MINISTRY OF DEFENCE

MOD Architectural Framework

White Paper on Systems View 1 (SV-1): *Systems Interface 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	14 November 2004	First draft for review
Draft 0.2	21 January 2005	ERM Excerpts removed for release.
Draft 0.3	27 January 2005	Final revision prior to release

Introduction

The purpose of this paper is to describe the initial content and layout of the modified SV-1 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.

The existing DoDAF SV-1 does not mandate that relevant operational nodes are shown in the diagrams, though in practice most DoDAF compliant architectures follow this good practice. The MODAF SV-1 recommends that operational nodes be shown *overlaid* on the systems nodes at which they are deployed. In all other respects, the MODAF SV-1 specification is the same as that for DoDAF.

[1] CM(IS) NEC Next Steps paper of April 2003

Systems Interface Description (SV-1)

Systems Interface Description (SV-1) – Product Description

Product Definition –The *Systems Interface Description* depicts systems and identifies the interfaces between those systems. An SV-1 also shows the system nodes[2] at which those systems are located, and overlays operational nodes that are deployed at systems nodes.

Product Purpose – SV-1 identifies where relationships exist between systems – i.e. the key interfaces. Sub-system assemblies may be identified in SV-1 to any level (i.e. depth) of decomposition the architect sees fit. SV-1 may also identify the system nodes (e.g. platforms) at which systems are deployed, and optionally overlay operational nodes that utilise those systems.

Product Detailed Description – SV-1 links together the OV and SV by depicting which operational nodes are deployed at each system node, and the systems resident at those systems nodes. SV-1 also shows the key interfaces between systems, and indicates which needlines (specified in OV-2) are satisfied by each of the interfaces. OV-2 depicts the operational nodes representing organizations, organization types, and/or human roles, and the required communications (needlines) between those nodes. SV-1 depicts how those operational nodes are deployed at systems nodes, which systems make up the systems nodes and the interfaces which implement the needlines specified in OV-2.

The term *system* in the framework is used to denote a family of systems (FoS), system of systems (SoS), nomenclatured system, or a subsystem. An *item* denotes a hardware or software item. The term *system node* describes a logical or physical deployment for operational nodes – e.g. locations, platforms, units, facilities, etc. The following are documented in an SV-1:

- **Systems and the interfaces between them**
- **System nodes and the operational nodes deployed at them**
- **Hardware/software items and their associated standards**

Details of the communications infrastructure (e.g., physical links, communications networks, routers, switches, communications systems, satellites) are documented in the Systems Communication Description (SV-2).

In addition to depicting system nodes and systems, SV-1 addresses system interfaces. An interface, as depicted in SV-1, is a simplified, abstract representation of one or more communications paths between systems nodes or between systems (including communications systems) and is usually depicted graphically as a straight line. SV-1 depicts all interfaces that are of interest for the architecture purpose.

An SV-1 interface is the systems representation of an OV-2 needline. A single needline shown in the OV may translate into multiple system interfaces. The actual implementation of an interface may take more than one form (e.g., multiple physical links). Details of the physical links and communications networks that implement the interfaces are documented in SV-2. Characteristics of the interface are described in Systems-Systems Matrix (SV-3). System functions and system data flows are documented in a Systems Functionality

[2] It has become apparent from DoDAF usage that a system node may be the same as an operational 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.

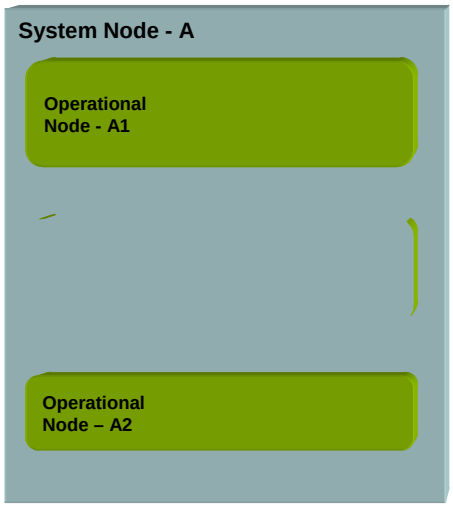
Description (SV-4), and the system data carried by an interface are documented in the Systems Data Exchange Matrix (SV-6).

An interface between systems nodes or systems may be annotated as a Key Interface (KI). A KI is defined as an interface where one or more of the following criteria are met:

- The interface spans organizational boundaries (may be across instances of the same system, but utilized by different organizations).
- The interface is mission critical.
- The interface is difficult or complex to manage.
- There are capability, interoperability, or efficiency issues associated with the interface.

If desired, annotations summarizing the system data exchanges carried by an interface may be added to SV-1.

Wherever possible, an SV-1 should show operational nodes, system nodes and system interfaces for the entire architecture on the same diagram. It should also identify which OV-2 needlines are implemented by each system interface. Figures 1 and 2 show typical SV-1 diagrams. Figure 1 is a generic example showing systems deployed at systems nodes, being used by operational nodes, as well as unmanned systems (e.g. satellites, autonomous vehicles, etc.). Figure 2 is an example from the US Navy, showing operational nodes (SACC, JIC, etc.) located at platforms, and the supporting systems nodes.



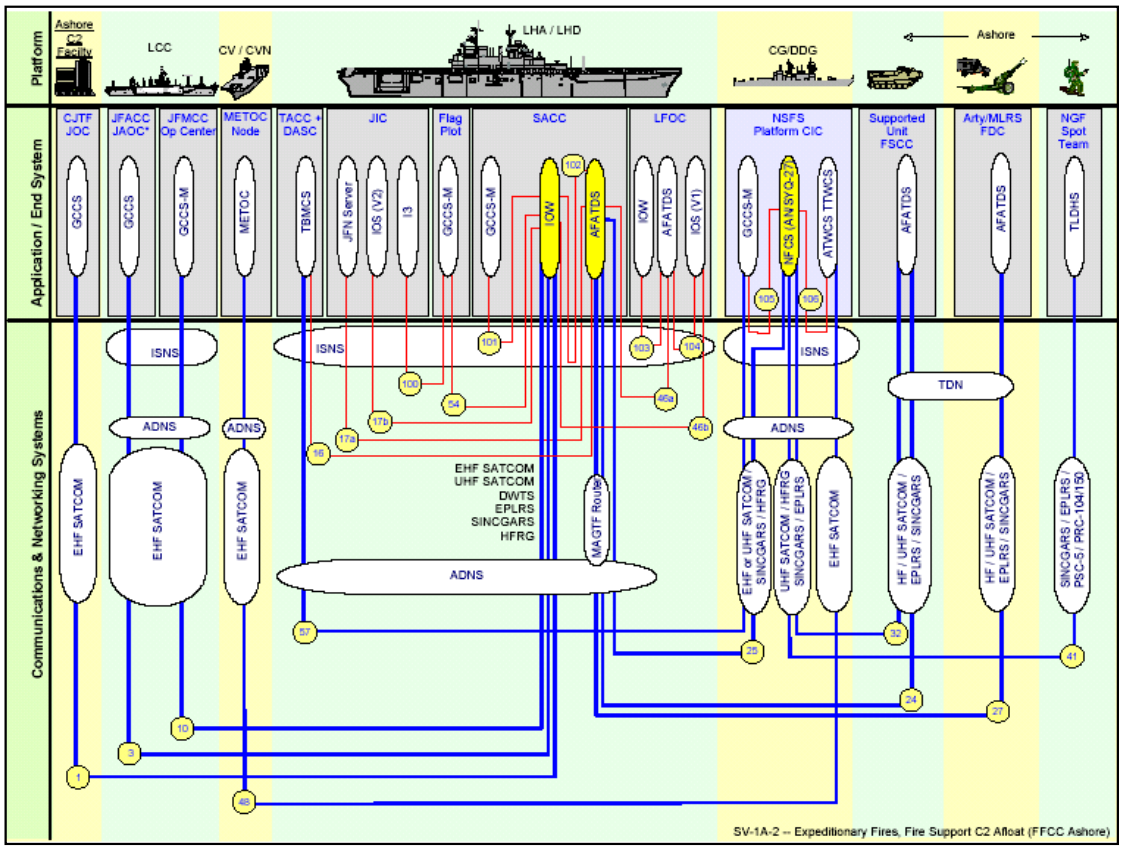


Figure 2 – SV-1 Example from US Navy Using Swim Lanes

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

SV-1 may be expressed as a UML class diagram, using the stereotypes defines in the MODAF Meta Model. Figure 3 shows an example SV-1 diagram in UML, based on the generic example in Figure 1. The type of link between the systems is governed by the taxonomy, and is shown on the diagram as a comment.

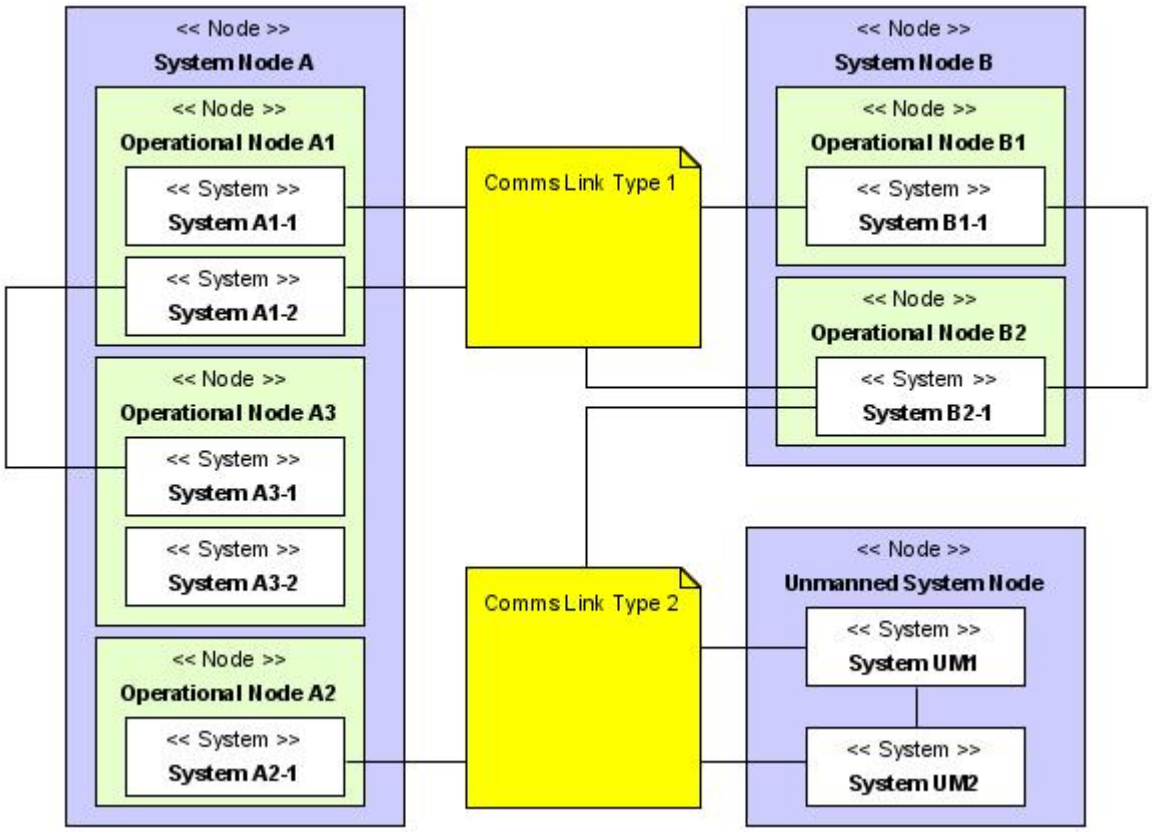


Figure 3 – Example UML for SV-1

MODAF Meta-Model Support for SV-1

The MODAF Meta-Model defines a UML profile for exchanging information between MODAF tools using the XMI file format. For SV-1 the appropriate section of meta-model needed to exchange that view's information is shown in Figure 4. 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

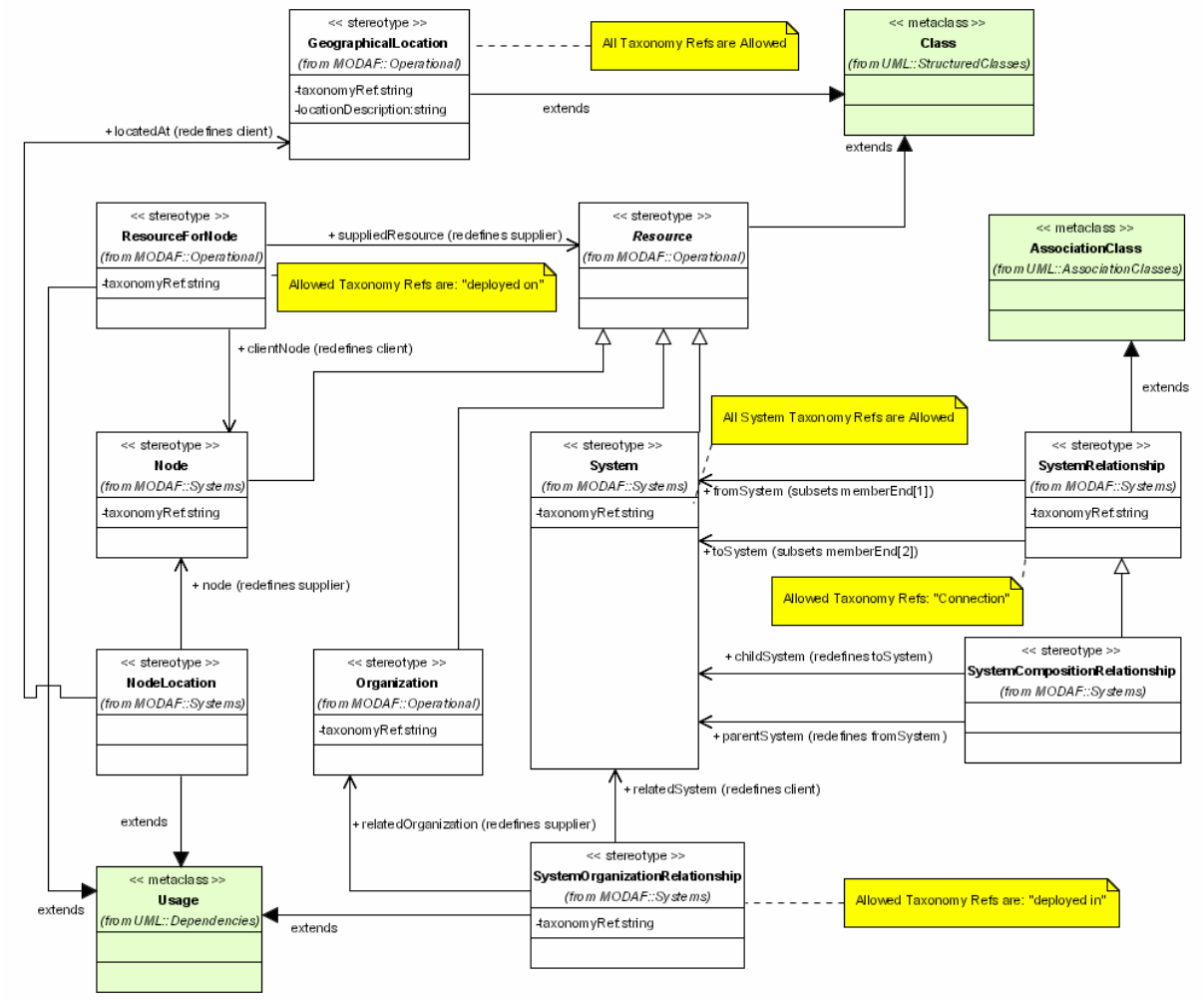


Figure 4 – MODAF Meta Model Excerpt for SV-1

Model Element Definitions for SV-1

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.

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

Node – A grouping of organizations and systems (and other nodes) for a particular purpose. In SV-1, allowable types of node are “System Node” and “Operational Node”.

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

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.

SystemCompositionRelationship – An assertion of a parent-child relationship between systems - the parent being the assembly and the child being a part of that assembly.

SystemRelationship – An assertion of a relationship between two systems. In SV-1, the relationship is only used to assert that a connection can exist between the two systems.

SystemOrganizationRelationship – An assertion that there is a relationship between a system and an organization. In SV-1, the relationship is only uses to assert that an organization uses a system

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)