The OV-2a may also show the location (geographic, or platform) of operational nodes. The operational nodes shown in an OV-2a may be internal to the architecture, or external nodes that communicate with those internal nodes.

Product Purpose – OV-2a is intended to track the need to exchange information from specific operational nodes (that play a key role in the architecture) to others. OV-2a does not depict the physical connectivity between the nodes.

Product Detailed Description – The main features of this product are the operational nodes, the platform or location where the nodes are deployed, and the needlines between the nodes that indicate a need to exchange or share information. The product indicates the key players and the interactions necessary to conduct the corresponding operational activities of OV-5.

Operational Nodes[3]. An operational node is an element of the operational architecture that produces, consumes, or processes information. What constitutes an operational node can vary among architectures, including, but not limited to; representing an operational/human role (e.g., Air Operations Commander), an organization (e.g., The Ministry of Defence) or organization type, i.e., a logical or functional grouping (e.g., Logistics Node, Intelligence Node), and so on. The notion of operational node will also vary depending on the level of detail addressed by the architecture effort.

Needlines and Information Exchanges. A needline documents the requirement to exchange or share information, energy, or matter between nodes. The needline does not indicate how the transfer is implemented. For example, if information is produced at node A, is simply routed through node B, and is used at node C, then node B would not be shown on the OV-2a diagram – the needline would go from node A to node C. OV-2a is not a communications link or communications network diagram. The system implementation (or

[3] It has become apparent from DoDAF usage that an operational node may be the same as a system node, depending on the architect's point of view. For this reason, the MODAF Meta-Model only describes nodes. The question of whether to distinguish types of nodes in the MODAF views is under consideration by the MODAF team. The final version of the MODAF handbook will resolve this issue and provide clarity on the subject.

what systems nodes or systems are used to execute the transfer) is shown in the Systems Interface Description (SV-1). Furthermore, the systems-equivalent to a needline is the interface line depicted in SV-1. The actual implementation of an interface may take more than one form and is documented in a Systems Communications Description (SV-2). Therefore, a single needline shown in the OV may translate into multiple interfaces in SV-1 and multiple physical links in SV-2.

Needlines are represented by arrows (indicating the direction of information flow) and are annotated with a diagram-unique identifier and a phrase that is descriptive of the principal types of information exchanged. It is important to note that the arrows on the diagram represent needlines only. This means that each arrow indicates only that there is a need for some kind of information transfer between the two connected nodes.

There is a one-to-many relationship from needlines to information exchanges (e.g., a single needline in OV-2 represents multiple individual information exchanges). The mapping of the information exchanges to the needlines of OV-2 occurs in the Operational Information Exchange Matrix (OV-3). For example, OV-2 may list “Situation Report” as a descriptive name for a needline between two operational nodes. In this example, the needline represents a number of information exchanges, consisting of various types of reports (information elements), and their attributes (such as periodicity and timeliness) that are associated with the “Situation Report” needline. The identity of the individual information elements and their attributes are documented in OV-3.

OV-2a should also illustrate needs to exchange information between operational nodes and external nodes (i.e., operational nodes that are not strictly within the scope of the subject architecture but that act as important sources of information required by nodes within the architecture or important destinations for information provided by nodes within the architecture).

The information exchange requirements represented by individual needlines are specified in OV-2b.

Operational Activities. The operational activities (from the OV-5 Operational Activity Model) performed by a given node may be listed on the graphic, if space permits. OV-2a, in effect, turns OV-5 inside out, focusing first-order on the operational nodes and second-order on the activities. OV-5, on the other hand, places first-order attention on operational activities and only second-order attention on nodes, which can be shown as annotations on the activities.

Platform & Geographic Location. An OV-2a graphic shall show the location of each operational node, wherever the location *can* be specified. The location may be specified geographically, and this in turn may be a specific geographic location (e.g. RAF Wyton) or a type of location (e.g. behind enemy lines). The other way to specify a location is to use the platform where the operational node is deployed – again this may be specific (e.g. HMS Iron Duke) or typical (e.g. Nimrod).

Representation of the product. For complex architectures, OV-2a may consist of multiple graphics. There are at least two different ways to decompose OV-2a. One method involves using multiple levels of abstraction and decomposing the nodes. Another method involves restricting the nodes and needlines on any given graphic to those associated with a subset of operational activities. Both of these methods are valid and can be used together.

Operational nodes are independent of materiel considerations; indeed, they exist to fulfil the missions of the enterprise and to perform its tasks and activities (business processes, procedures, and operational functions). Use of operational nodes supports analysis and design by separating business process modelling and information requirements from the

materiel solutions that support them. Similarly, tasks and activities are organized, and communities of interest are defined to suit the mission and process requirements; the materiel is flexibly and automatically configurable to support the operational processes. However, an OV often has materiel constraints and requirements that must be addressed. Where appropriate, system or physical nodes that constitute the location of an operational node shall augment the description of an operational node. These are often taken as recommendations or boundaries for further SV details. Figures 1 and 2 show example OV-2a diagrams.

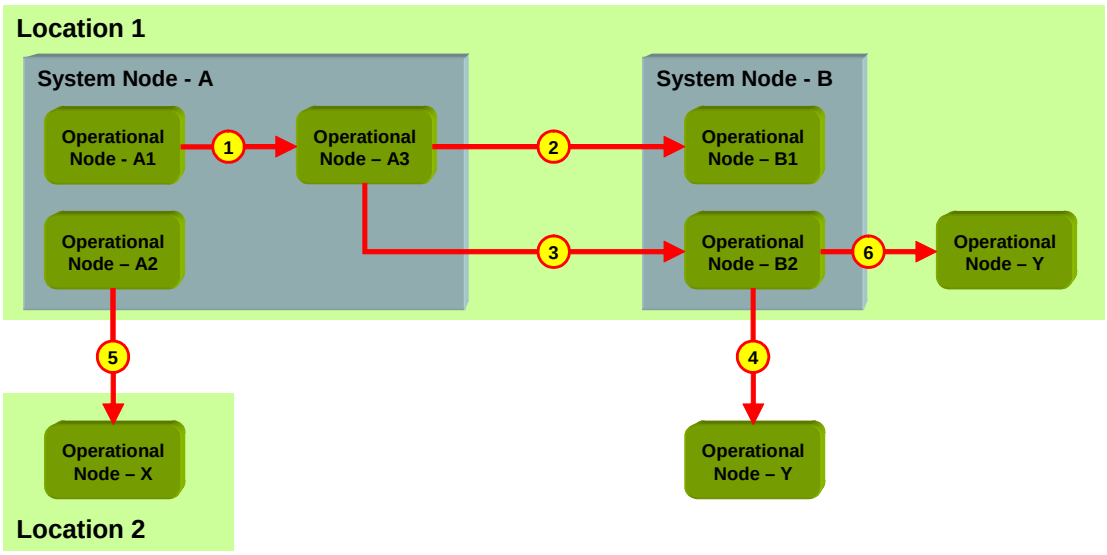


Figure 1 – Generic OV-2a Example

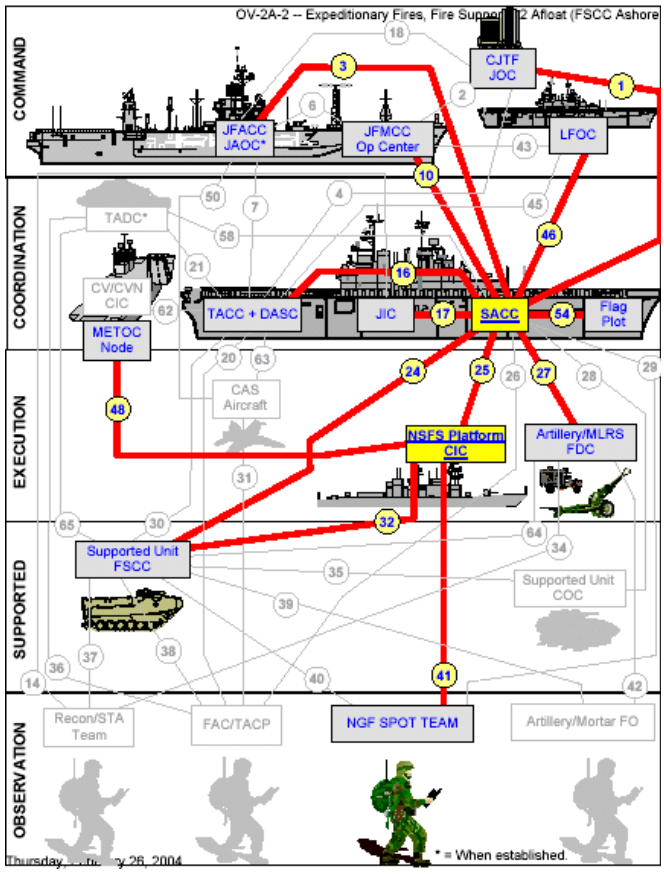


Figure 2 – Example OV-2a from US Navy

Service provider architectures also use a type of logical node. One purpose of a service provider architecture can be to communicate an external view of the available services to potential subscriber communities. In this situation, the service provider's OV-2a (and OV-3) can use generic representations of the subscriber environments it supports and, potentially, of the service provider facilities as well.

For the service provider, needlines may focus on the characteristics of the service provided or on a generic type of information to be exchanged and not on the exact type or critical attributes of the actual information exchanged. What is represented depends on the type of service being provided. For example, a communications service provider will describe needlines in terms of the type of information to be transferred, with what reliability or priority and security features. A human resources (HR) services provider will describe needlines in terms of the complete set of HR information produced or consumed, but any given subscriber may only deal with a subset of this information. Figure 3 is a notional example of service providers and subscribers.

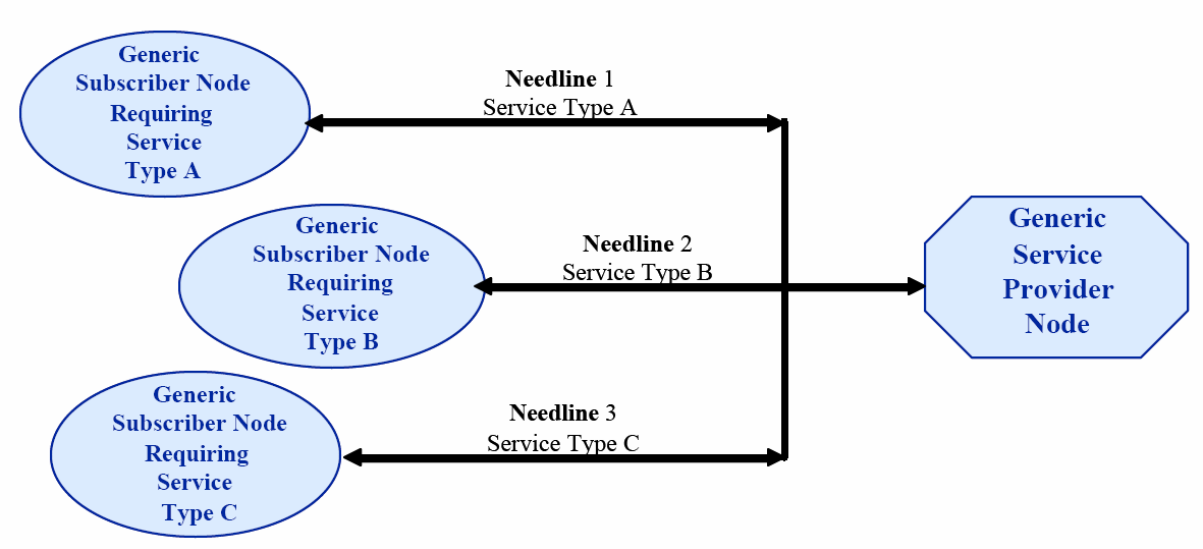


Figure 3 – Example OV-2a for Service Provision

Subscribers can use information from the service provider's OV-2a to build the portions of their own OV-2a that include use of services from the service provider. The subscribers fill in the blanks or make specific the relevant generic portions of the service provider's OV-2a.

Taxonomies

The MODAF Taxonomy is to be developed in a related project in conjunction with the communities of interest. The Integration Authority is coordinating current work and subsequent ownership will rest with DG Info.

UML Representation

OV-2a may be expressed as a UML class diagram, using the stereotypes defines in the MODAF Meta Model. Figure 4 shows an example OV-2a diagram in UML, based on the US Navy example in Figure 2.

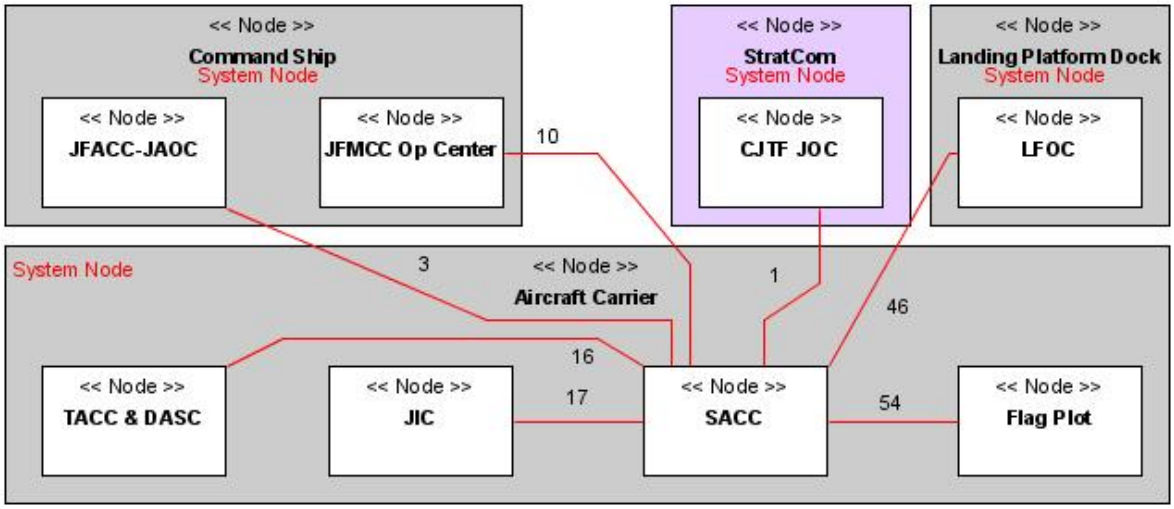


Figure 4 – Example UML for OV-2a

As there is often no clear distinction between system nodes an operational nodes (usually depends on user viewpoint), the MODAF Meta-Model uses a generic <<Node>> stereotype to cover both. As system nodes and operational nodes may be shown on an OV2a, it is necessary to differentiate between the node types in an OV-2a UML diagram. In the example above, this has been achieved with a text annotation on the class.

Operational Node Needline Specification (OV-2b) – Product Description

Product Definition – The *Operational Node Needline Specification* (OV-2b) describes each needline identified in the OV-2a, and defines the nature of the information to be exchanged or shared across that needline.

Product Purpose – The OV-2b is used to specify the information exchange requirements for each needline.

Product Detailed Description – The OV-2b defines the information requirements of each needline at a high level. Whereas SV-2d specifies the detailed schema for data transmission, the OV-2b concentrates on capturing the types of information that is to be exchanged or shared.

On OV-2b specification shall be produced for each needline shown in the OV-2a. Each OV-2b specification shall include:

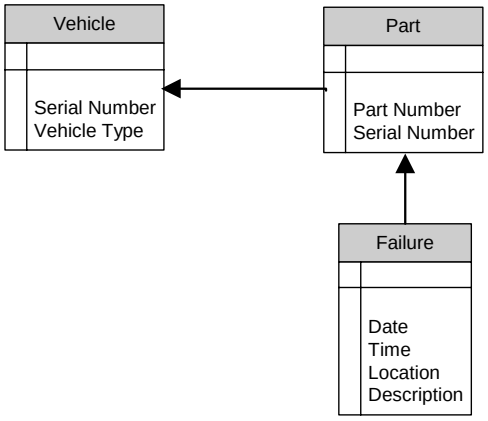
- *The needline identifier* – usually a number, shall correspond to identifiers in OV-2a
- *The needline name* – usually the phrase used in the OV-2a
- *The needline description* – a textual requirement specification (possibly with illustrative diagrams) describing the information to be exchanged across the needline
- *Logical data model (optional)* – a data model defining the information to be exchanged

The information in OV-2b may be shown as a key description on an OV-2a diagram, or as a separate product.

Figure 5 shows some example OV-2b specifications.

Needline 1 **Full Theatre Situational Picture**
Communicating location and movement information about red, blue and non-aligned forces that are in theatre back to HQ. Covering air, ground and naval forces.

Needline 2 **Operational Feedback (Logistics)**
Communicating failure reports from land vehicles back to IPT for analysis. Communications shall include vehicle identification, part number of failed item, a description of the failure, and the date, time and location at which the failure occurred.



Needline 3 **Theatre Imagery**
Communicating electronic imagery (visual and IR spectrum) from observation drones to local command HQ.

Figure 5 – Example OV-2b

The OV-2b provides the requirements specification for the connectivity which is described in detail in the SV-2. For example, needline 1 in Figure 5 may be implemented using the C2IEDM standard, needline 2 as PLCS DEX 7 and needline 3 as TIFF images.

Taxonomies

The MODAF Taxonomy is to be developed in a related project in conjunction with the communities of interest. The Integration Authority is coordinating current work and subsequent ownership will rest with DG Info.

UML Representation

It is not recommended that a UML representation would be used for an OV-2b.

MODAF Meta Model Support for OV-2

The MODAF Meta-Model defines a UML profile for exchanging information between MODAF tools using the XMI file format. For OV-2a the appropriate section of meta-model needed to exchange that view's information is shown in Figure 6. Figure 7 shows the excerpt for OV-2b. It should be noted that the classes shown for one view may be used in several other views.

The classes defined in the MODAF Meta-Model specify the allowable UML stereotypes that may be exchanged in an XMI file. As it is a meta-model, all relationships that feature in the view are also modelled as classes. Rather than define a class for every conceivable item that could appear in a view, the meta-model defines generic classes and allows references to the MODAF Taxonomy. For example, the MOD would be represented in XMI as an Organization stereotype, with a tagged value referring to the element in the taxonomy which says “Ministry of Defence”.

For more information on the use of XMI in MODAF, refer to the document “XMI UML & MODAF”, available from www.modaf.com

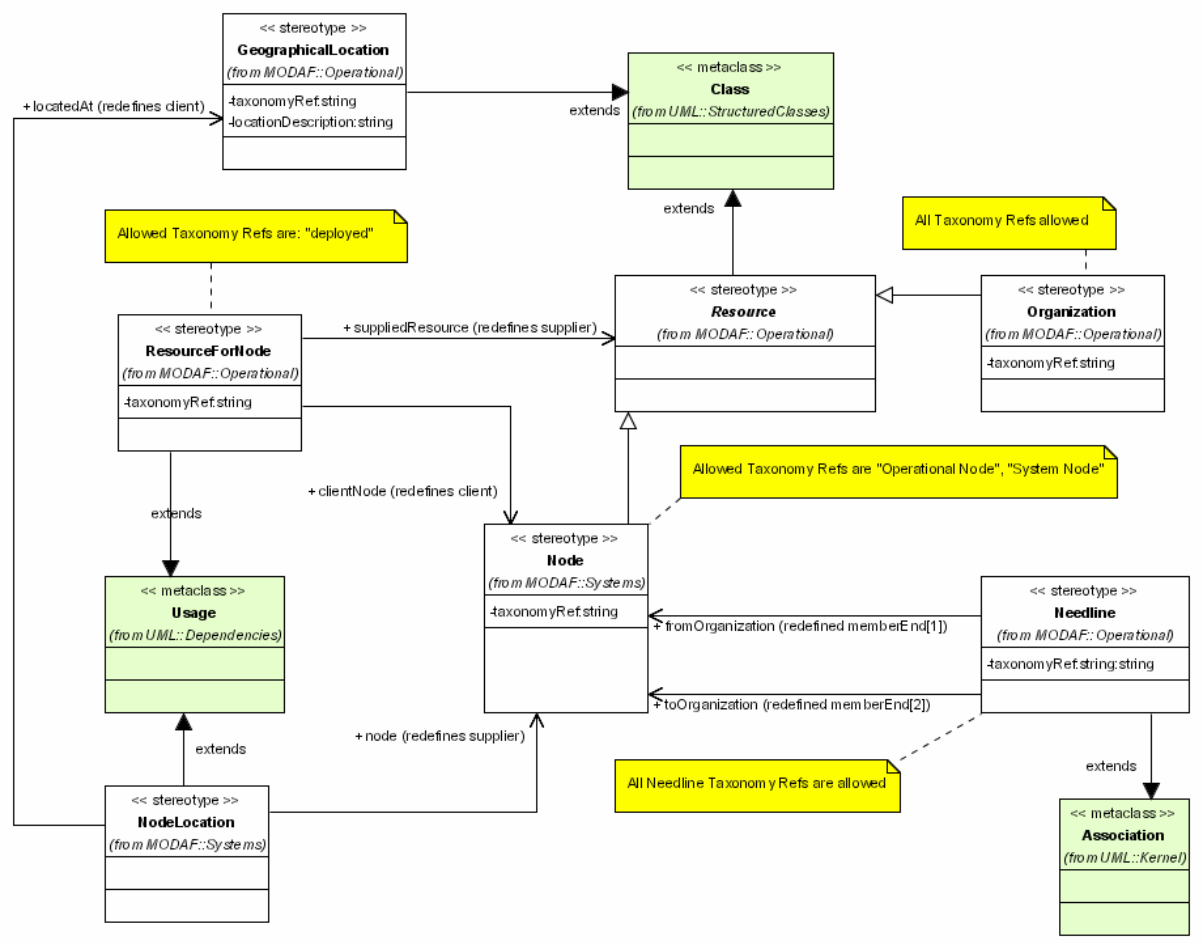


Figure 6 – MODAF Meta Model Excerpt for OV-2a

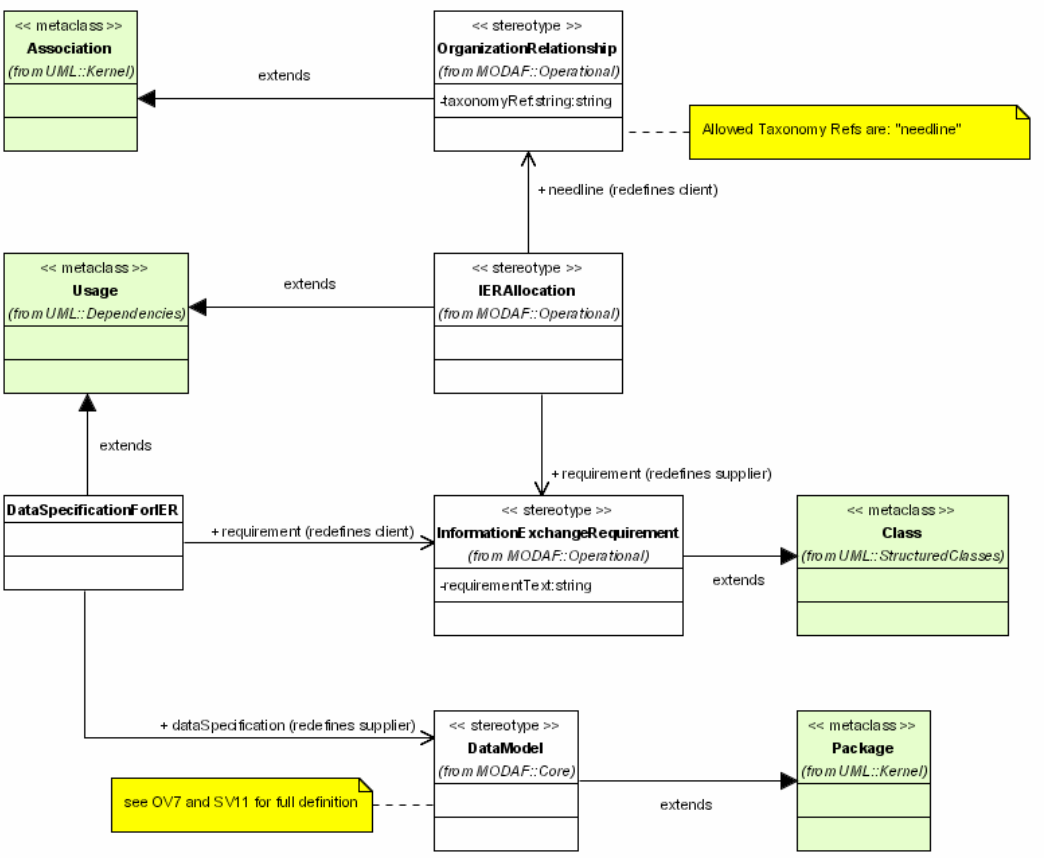


Figure 7– MODAF Meta Model Excerpt for OV-2b

Model Element Definitions for OV-2

DataModel – A structural specification of data, showing classifications of data elements and relationships between them.

DataSpecificationForIE – A relationship asserting the DataModel which defines the structure of data to be used in an InformationExchange.

GeographicLocation – A location anywhere on the earth. The means of describing the location is a string (*locationDescription*). The information contained in that string is governed by the taxonomy reference – e.g. if the GeographicLocation is a “GPS reference”, the string will contain the GPS coordinates.

InformationExchange – A specification of the information that is to be exchanged.

IEAllocation – A relationship between a needline and an InformationExchange – used only when the needline represents an exchange of information (as opposed to materiel or energy).

Needline – A relationship specifying the need to exchange information, energy or matter between nodes. The needline does not indicate how the transfer is implemented.

Node – A grouping of organizations and systems (and other nodes) for a particular purpose. In OV-2, allowable types of node are “System Node” and “Operational Node”.

NodeLocation – A relationship asserting the GeographicalLocation at which the Node is positioned.

Organization – A group of persons, associated for a particular purpose.

Resource – Something that is able to supply functionality, information or material. ABSTRACT.

ResourceForNode – An assertion that a resource is provided to a node.

System – A coherent combination of physical artefacts, energy and information, assembled for a purpose.

MODAF Partners

This document has been prepared by MODAF partners with contributions from David Mawby (PA Consulting Group), Fariba Hozhabrafkan (Cornwell Associates), Ian Bailey (Cornwell Associates), and David Pile (PA Consulting Group)