

Maximizing Discovery of M&S Resources - An Inside Look at the M&S COI Discovery Metadata Specification



Abstract

It is widely recognized that metadata is vital to support the discovery of M&S resources (including models, simulations, data, M&S documentation, etc.). For example, the DoD Net Centric Data Strategy, which identifies the DoD goal to make data visible, accessible, and understandable, states that metadata is needed to “facilitate the discovery of data assets”. This need for discovery -- the ability to locate data assets (software, simulations, tools, data models, and related documents) through a consistent and flexible search -- persists across all M&S communities and services.

The US DoD established a core Defense Discovery Metadata Specification (DDMS) with the intent that individual Communities of Interest (COIs) would extend this metadata specification as necessary to allow discovery of their resources. In response to the need of the M&S community, the Modeling and Simulation Coordination Office (M&S CO), developed extensions to the DDMS to facilitate the search and discovery of M&S resources. The result is the M&S Community of Interest (COI) Discovery Metadata Specification (MSC-DMS).

This paper examines the MSC-DMS and its benefits. We explore the various standards, practices and approaches that have been cross integrated to form the MSC-DMS, and how the resulting metadata schema can be used. This paper will describe the key concepts that comprise the MSC-DMS. We also examine how the MSC-DMS is beginning to be leveraged by various programs and efforts, including the M&S Catalog Project, which is focused on providing an M&S search engine for which such tagged M&S resources can be queried and discovered.

1. Introduction

The Modeling and Simulation Coordination Office (M&S CO), which is chartered by the Office for the Secretary Defense (OSD), is focused on facilitating simulation interoperability across Department of Defense (DoD) agencies and communities including testing and evaluation, analysis, and acquisition. One item that has been of great interest at the DoD level, specific to M&S CO, and also within the wider SISO community is the need to support the aid and discovery of M&S assets. This need for discovery has also been identified as part of the DoD Net-Centric Data Strategy. Specifically, the DoD Net-Centric Data Strategy, dated May 9, 2003, defines goals and approaches for users and systems to discover and access a wide-range of data assets throughout the DoD Enterprise. This concept of

“discovery” is understood as “the ability to locate data assets through a consistent and flexible search.”¹

Over the past two years, M&S CO has led the development of the Discovery Metadata Simulation Modeling and Simulation Specification (MSC-DMS) as means to support the net-centric goals of data visibility of M&S assets across the DoD and related communities. This technical paper reports to the SISO community the research, rationale, and results of this effort.

1.1 Purpose

The purpose of the MSC-DMS has been to standardize on the set of metadata used to describe resources in Modeling and Simulation Resource Repository (MSRR) nodes and similar applications, and to ensure that the product metadata template will align with the DoD

CLEARED
For Open Publication

SEP 09 2008

Office of Security Review
Department of Defense

¹ Deputy Assistant Secretary of Defense, Department of Defense Discovery Metadata Specification (DDMS), Version 1.4, July 1, 2007.

08-5-2502

Maximizing Discovery of M&S Resources - An Inside Look at the M&S COI Discovery Metadata Specification

Abstract

It is widely recognized that metadata is vital to support the discovery of M&S resources (including models, simulations, data, M&S documentation, etc.). For example, the DoD Net Centric Data Strategy, which identifies the DoD goal to make data visible, accessible, and understandable, states that metadata is needed to “facilitate the discovery of data assets”. This need for discovery -- the ability to locate data assets (software, simulations, tools, data models, and related documents) through a consistent and flexible search -- persists across all M&S communities and services.

The US DoD established a core Defense Discovery Metadata Specification (DDMS) with the intent that individual Communities of Interest (COIs) would extend this metadata specification as necessary to allow discovery of their resources. In response to the need of the M&S community, the Modeling and Simulation Coordination Office (M&S CO), developed extensions to the DDMS to facilitate the search and discovery of M&S resources. The result is the M&S Community of Interest (COI) Discovery Metadata Specification (MSC-DMS).

This paper examines the MSC-DMS and its benefits. We explore the various standards, practices and approaches that have been cross integrated to form the MSC-DMS, and how the resulting metadata schema can be used. This paper will describe the key concepts that comprise the MSC-DMS. We also examine how the MSC-DMS is beginning to be leveraged by various programs and efforts, including the M&S Catalog Project, which is focused on providing an M&S search engine for which such tagged M&S resources can be queried and discovered.

1. Introduction

The Modeling and Simulation Coordination Office (M&S CO), which is chartered by the Office for the Secretary Defense (OSD), is focused on facilitating simulation interoperability across Department of Defense (DoD) agencies and communities including testing and evaluation, analysis, and acquisition. One item that has been of great interest at the DoD level, specific to M&S CO, and also within the wider SISO community is the need to support the aid and discovery of M&S assets. This need for discovery has also been identified as part of the DoD Net-Centric Data Strategy. Specifically, the DoD Net-Centric Data Strategy, dated May 9, 2003, defines goals and approaches for users and systems to discover and access a wide-range of data assets throughout the DoD Enterprise. This concept of

“discovery” is understood as “the ability to locate data assets through a consistent and flexible search.”¹

Over the past two years, M&S CO has led the development of the Discovery Metadata Simulation Modeling and Simulation Specification (MSC-DMS) as means to support the net-centric goals of data visibility of M&S assets across the DoD and related communities. This technical paper reports to the SISO community the research, rationale, and results of this effort.

1.1 Purpose

The purpose of the MSC-DMS has been to standardize on the set of metadata used to describe resources in Modeling and Simulation Resource Repository (MSRR) nodes and similar applications, and to ensure that the product metadata template will align with the DoD

¹ Deputy Assistant Secretary of Defense, Department of Defense Discovery Metadata Specification (DDMS), Version 1.4, July 1, 2007.

Discovery Metadata Specification (DDMS) as part of the Global Information Grid (GIG) /Net-Centric Data Strategy.

Metadata is defined as “structured, encoded data that describe characteristics of information-bearing entities to aid in the identification, discovery, assessment, and management of the described entities.”² To state it more simply, metadata is data about data. When exploring the concept of metadata there are two types of metadata that can be identified: Structural Metadata and Discovery Metadata.

- **Discovery Metadata**
 - aid in the recall and retrieval of artifacts
 - Artifacts that we collect resource metadata on (M&S Assets)
 - M&S software
 - Adjunct tools (e.g., data loggers)
 - Federations of simulations
 - M&S services
 - M&S data
 - M&S data models
 - Interface specifications
 - M&S software design documents
 - Register in “Metadata Catalogs”, use DDMS bibliographic information
 - About Making things visible

Figure 1 – Discovery Metadata

As highlighted in Figure 1, *Discovery Metadata* is focused on tagging the outer shell of resources in a way so that the resource is clearly marked and rediscoverable. *Structural Metadata*, on the other hand is focused on describing the framework and organization of information embedded within a resource (the internal aspects). Typically a metadata discussion that doesn’t quantify which type of metadata is being discussed could lead to misinterpretation or misunderstanding among stakeholders. Therefore, it is important to clarify the type of metadata that is being discussed, and also the attributes associated to each type. Again, the MSC-DMS specification that has been developed over the past two years has been focused on defining the necessary attributes for Discovery Metadata.

1.2 Types of M&S Assets

² The Final Report of the Association for Library Collections and Technical Services’ Task Force on Metadata (2000).

The scope of the MSC-DMS has been to identify the necessary Discovery Metadata components needed to support the visibility, accessibility and understandability of M&S assets within the DoD community. Such M&S assets include, but are not limited to the following;

- 1 M&S software (implements a model or simulation)
- 2 Adjunct tools (e.g., data loggers)
- 3 Federations of simulations
- 4 M&S software components
- 5 M&S services (models and simulations implemented as web services)
- 6 M&S data (data in M&S-usable format and data produced by M&S)
- 7 M&S data models (structural metadata for M&S data)
- 8 Interface specifications
- 9 M&S software design documents

2 M&S Discovery Metadata Canvassing Questions

As part of the MSC-DMS development effort, the following inquiries were canvassed of members of the DoD M&S community so that the M&S CO could succeed in defining the essential discovery metadata components needed for the discovery and reuse of DoD M&S assets

- The organization and service program(s) in which the cataloging of resources via metadata is a key need.
- The type of M&S resources an organization or service currently and/or intends to make reusable? Including descriptions of these resources as well as identifying names of each resource.
- The aspects of metadata an organization or service felt was important to be attributed to such resources? In this regard, we asked members to identify the following:
 - What “general” elements of metadata need to be conveyed (i.e., represented) across all resources?
 - What “specific” elements of metadata need to be documented for the resources your organization or program, which may not be a “general” element?
 - What “search” items pertaining to your resources, which are tagged with metadata, are important to offer to users who seeking to find relevant resources (i.e., keywords, POCs, security classification, user experiences, other?)?
- Specific metadata structure used to support the identification and discovery of an organization or

services resources? In this regard, we asked members to identify the following:

- Has your organization selected an existing metadata structure to support the identification and discovery of your resources? OR
- Has your organization developed their own metadata structure to support the identification and discovery of your resources?
- If it can be identified by name, what metadata structure(s) has your organization defined (or selected) to support the identification and discovery of your resources?
- The storage medium / mechanism (i.e. database) employed (or being planned to employ) in regards to cataloging M&S resources? In this regard, we asked members to identify the following:
 - What technology capabilities you plan (or plan to employ) for providing network access to your resources? (i.e., web based, web services, Sharepoint, Drupal, Oracle, MySQL, MS Access)
 - Do you plan to use existing resource repositories that are available? (i.e., MSRR, MSIAC), OR
 - Do you plan to build and maintain your own resource repository?
 - Will access to your repository (and resources) be limited to your internal organization, or do you plan to share your resources with other programs and organizations?
- The interest in leveraging and reusing M&S assets that may be developed and available elsewhere. In this regard, we asked members to identify the following:
 - Is it vital that the resources that you or your organization search for be tagged using the same metadata structure that you have employed?
 - Is there an issue with your organization if the resources you may search for be tagged using a different metadata structure? Will your organization accept resources acquired from another organization if the metadata structure is tagged differently?
 - Do you and your organization use (or plan to use) mechanisms to convert (transform) foreign resources that are tagged differently to the structure your organization has adopted?
- Whether the metadata structure an organization has adopted is defined in XML as a Schema? DTD?
 - If not, we have asked members to identify the following:
 - How is metadata structured presently for an organization?
 - If the organization plans to adopt an XML based metadata structure, and in what time frame?
 - For one or more resources to be provided as an example to understand how the schema is used?
 - If so, we have asked members to identify the following:
 - If the metadata schema / DTD be used can be shared with M&S CO for analysis?
 - If one or more resources also be provided as an example to understand how the schema is used?
- The importance of security and access rights of the M&S resources your program catalogs, In this regard, we are asking members to identify the following:
 - Is it possible your organization would share M&S resources if an outside user had the right access credentials?
 - Describe what mechanisms your organization has put in play in regards to limiting access? Are they imposed using username / password protection at the portal level of the repository? Are they (also) imposed at the metadata level?

In addition to these questions, we also encouraged community members to provide additional comments that would help us reflect the necessary metadata elements(s) needed to facilitate discovery of metadata resources within the DoD community.

3 M&S Discovery Metadata Logical Model

Based on the needs of the DoD M&S community, the MSC-DMS identifies both the mandatory and recommended Core set of metadata for the discovery of M&S assets, and identifies the Supplemental set of metadata for supporting specific community M&S datasets such as acquisition, test and evaluation (T&E), and analysis, and supporting services such as the Navy, Army, Air Force, and Marine Corp, and the associated practices that are cross-cutting for such communities and services such as verification, validation and accreditation (VV&A).

Figure 2 depicts the organization of the metadata within the MSC-DMS.

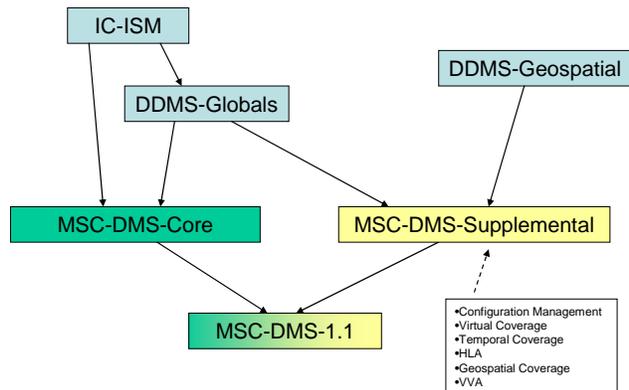


Figure 2 – Organization Structure for the M&S COI Discovery Metadata Specification

The “Green” shaded boxes in Figure 2 represent those core metadata elements and entities needed or recommended for all types of M&S resources. The “Yellow” shaded boxes above represent those supplemental metadata elements and entities which are either suggested or provided to enhance a specific operational requirement or community interest. The “Yellowed Gray” shaded boxes to the right also represent those supplemental elements and entities which may be required in some community, service or application specific contexts. The “Light Blue” shaded boxes above represent existing standards that are leveraged in helping define the MSC Discovery Metadata for either the “Green” shaded boxes or “Yellow” shaded boxes.

3.1 Integration Approach

Various metadata profiling and harmonization efforts have been undertaken across the DoD M&S community, among them is the influence of current standards development work to support M&S Discovery Metadata requirements. Specific standards and service approaches for documenting M&S assets for all the layers described above have been integrated to formulate the M&S Discovery Metadata specification identified in this document. Such standards, specifications and guides include the following:

- DDMS
- HLA Object Model Template / Base Object Model Specification – Object Model Identification
- Product Development Metamodel Specification (PDMS)
- MSRR (DoD, Navy, Air Force, Army)

- VV&A Recommended Practice Guide

Additionally input has been sought from the communities including the following:

- The analysis community, which is represented by the Joint Data Support (JDS) organization,
- The repository community, which is represented by the various service MSRRs, and the MSIAC,
- The test & evaluation community, which is represented by the various services including Army and Navy.
- The M&S Catalog Project Team.

3.1.1 DDMS

The Department of Defense Discovery Metadata Specification (DDMS), for which much of the M&S Discovery Metadata specification is modeled, defines Discovery Metadata elements for resources posted to community and organizational shared spaces. It is designed using a layered approach, combining a Core Layer and an Extensible Layer. The Core Layer is composed of four sets of element categories, each with a specific functional focus for describing a data asset. These four core layer areas include the following: security, resource, summary content, and format. The Extensible Layer provided by the DDMS allows for extensions, such as those documented in this specification, to be identified.

It’s important to note that the DDMS itself is a derivative and integration of other metadata efforts including the IC ISM, ISO Dublin Core, and W3C standards (OWL, Date & Time) as illustrated in Figure 3. These same external standards are also relevant to the M&S Discovery Metadata specification.

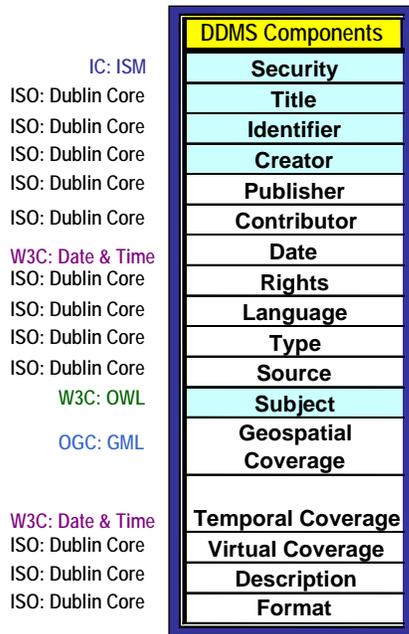


Figure 3 –DDMS Structure

Further information regarding the DDMS can be found in the Department of Defense Discovery Metadata Specification (DDMS), Version 1.4, 1 July 2007, Deputy Assistant Secretary of Defense.

For the MSC-DMS effort, much of the DDMS was used to formulate its structure. Exploration of the various communities needs were weighed against the DDMS to determine which aspects were necessary for the core aspects of the MSC-DMS, and which aspects were better suited for the supplemental aspects of the MSC-DMS.

3.1.2 HLA OMT / BOM – Model Identification

The HLA Evolved OMT and the BOM specification, which follow similar metadata conventions, were analyzed and evaluated to determine which elements and entities should be incorporated with the Core Layer and Extension Layer of the MSC-DMS.

One thing that is in common with HLA object models (such as FOMs and SOMs) and Base Object Models (BOMs) is that they both provide information that enables inferences to be drawn regarding their reuse potential for supporting the extension and creation of models, simulations, and federations. It is important to include a minimum but sufficient degree of descriptive information within an HLA FOM or SOM, or within a BOM. For instance, when developers wish to pose detailed questions to those who were responsible in the

development and distribution of the FOM, SOM or BOM, point-of-contact (*POC*) information provided by such models is important. The purpose of the Model Identification table is to document certain key *metadata* information about the object model. Figure 2-4 illustrates the key elements provided by this table.

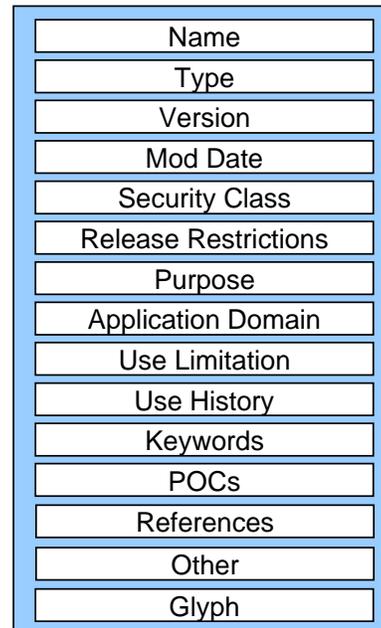


Figure 4 – Model Identification Structure used for HLA OMT and BOM

It is important to note that the Model Identification illustrated in Figure 4-4 carries both the pedigree of the previous HLA OMT specification (IEEE 1516.3) and also DDMS Version 1.3, which was evaluated and leveraged during the creation of the BOM Specification, and also later for the HLA Evolved OMT Specification. Since much of the under pinning of the Model Identification can be correlated with the DDMS and knowing that the Model Identification helps to foster discovery of M&S resources such HLA object models and Base Object Models, it is only logical to analyze, evaluate and integrate useful elements and entities from the Model Identification that could be used to help facilitate M&S resource discovery. As such, specific fields that have been incorporated into the MSC-DMS include Application Domain, Use Limitation, Use History, References, multiple POCs, and the Glyph identifier among others.

3.1.3 PDMS (Acquisition)

For the Joint Strike Fighter (JSF) Program, information related to concepts being employed to manage the range of product development data (e.g., representations of the JSF Air System, threat systems, and operational contexts), and the information required to make and to support decisions regarding weapons systems, must be configuration-controlled, protected, shared, understood, evaluated and used across the JSF enterprise. This ability to manage digital data produced as part of the product development process is of specific interest to the acquisition community. The Product Development Metamodel Specification (PDMS), which was developed by the JSF program, offers a formalized set of metadata concepts to manage information resources and models.

Since the acquisition community is a key user of M&S resources, the PDMS has been analyzed and evaluated to determine which elements and entities should be incorporated with the Core Layer and Extension Layer of the MSC-DMS. Like the Model Identification defined by the HLA OMT Evolved Specification and the BOM Specification, the PDMS also has ties with existing metadata standards and efforts including the DDMS, the Dublin Core Metadata Element Set, and the Verification, Validation, and Accreditation (VV&A) Recommended Practices Guide (RPG).

The team that developed the PDMS identified two principle goals which are shared with the effort reflecting the MSC-DMS strategy. This includes the desire to (1) establish concepts necessary to locate, assess and properly use data by documenting its meaning, structure, lineage, and limitations, and (2) enable interoperability among information systems compliant with the specification.³ In the case of the MSC-DMS effort, the development team representing the M&S COI, has attempted to identify the concepts necessary to discover and understand M&S resources by defining a means to document a resources capability, history, and stakeholders. This is similar to PDMS principle goal #1. Additionally, the MSC-DMS goal to facilitate interoperability and exchange of data across all communities and services which require M&S resources can be found similar to goal #2.

Considering that the PDMS is focused on a “metamodel”, as opposed to metadata, the PDMS provides focus on three types of resource artifacts and

their relationship. These include Information Resources, Information Resource Classes, and Information Models.

While each of these metamodel components share similar characteristics, of most interest to the MSC-DMS effort is the way the PDMS describes and tags Information Resources, as this provides the closest match to outlining what is needed for Discovery Metadata. As such, the MSC-DMS leveraged, as appropriate, what is used to tag an Information Resource, see Figure 5.

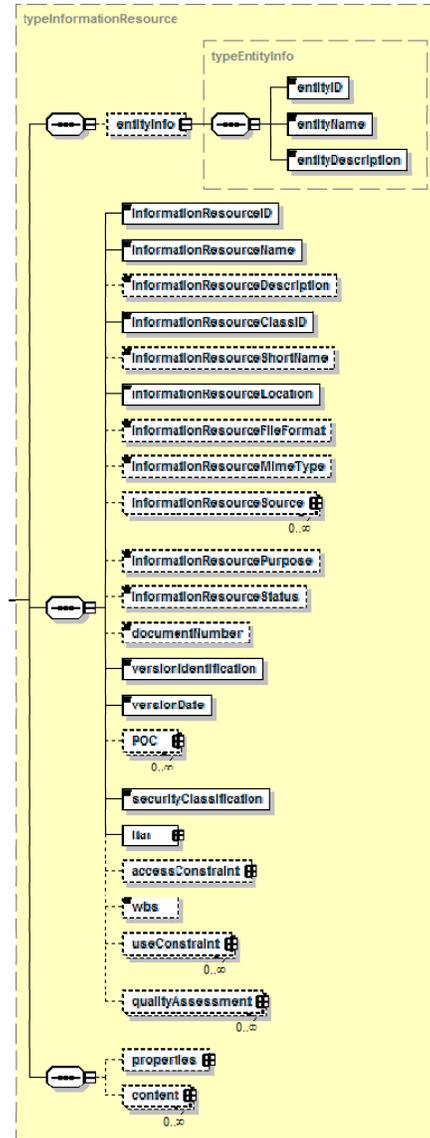


Figure 5 – PDMS Information Resource

³ Product Development Metamodel Specification, Version 1.0, Prepared for JSF Program Office & DMSO, 22 June 2004.

3.1.4 Modeling and Simulation Resource Repositories (MSRRs)

Each of the major services offers and manages its own Modeling and Simulation Resource Repository (MSRR). These online repositories offer the community a way to register and identify M&S resources including data sources, documents, models and simulations, and supporting tools and utilities. For this effort each of the three major MSRRs have been examined in order to identify both Core and Supplemental elements useful for cataloging M&S resources.

The specific type of data sources that are supported by the service MSRRs include the following: databank, dataset, document, library, repository, software program, subject matter expert, warehouse, and other. For this effort, the specific data source types of interest included datasets, documents, and software programs as these are identified as key M&S resources for which Discovery Metadata is needed. In addition to these data source types, the registration process for models, simulations, and simulators was examined as well as the registration process for support tools and utilities, which may be used in the support, development, and management of a services' M&S activities.

What is interesting to note is that while each of the three service MSRRs support the registration of the same common types of resources, the information collected for each of these resources is not exactly the same. An attempt to extract and identify the information of interest both at the Core and Supplemental layers was reflected in the MSC-DMS. Additionally, the following Supplemental Categories have been identified from the MSRRs.

- HLA Coverage
- VV&A Coverage

3.1.5 JDS (Analysis)

The Joint Data Support (JDS) program representing the Analysis community also shared their requirements in regards to the cataloging and retrieval of information. Each item desired to be reflected in support of the JDS program was evaluated and, where appropriate, mapped with the resulting M&S Discovery Metadata.

3.1.6 VV&A

There are several M&S related VV&A documents, artifacts, and requirements that have been developed

and shared over the last few years. As many of these as possible were examined to ensure that, as an extension to the M&S Discovery Metadata (via the Supplemental Layer), the attributes of VV&A could be captured. The VV&A Recommended Practice Guide (RPG) has provided an initial set of metrics and attributes that have been analyzed. In fact, the VV&A RPG was examined and leveraged in helping craft the creation of the current proposed Model Identification provided for the HLA OMT, and the Model Identification that has been standardized within the BOM. Because the Model Identification has played a key part in identifying the elements of the M&S Discovery Metadata specification, it can be said that there is already pedigree with the VV&A RPG, as there is with the Dublin Core metadata standard, which the DDMS leveraged.

In addition to the VV&A RPG, VV&A needs from the Navy have also been captured and analyzed, which have helped in the formation of the M&S Discovery Metadata specification described in this document. Additionally, the VV&A attributes identified for resources being registered within the MSRRs were analyzed as well.

4 Resulting Resource Metadata Set

Figure 6 provides an illustration of the resulting Resource Metadata Set, which integrates Core Layer and Supplemental Layer component views pertaining to Discovery Metadata.

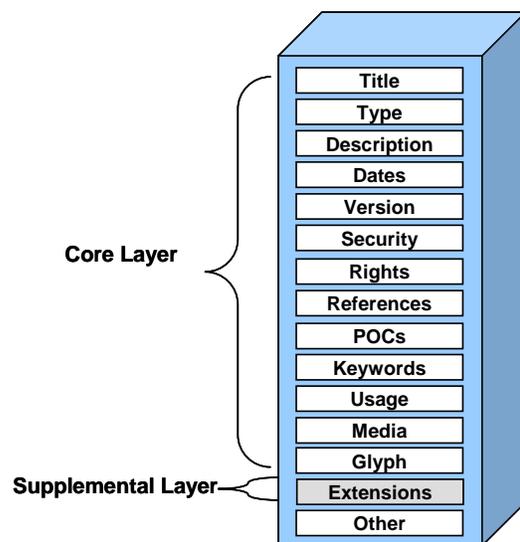


Figure 6 MSC-DMS Structure for the Resource Metadata Set

These metadata sets provide information that enables inferences to be drawn regarding the reuse potential for supporting the extension and creation of M&S resources for specific communities and domains. Each of these supplemental extensions is intended to add value to MSC Discovery Metadata.

Table 4.1 provides a description of the metadata elements pertaining to the Resource Metadata Set information. Again, many of the metadata elements used for the Resource Metadata Set are leveraged from the DDMS, however there are some additional metadata elements that were extended, altered or added to better support the M&S Community of Interest (COI).

Table 4-1 Resource Metadata Set

Metadata Element	Description
Title (<i>mandatory</i>)	Title information assigned to the resource. A resource may not only be identified by a title value, but also by a subtitle, acronym, or document number. Typically these values, once determined, do not change even if the resource is updated.
Type (<i>mandatory</i>)	This field specifies the type that the resource represents. Also described as the nature, genre, or discipline of the content of the resource.
Description (<i>mandatory</i>)	This field provides an account of the content of the resource.
Dates (<i>mandatory</i>)	A calendar date associated with an event in the life cycle of the resource.
Version (<i>mandatory</i>)	This field specifies the version identification assigned to the resource.
Rights (<i>recommended but optional</i>)	Information about rights held in and over the resource.
Releasability (<i>mandatory</i>)	Information about the releasability of the title information.
Security (<i>recommended but optional</i>)	Information about the security of the resource.
Associations (<i>recommended but optional</i>)	Specifies references to original source material used to develop or derive the resource. Serves as a container class to identify multiple references
POCs (<i>mandatory</i>)	Specifies organizations and/or persons who has a particular role with respect to the M&S resource. At least one set of POC information be supplied. Multiple sets may be supplied.
Keywords (<i>mandatory</i>)	Specifies one or more keywords attributed to the M&S resource. Typically, a Keyword will be expressed as keywords, key phrases or classification codes that describe a topic of the resource. Recommended best practice is to select a value from a controlled vocabulary or formal classification scheme. This may list keywords that apply to the resource, or a particular subject Metadata Set, which will aid the user in understanding the genre of the content.
Usages (<i>recommended but optional</i>)	Specifies information about one or more usages pertaining to the M&S resource.

Media (<i>recommended but optional</i>)	Specifies information about the media pertaining to the M&S resource
Glyph (<i>recommended but optional</i>)	Specifies an image that can be used to visually represent a resource.
Extensions (<i>recommended but optional</i>)	Specifies one or more extensions that can be added to the core M&S resource metadata
Virtual Coverage	Specifies virtual coverage extension that can be added to core metadata
Temporal Coverage	Specifies temporal coverage extension that can be added to core metadata
Geospatial Coverage	Specifies geospatial coverage extension that can be added to core metadata
HLA Coverage	Specifies HLA coverage extension that can be added to core metadata
Configuration Management	Specifies configuration management aspects that can be added to the core metadata
VVA Coverage	Specifies additional vv&a coverage aspects that can be added to the core metadata
Other	Specifies other extension information deemed relevant by the author of the resource.
Other (<i>optional</i>)	Specifies other data deemed relevant by the author of the resource.

5 Summary

The MSC-DMS document is currently at version 1.1, with the expectation that version 1.2 will be released December 2008 based on community feedback. The MSC-DMS is currently being leveraged by the M&S Catalog Project team, which is focused on providing an M&S search engine for which such tagged M&S resources can be queried and discovered. Additionally, it is expected that the MSC-DMS will find significant use across the various services and communities including analysis, acquisition, test and engineering, and training.

References

1. Modeling and Simulation (M&S) Community of Interest (COI) Discovery Metadata Specification (MSC-DMS), DoD M&S Coordination Office, Preliminary Release, Version 1.1, 18 August 2008.
2. Deputy Assistant Secretary of Defense (Deputy Chief Information Officer), "Department of Defense Discovery Metadata Specification," Version 1.4.1, 10 August 2007
3. IEEE Standard for Modeling and Simulation (M&S) High Level Architecture (HLA) - Object Model Template (OMT) Specification, IEEE Std 1516.2-2000.
4. Defense Modeling and Simulation Office (DMSO), VV&A Recommended Practices Guide, Millennium Edition, <http://vva.dmsomil>, 2001

Author Biographies

PAUL GUSTAVSON is Chief Scientist at SimVentions, Inc, and has over 19 years of experience including the design and development of DoD standards, simulation systems, software applications, and numerous technical publications and tutorials on simulations and software development. Currently he is supporting the M&S Coordination Office (M&S CO) in helping to identify key metadata needed for the cataloging and discovery of M&S assets. He has been an active leader within the Simulation Interoperability Standards Organization (SISO) involved in multiple standards efforts including the Base Object Model (BOM), Distributed Simulation Engineering and Execution Process (DSEEP), and HLA Evolved. He is a co-author of several books including “C++Builder 6 Developer’s Guide.” Mr. Gustavson holds a Bachelor of Science degree in Computer Engineering from Old Dominion University, and lives in Virginia with his wife and two boys.

ALI NIKOLAI is the Principal Data Engineer on the System Engineering Technical Assistance contract for the Defense Modeling & Simulation Coordination Office (M&S CO). She provides technical support on issues and projects regarding data management, including: 1) Analyzing both current and future issues and DoD policies involving data in regard to M&S initiatives in the DoD M&S community; 2) Developing plans and managing technical projects for the M&S CO. Ms. Nikolai has over 30 years of experience in systems management and development serving DoD clients, including management of the DoD Data Architecture program for DISA. She also has provided system engineering and logistic support for the active Army and the Reserve Component. Ms. Nikolai holds a Bachelor of Science degree in Biology from Gannon University in Erie, PA and a Master of Science in Management from Troy State University in Alabama.

ROY SCRUDDER is an Associate Director at the US DoD Modeling and Simulation Coordination Office (M&S CO) where is he is the lead for data activities. He has over 25 years experience in information systems analysis and development, concentrating the last 13 years in information management for M&S. Mr. Scrudder's professional experiences are in the areas of data management and data engineering with a specialization in metadata. He has served as the director for the M&S Resource Repository Board of Directors and led the Analysis of Alternatives for future capabilities in that area. Mr. Scrudder holds a Bachelor of Science degree in Applied Mathematics from the University of Tennessee.



SimVentions
Imagine. Create. Explore. Discover.



MSCO
Modeling & Simulation Coordination Office

Maximizing Discovery of M&S Resources - An Inside Look at the M&S COI Discovery Metadata Specification (MSC-DMS)

Paul Gustavson
pgustavson@simventions.com

Ali Nikolai
Alberta.Nikolai.ctr@osd.mil

Roy Scrudder
roy.scrudder@osd.mil

**SLIDES ONLY
NO SCRIPT PROVIDED**



Fall 08 SIW

08F-SIW-043

1

08-5-2502

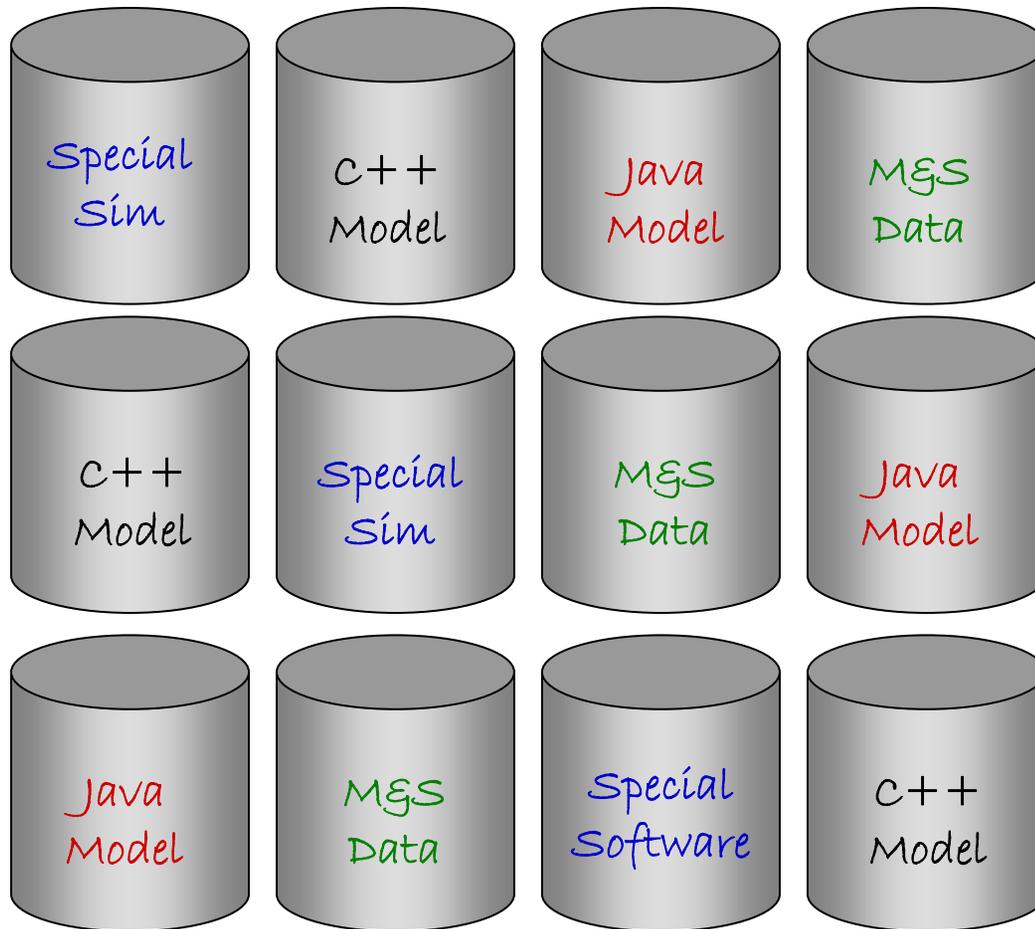
Maximizing Discovery of M&S Resources - An Inside Look at the M&S COI Discovery Metadata Specification (MSC-DMS)

Paul Gustavson
pgustavson@simventions.com

Ali Nikolai
Alberta.Nikolai.ctr@osd.mil

Roy Scrudder
roy.scrudder@osd.mil

What's Really on the Shelf?



What's really on the shelf.

Cans marked with a sharpie pen?

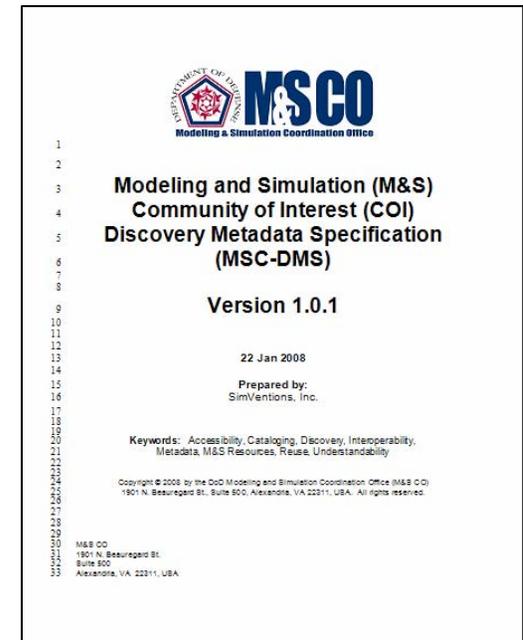
Hard for folks to find what they really need.

And understand what they can do with the components available to them.

This has been a common problem throughout the DoD / industry

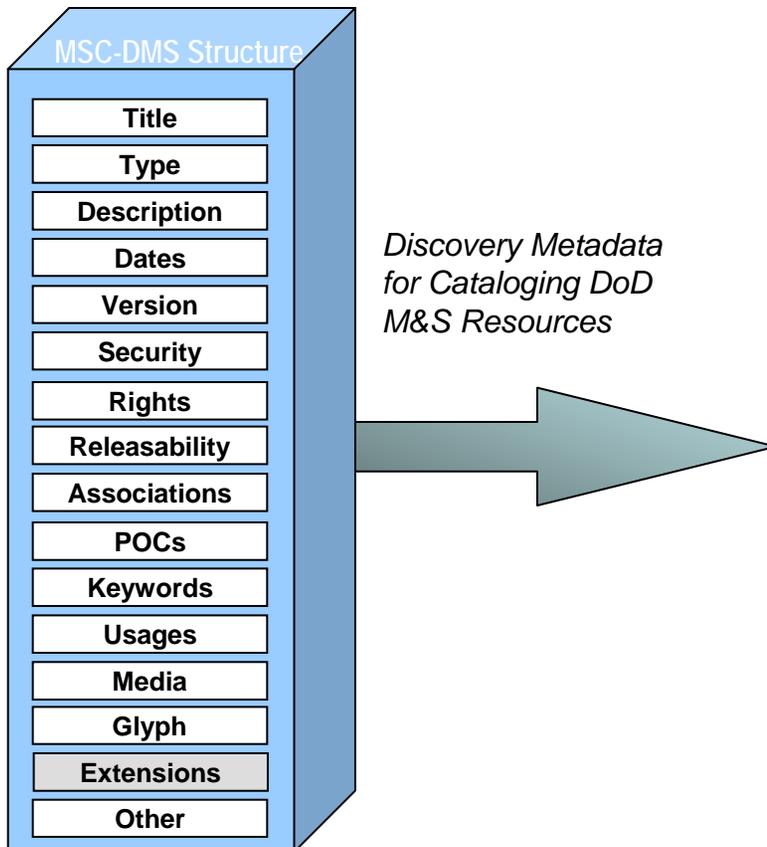
M&S COI Discovery Metadata Specification

- **Establish the specification for discovery metadata** suitable for use within the M&S Community of Interest
 - M&S COI Discovery Metadata Specification (**MSC-DMS**)
- Reports on necessary Discovery Metadata to **support net-centric goals of data visibility of M&S Resources** across DoD, in response to:
 - DoD Net-Centric Data Strategy
 - DoD Directive 8320.2
- Consistent set of metadata elements for **cataloging M&S Resources**
- Intended for assisting **searches** across multiple registries/repositories
- References information structures from the DoD Discovery Metadata Specification (**DDMS**)
- Integrated from **mapping of key repository / practices / catalog standards** and the DDMS



DoD Directive 8320.2

Describing M&S Resources



M&S Resources

1. **M&S Software** (*implements a model or simulation*)
2. **M&S Adjunct Tools** (*data loggers, visualization tools, or interfaces to live systems*)
3. **Federations of simulations** (*a named set of interacting federates such as simulations & adjunct tools*)
4. **M&S Software Components** (*reusable building blocks used to construct simulations and/or provide functionality*)
5. **M&S Services** (*delivers data or interactions in support of M&S*)
6. **M&S Data** (*in M&S-usable format / M&S produced data*)
7. **M&S Data Models** (*structural metadata for describing M&S data*)
8. **Interface Specifications** (*agreement for facilitating communication exchange among M&S Resources*)
9. **M&S Software Design Documents** (*plan or specification, which affects / controls function or development of M&S resource*)

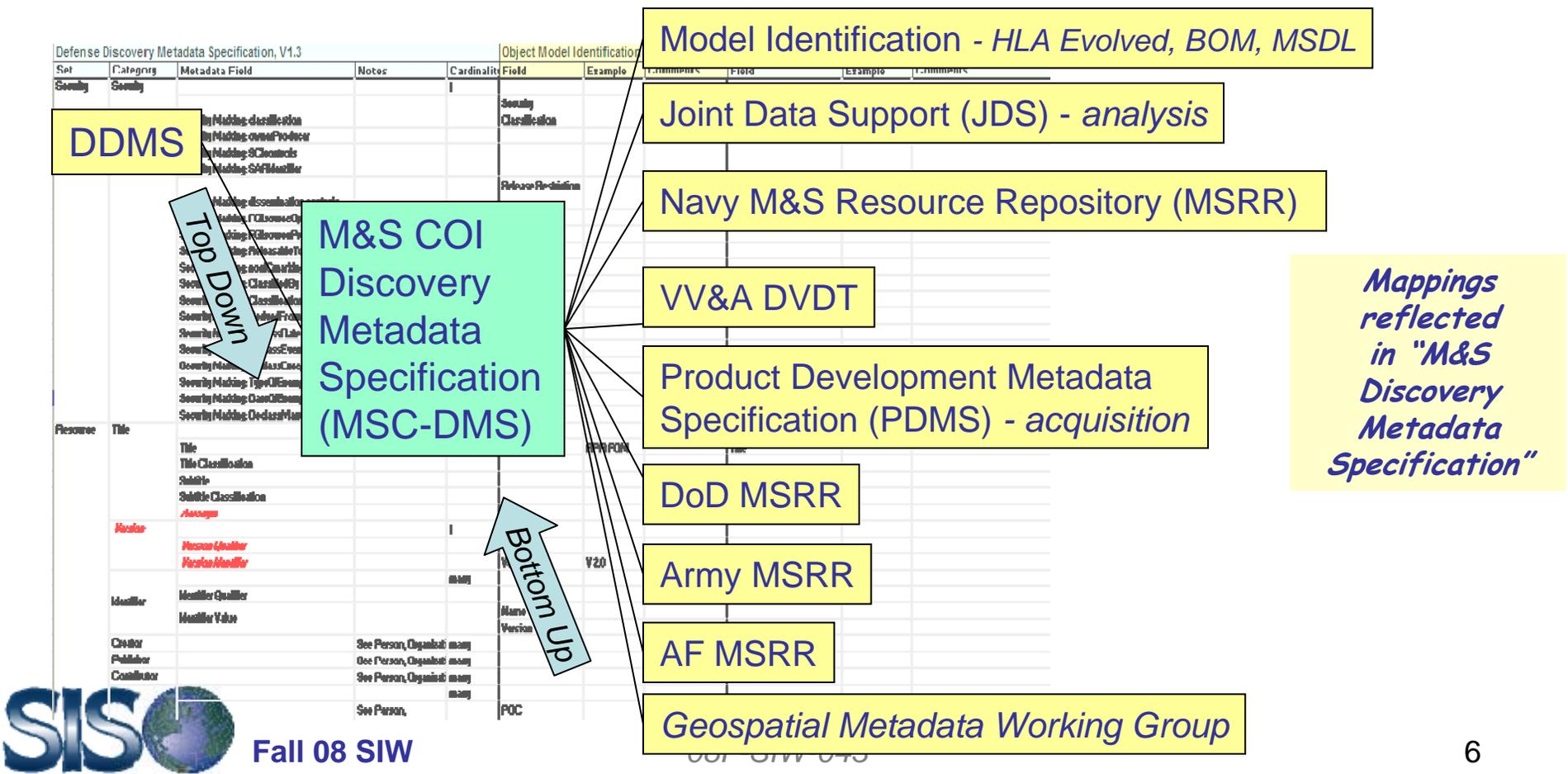
MSC-DMS: M&S COI Discovery Metadata Specification

MSC-DMS is intended to be used to tag metadata for **M&S resources** (1-9) by using a common structure to enable greater discovery and reuse

MSC-DMS tagged resources (1-9) may include **associations** to artifacts representative of either M&S Resources (1-9) or M&S Support Assets, which include: M&S Infrastructure, M&S supported events, M&S future capabilities requirements, M&S related documents, or M&S environment.

Sources Integrated

- Mapping of other repository / practices / catalog standards against DDMS,
 - reflected in crosswalks
 - results in needed DDMS extensions for M&S Asset discovery,

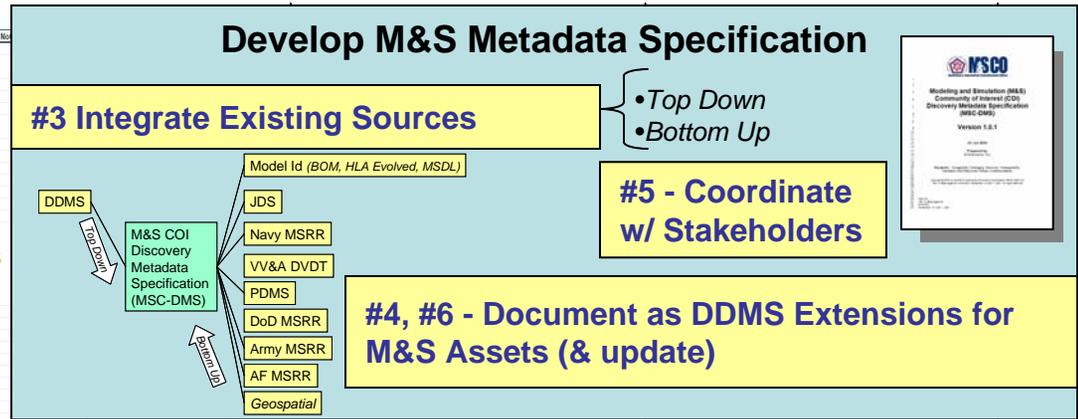


MSC-DMS – Development Effort Year 1

Deliverables	
A001	Monthly technicals
A002	Start of work minutes
A003	Monthly financial
A004	Spec V1 (Draft) - 8 months
A005	Spec V1 (Final) - 12 months

#1 Identify M&S Asset Repositories / Practices

#2 Document discovery metadata



MSRR nodes

- DoD,
- Army,
- Navy,
- Air Force

Other data repositories

- Joint Data Support

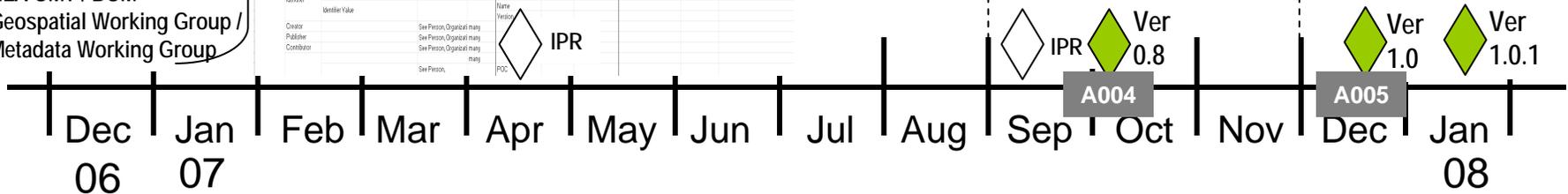
Practices

- Product Development Metadata Spec (PDMS)
- VV&A Recommended Practice Guide (DVDT)
- HLA OMT / BOM
- Geospatial Working Group / Metadata Working Group

Defense Discovery Metadata Specification, V1.1

Set	Category	Metadata Field	Notes
Security	Security	Security Marking classification	
		Security Marking confidentiality	
		Security Marking SCF standards	
		Security Marking SCF identifier	
		Security Marking authorization controls	
		Security Marking FIBrowserOpen	
		Security Marking FIBrowserProtected	
		Security Marking ReleaseableTo	
		Security Marking nonClassified	
		Security Marking ClassificationPolicy	
		Security Marking DerivedFrom	
		Security Marking DeviceScheme	

Resource	Title
Version	Title Classification
	Stable
	Stable Classification
	Accession
Version	Version Qualifier
	Version Identifier
Identifier	Identifier Qualifier
	Identifier Value
Creator	Name
	Version
Publisher	See Person, Organization many
Contributor	See Person, Organization many
	See Person, POC

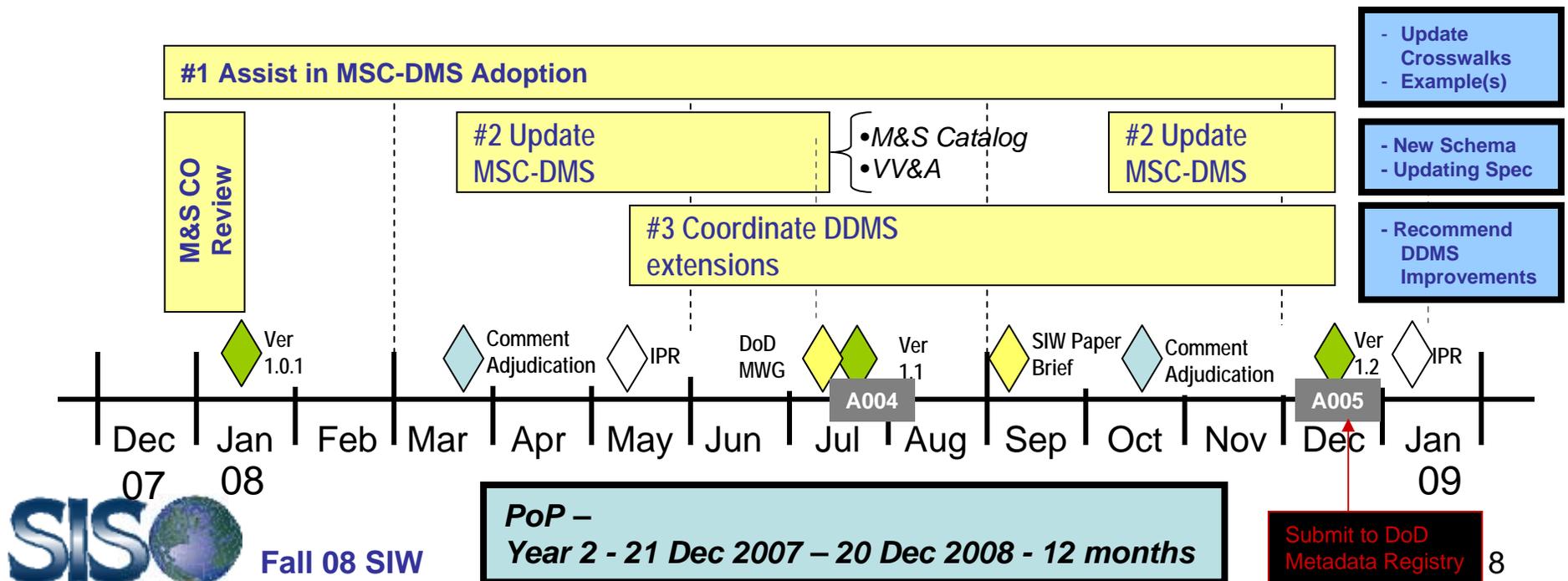


MSC-DMS – Development Effort Year 2



	Task
1	Assist implementers in adoption of the M&S COI Discovery Metadata Specification
2	Update the MSC-DMS based on implementer feedback
3	Coordinate DDMS extensions with the Defense Information Systems Agency (DISA) and other Communities of Interest (COIs)

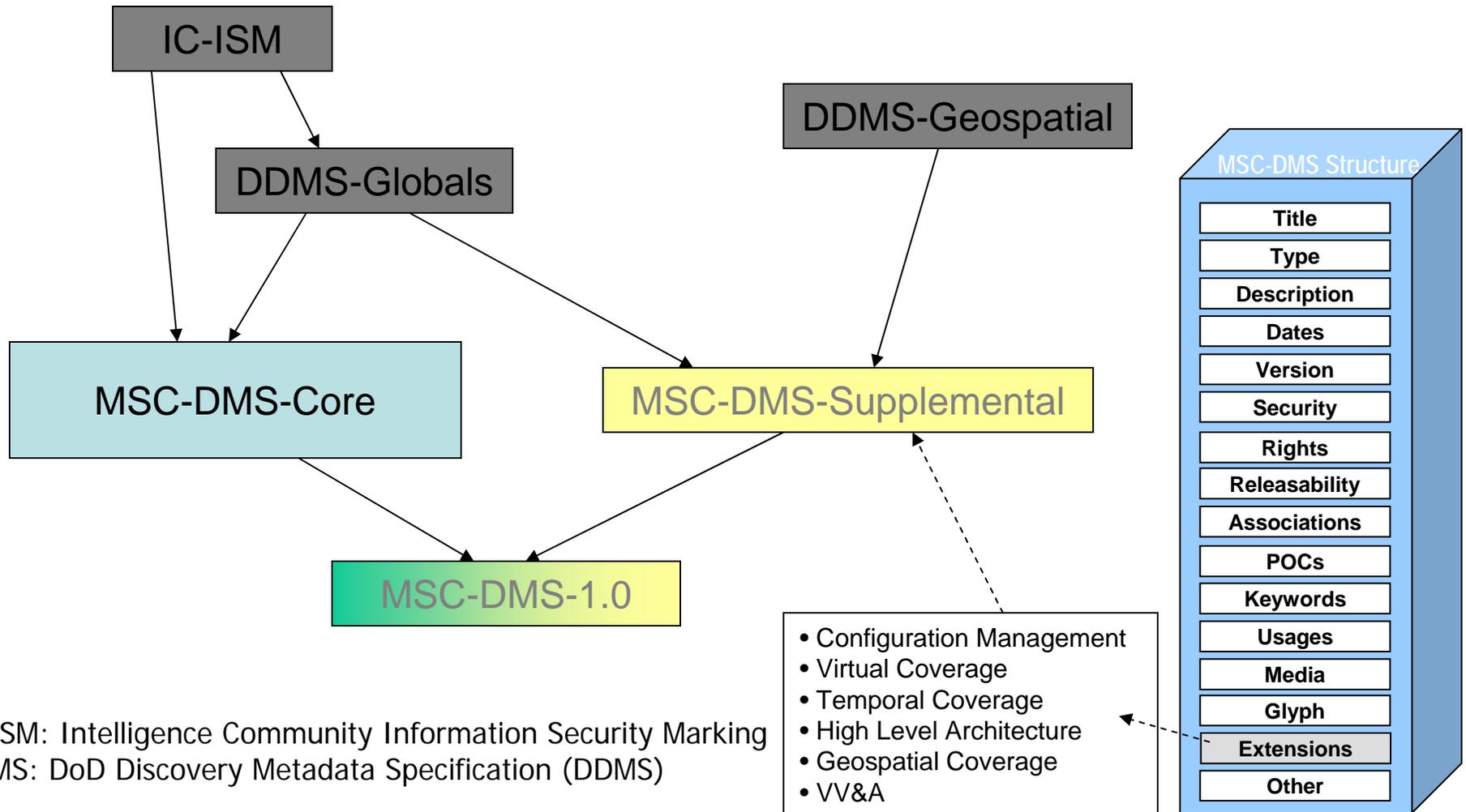
Deliverables	
A001	Monthly technicals
A002	Start of work minutes
A003	Monthly financial
A004	Spec Update (Draft) - 8 months
A005	Spec Update (Final) - 12 months



Current Points of Engagement

- Multiple M&S Repositories (Navy, PA&E, AFAMS)
- Employed by Standardized VV&A Documentation Team
- Joint Rapid Scenario Generation (JRSG)
- Joint Data Alternatives (Phase II)
- M&S Standards Baseline Study
- DoD Metadata Working Group

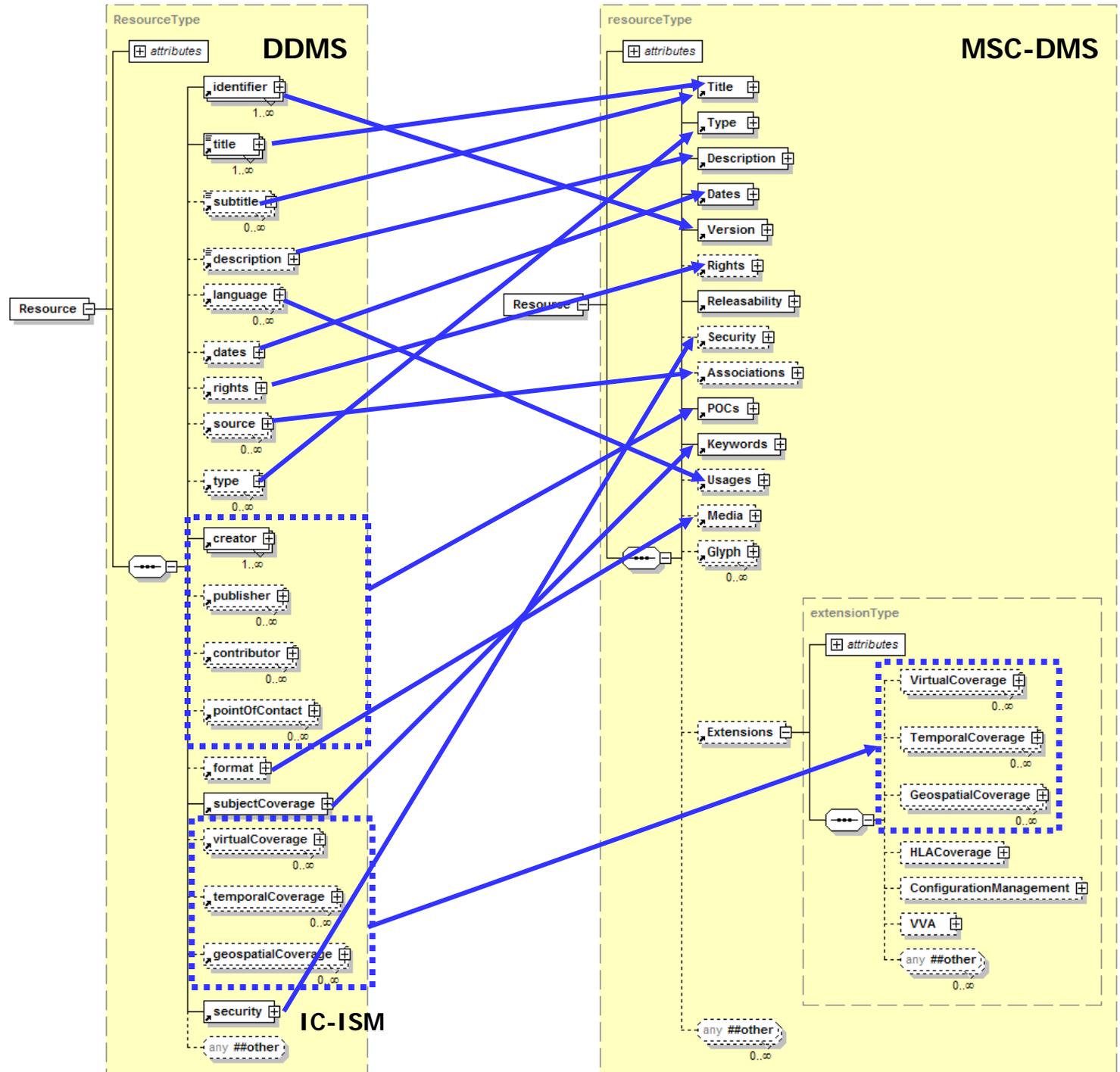
MSC-DMS Composition

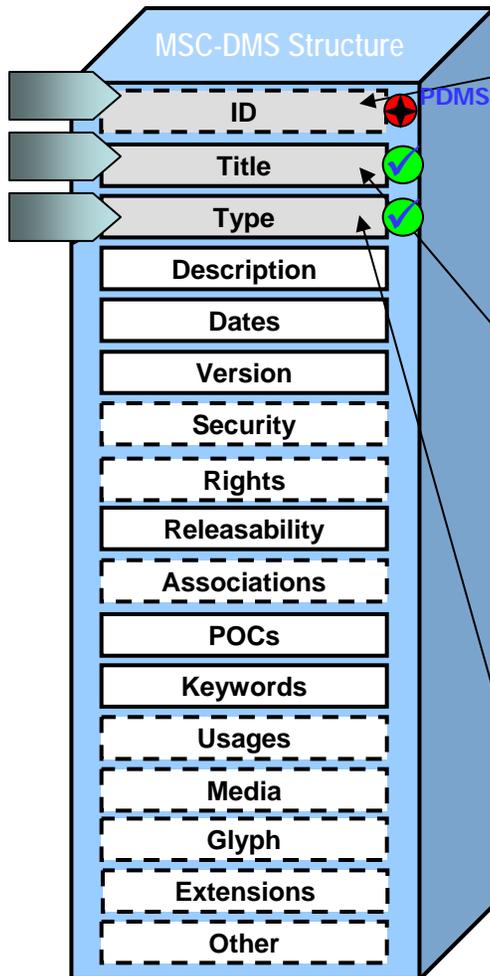


IC-ISM: Intelligence Community Information Security Marking
DDMS: DoD Discovery Metadata Specification (DDMS)

DDMS to MSC-DMS Comparison

- MSC-DMS Leverages / Extends upon DDMS

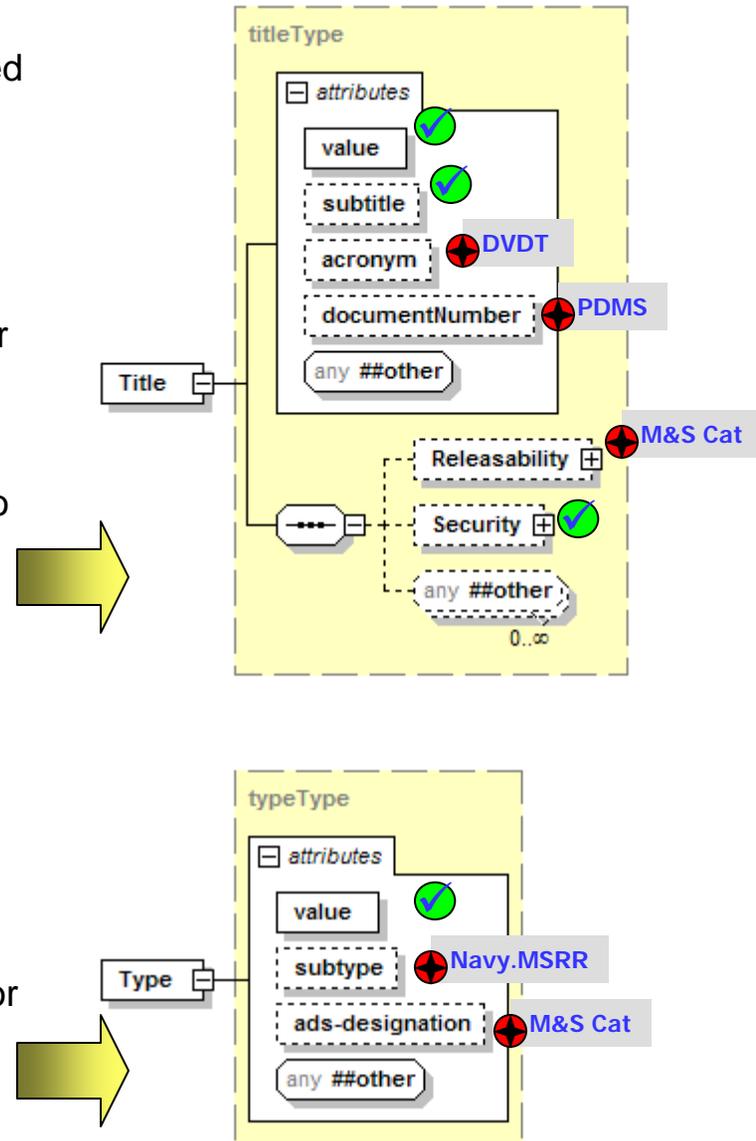




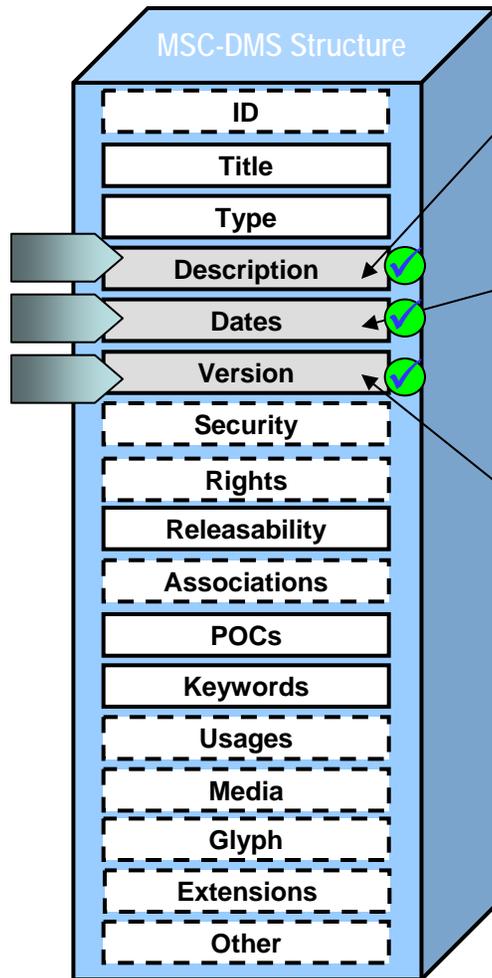
A resource record may be marked by a unique identifier to support cross referencing by other resources and for the benefit of organizing data by one or more repositories. This should not be confused with version number, or document number.

A resource may not only be identified by a title value, but also by a subtitle, acronym, or document number. Typically these values, once determined, do not change even if the resource is updated.

Specifies the type that the resource represents. Also described as the nature, genre, or discipline of the content of the resource.



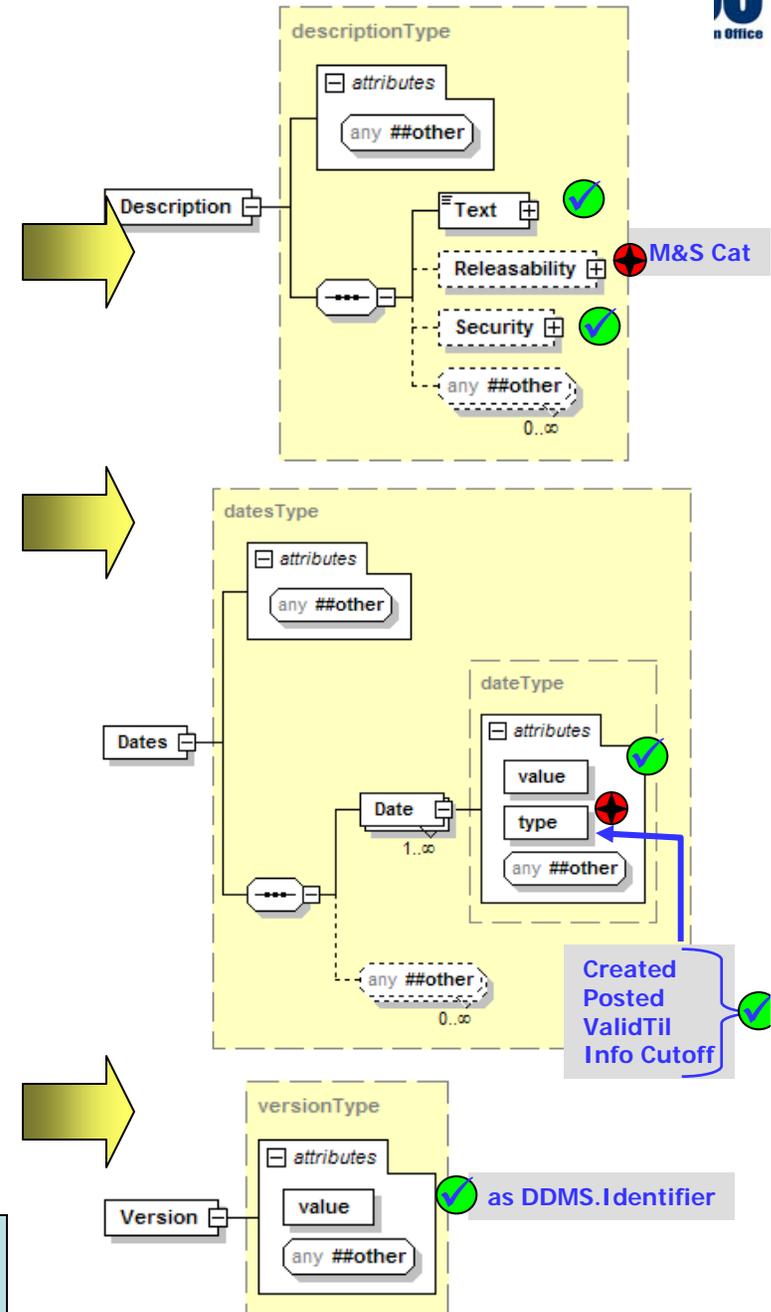
legend	
	mandatory
	optional
	DDMS Based
	Not in DDMS 1.4



Provides an account of the content of the resource.

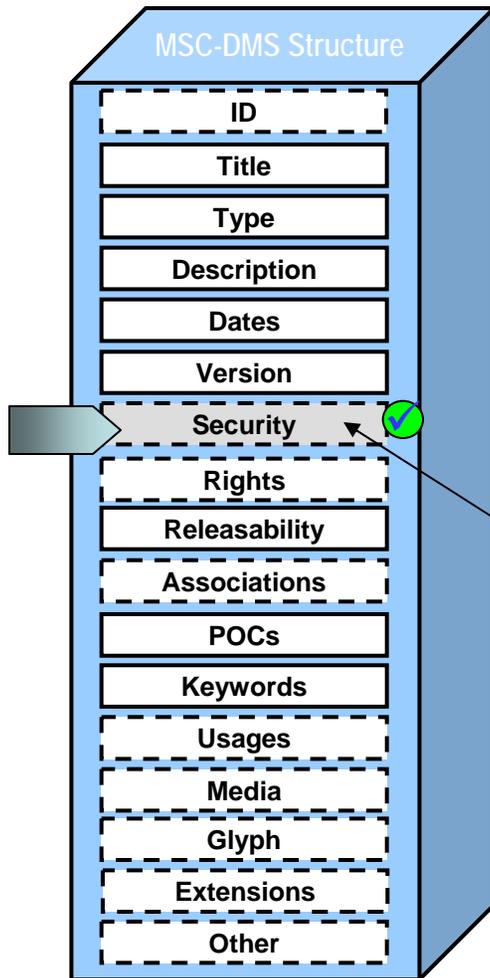
Specifies dates associated with an event in the life cycle of the resource.

A version may be an internal, external, and/or universal identification label for representing an M&S resource by means of a string or number conforming to a formal identification system. An example of an identifier would be an International Standard Serial Number (ISSN), or a Uniform Resource Locator (URL).

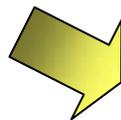


legend

	mandatory		optional		DDMS Based		Not in DDMS 1.4
---	-----------	---	----------	---	------------	---	-----------------



Specifies information about the security of the resource.



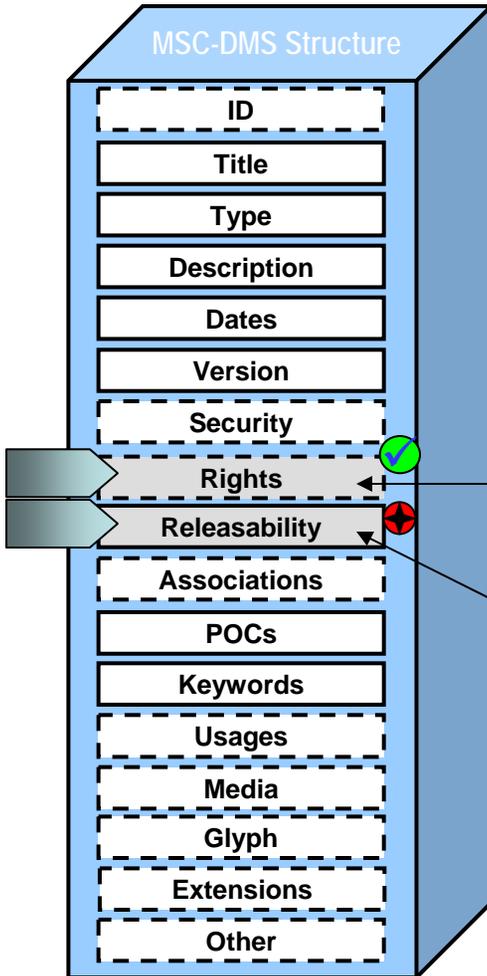
Security

IC-ISM



legend

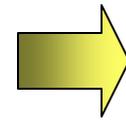
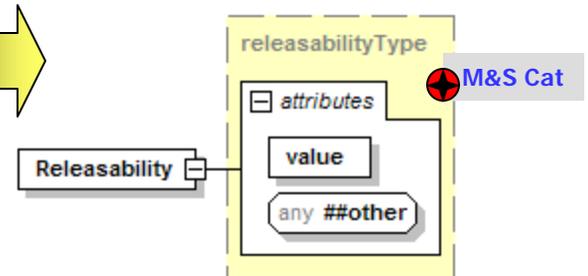
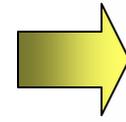
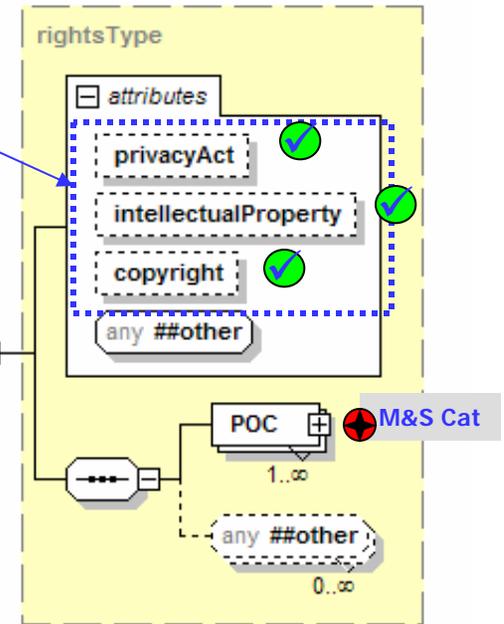
- mandatory
- optional
- DDMS Based
- Not in DDMS 1.4



Specifies information about rights held in and over the resource.

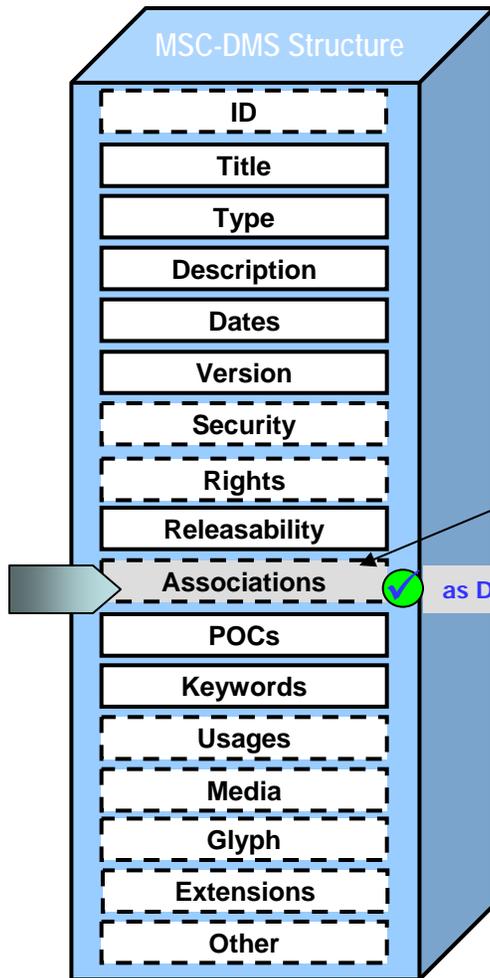
Specifies information about releasability of the resource.

ddms:RightsType extension

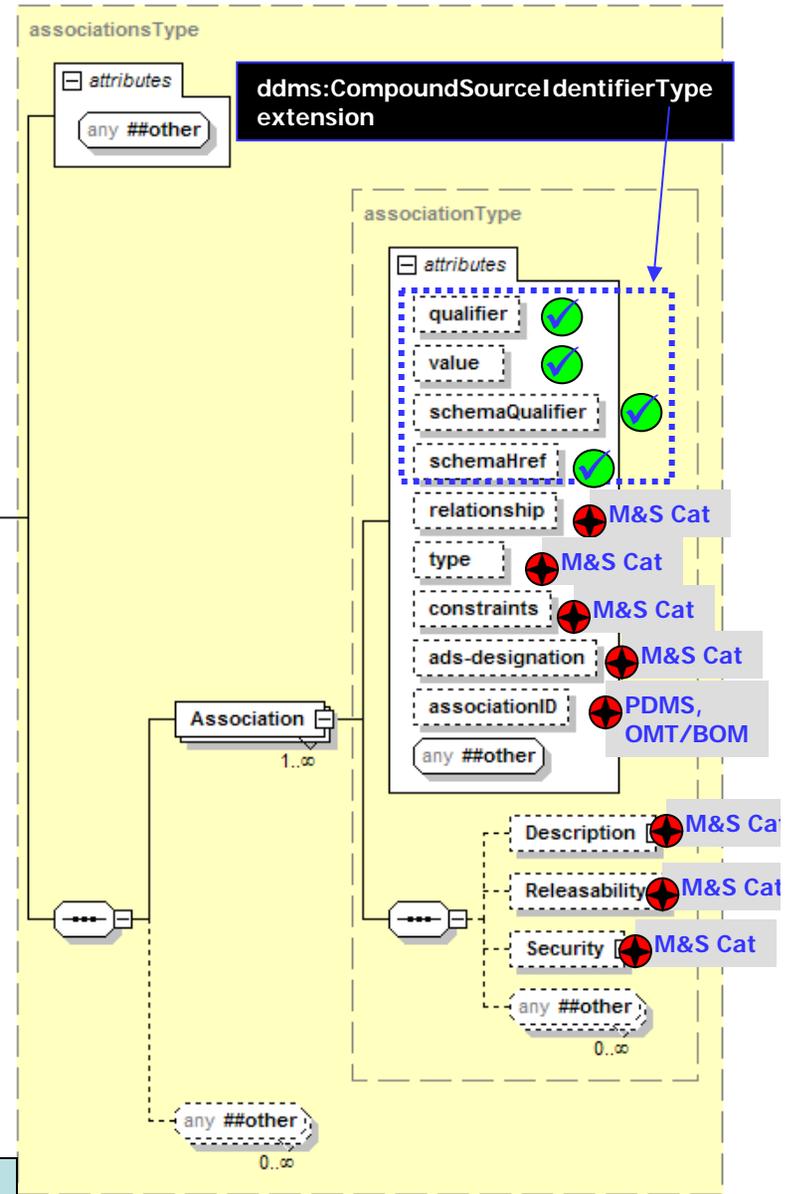
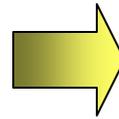


legend

- mandatory
- optional
- DDMS Based
- ⊕ Not in DDMS 1.4

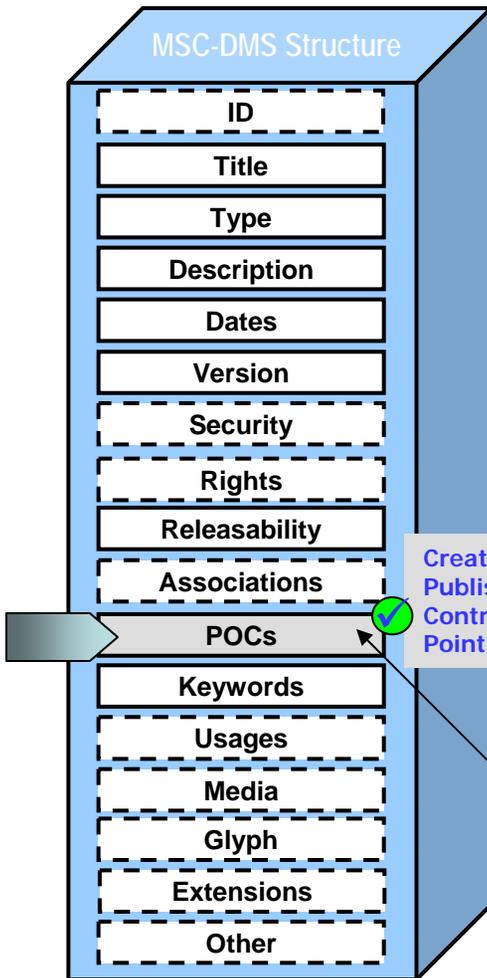


Specifies associations to original source material used to develop or derive the resource.

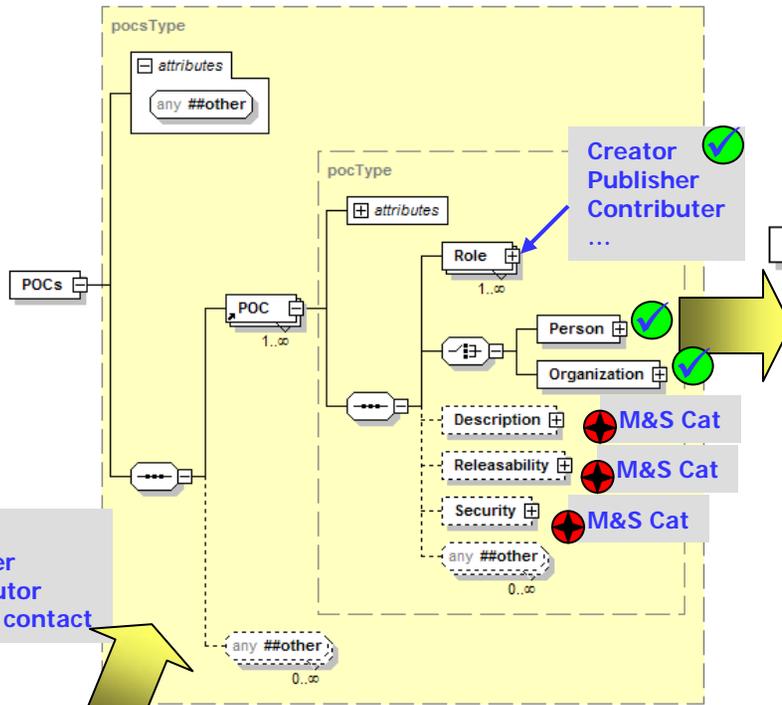


legend

mandatory
 optional
 ✔ DDMS Based
 ✘ Not in DDMS 1.4

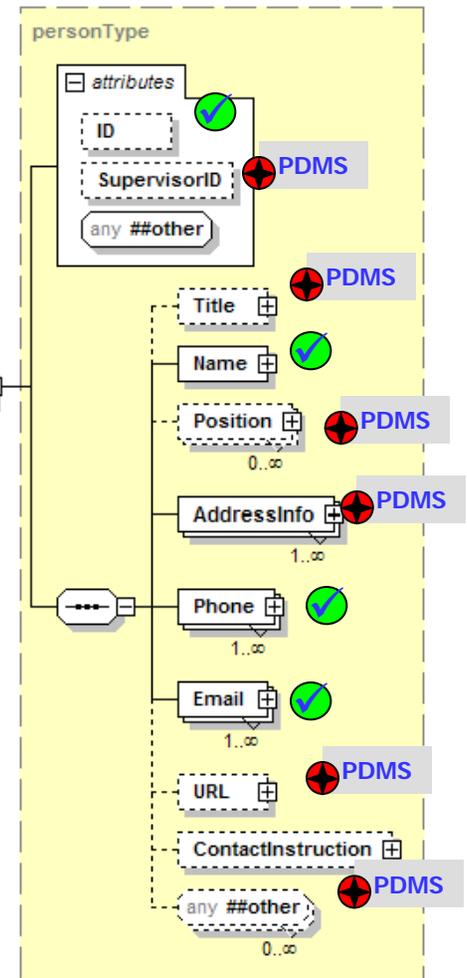


Creator
Publisher
Contributor
Point of contact

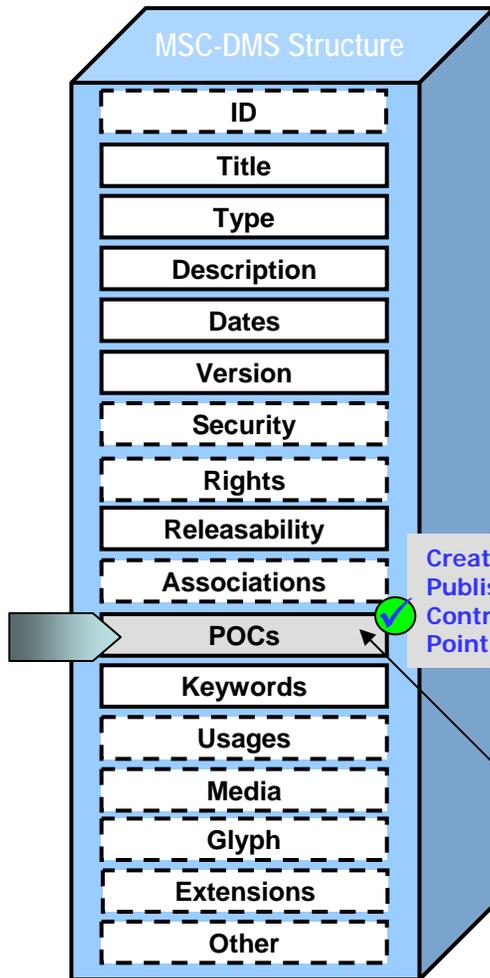


Creator
Publisher
Contributor
...

Specifies a person or an organization who has a particular role with respect to the M&S resource.

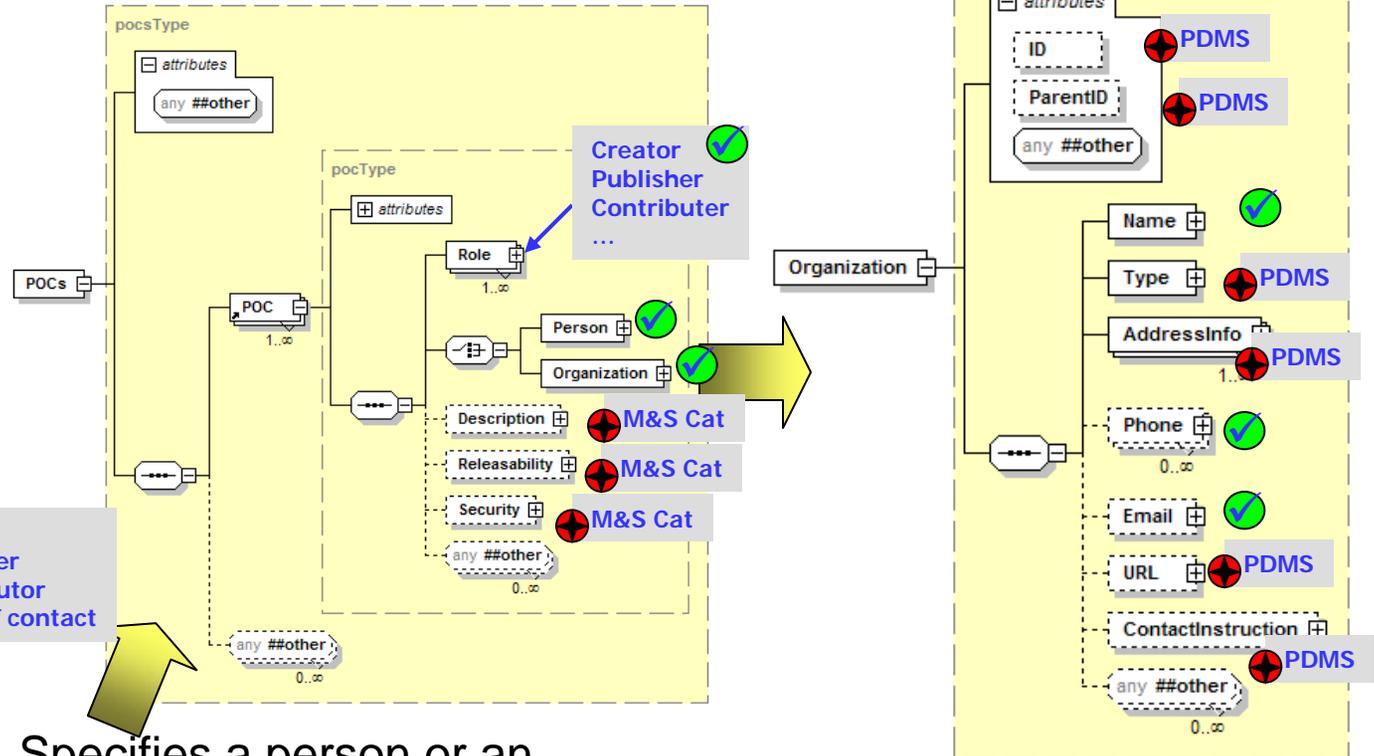


legend	
	mandatory
	optional
	DDMS Based
	Not in DDMS 1.4



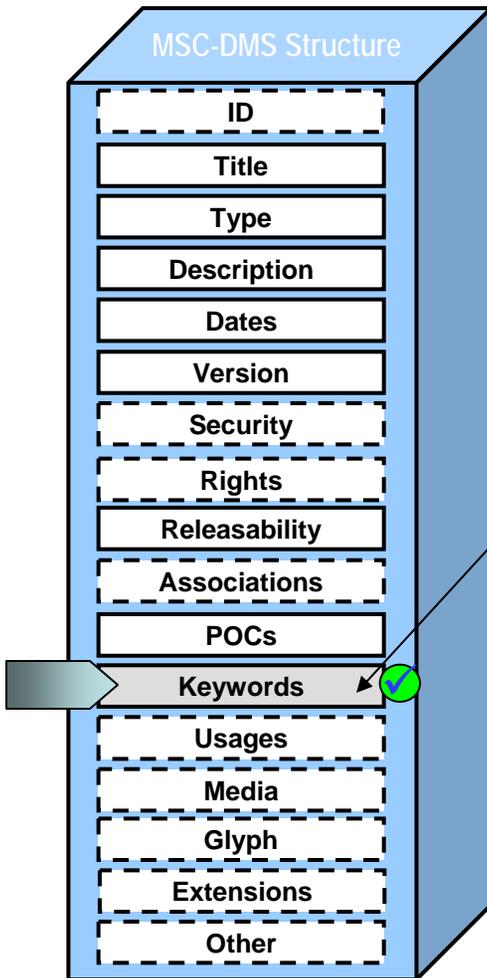
Creator
Publisher
Contributor
Point of contact

Specifies a person or an organization who has a particular role with respect to the M&S resource.

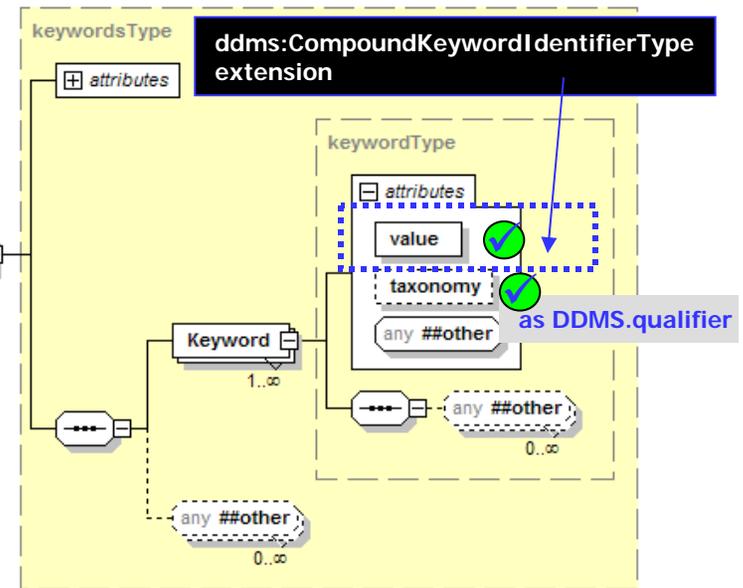
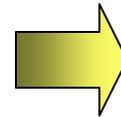


legend

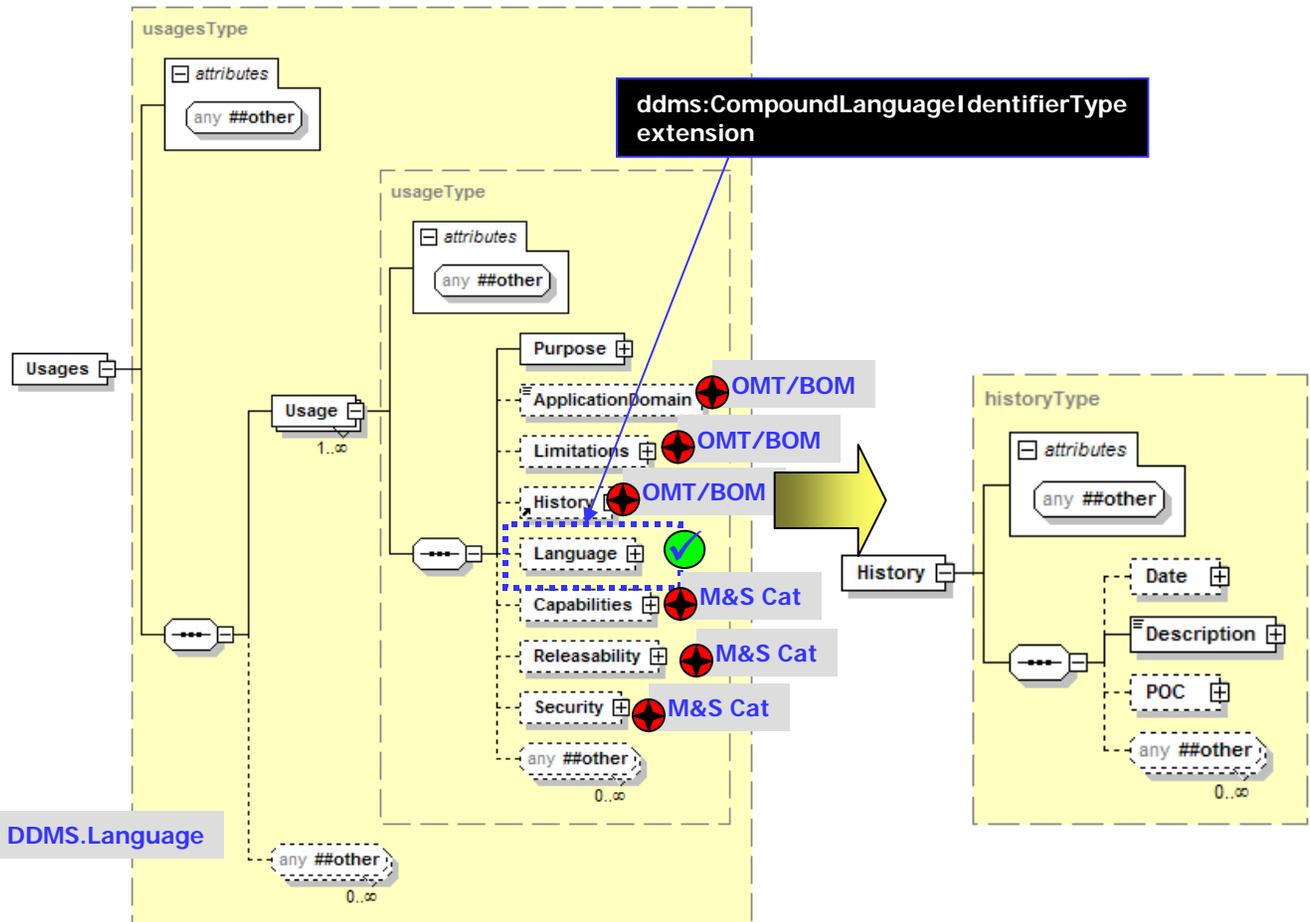
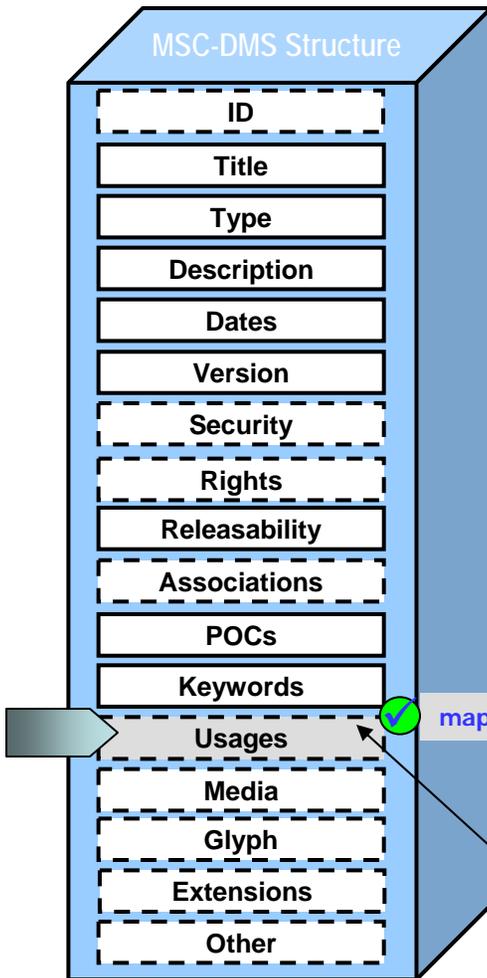
mandatory
 optional
 ● DDMS Based
 ⊗ Not in DDMS 1.4



Expressed as keywords, key phrases or classification codes that describe a topic of the resource. Recommended best practice is to select a value from a controlled vocabulary or formal classification scheme. This may list keywords that apply to the resource, or a particular subject Metadata Set, which will aid the user in understanding the genre of the content.

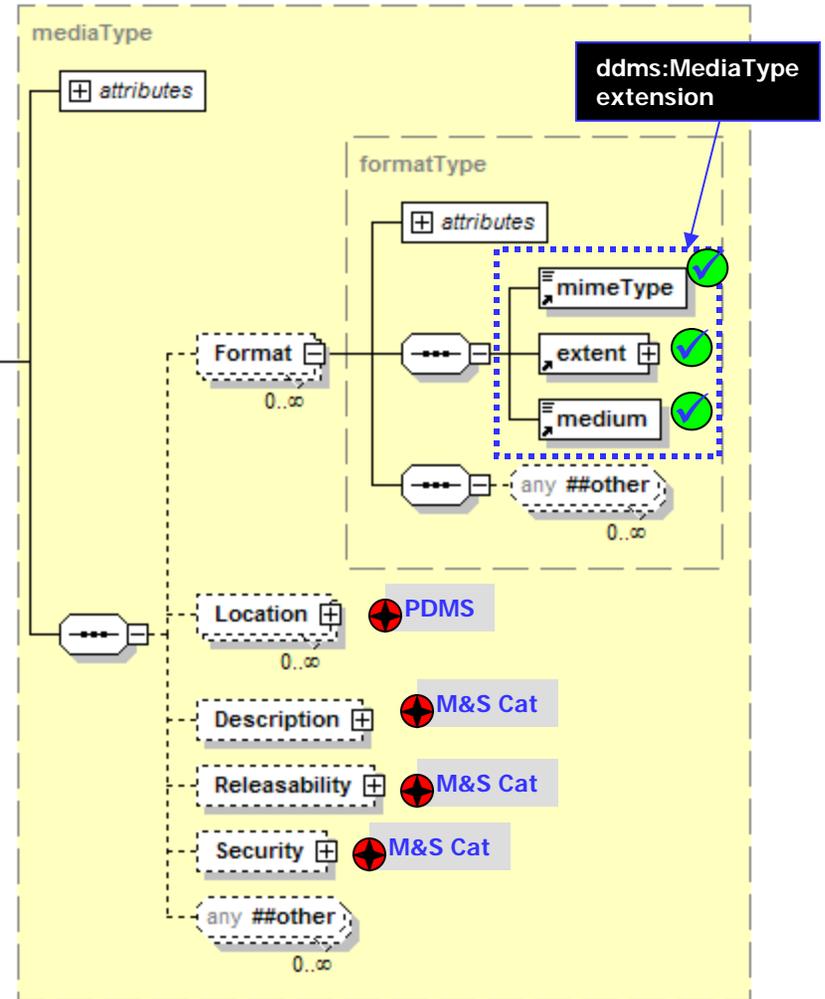
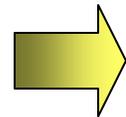
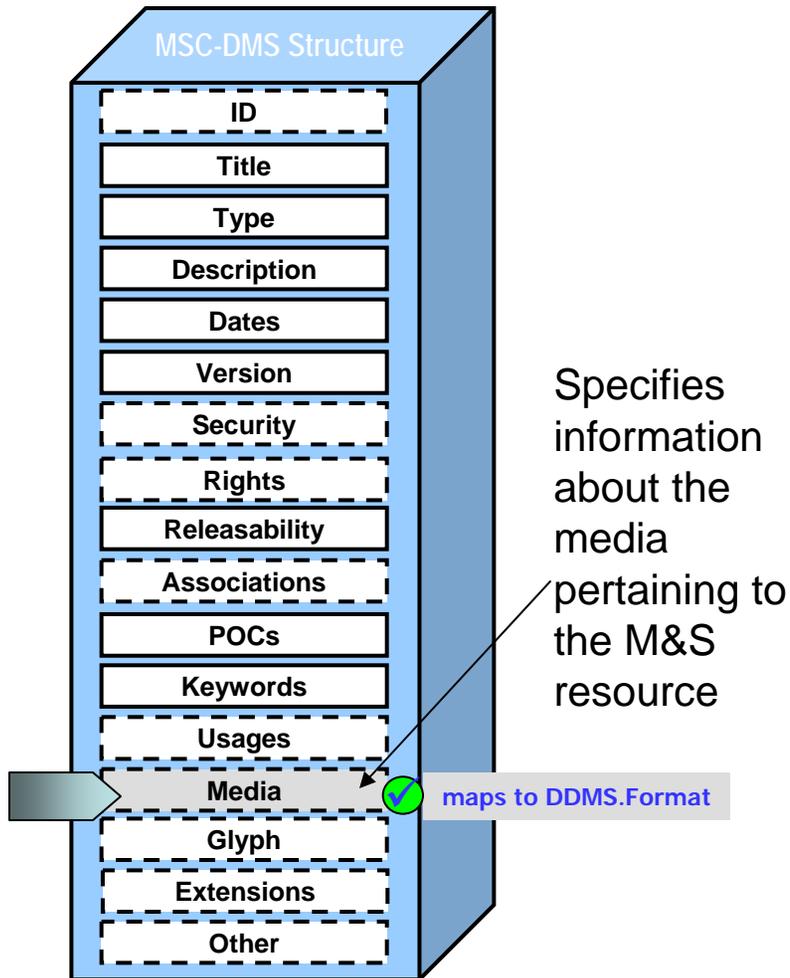


legend			
	mandatory		optional
	DDMS Based		Not in DDMS 1.4



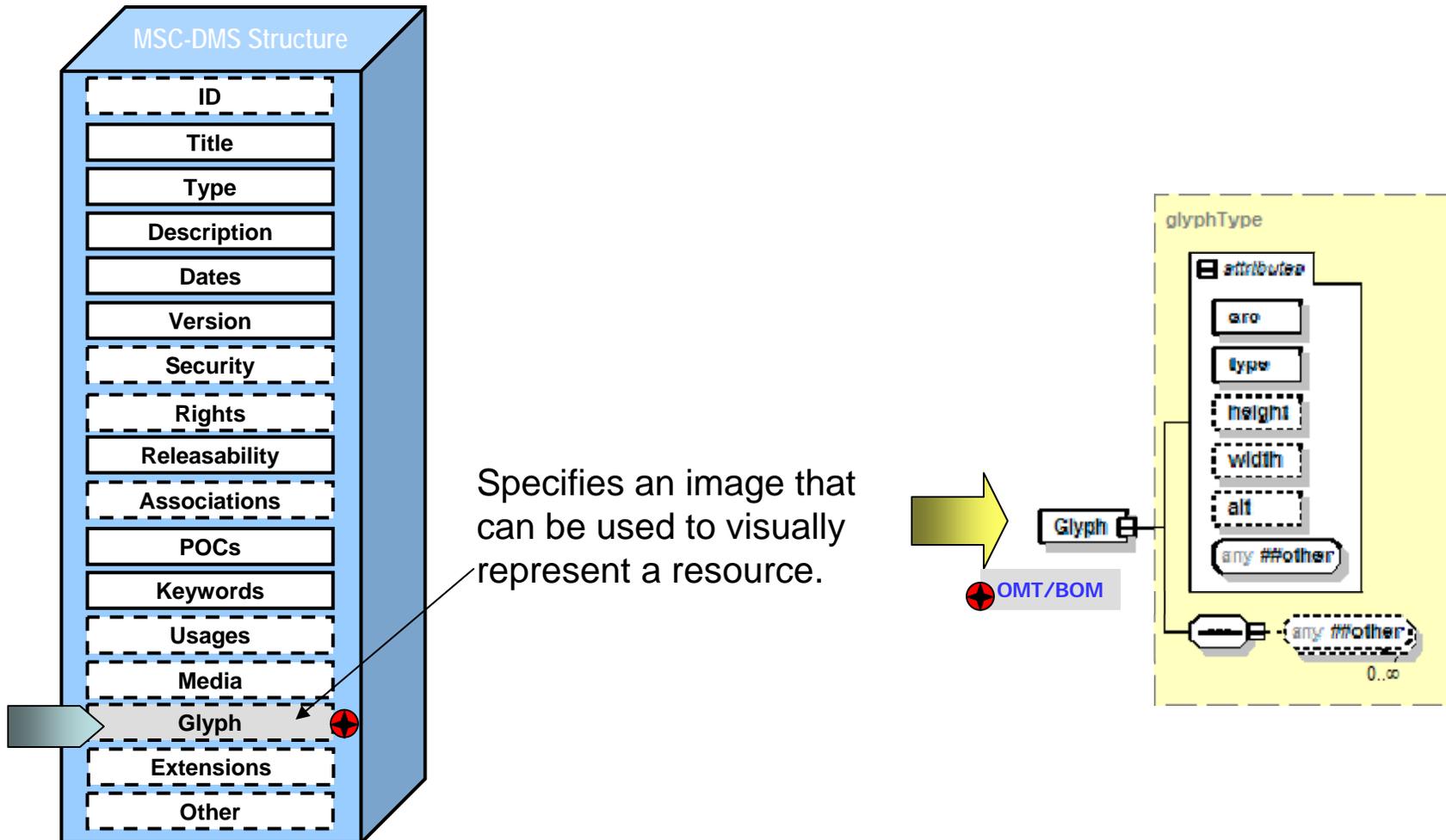
Specifies information about usages pertaining to the M&S resource.





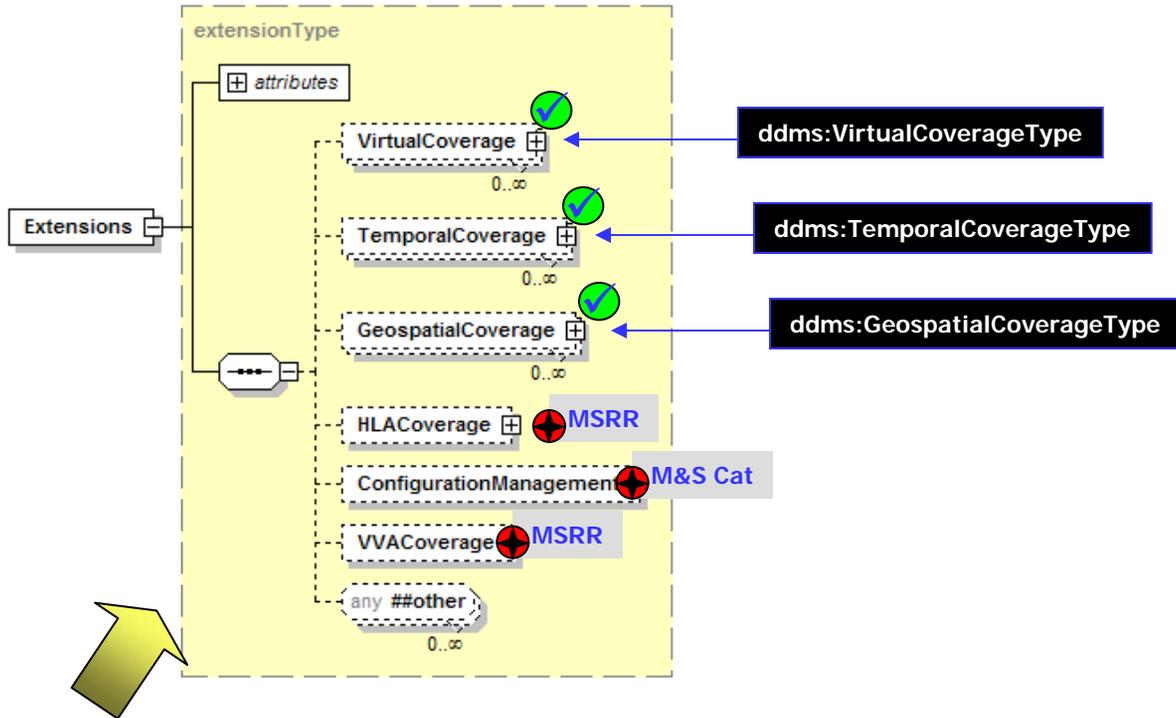
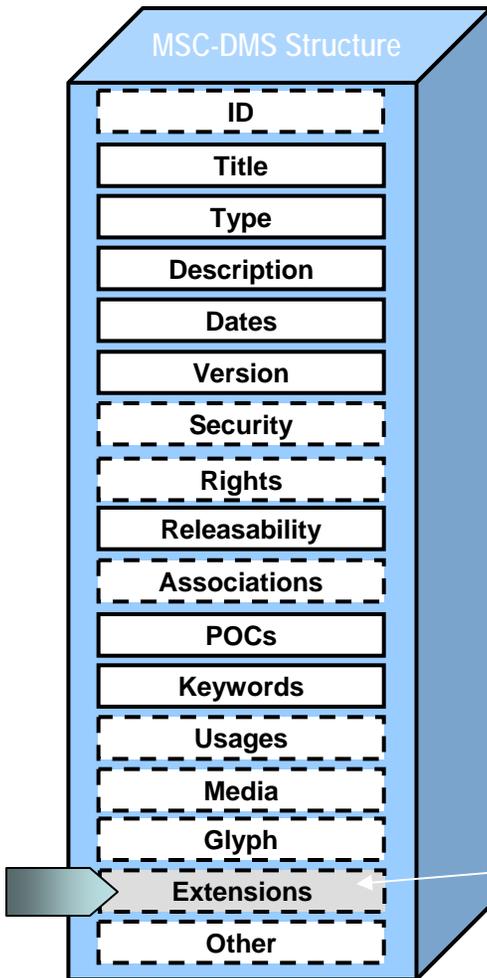
legend

mandatory
 optional
 ● DDMS Based
 ⊕ Not in DDMS 1.4



legend

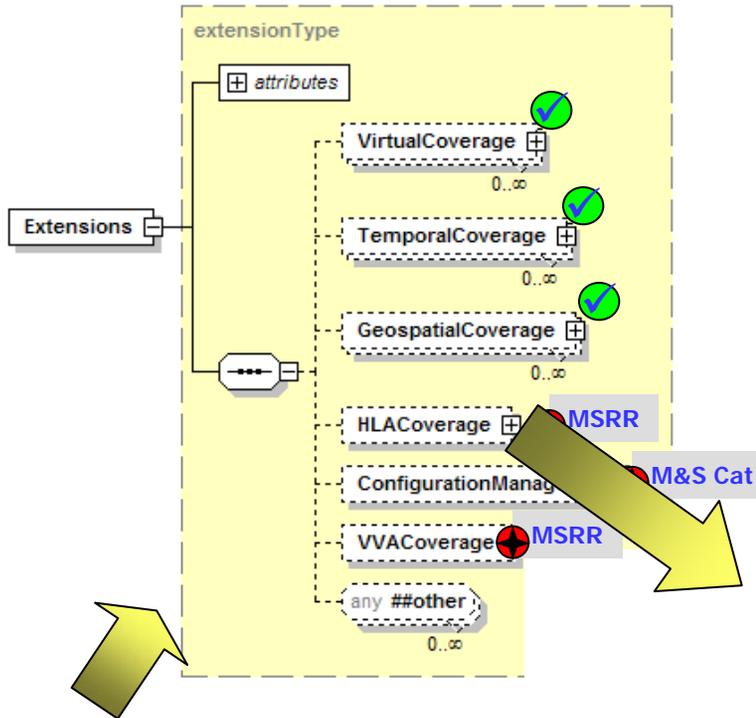
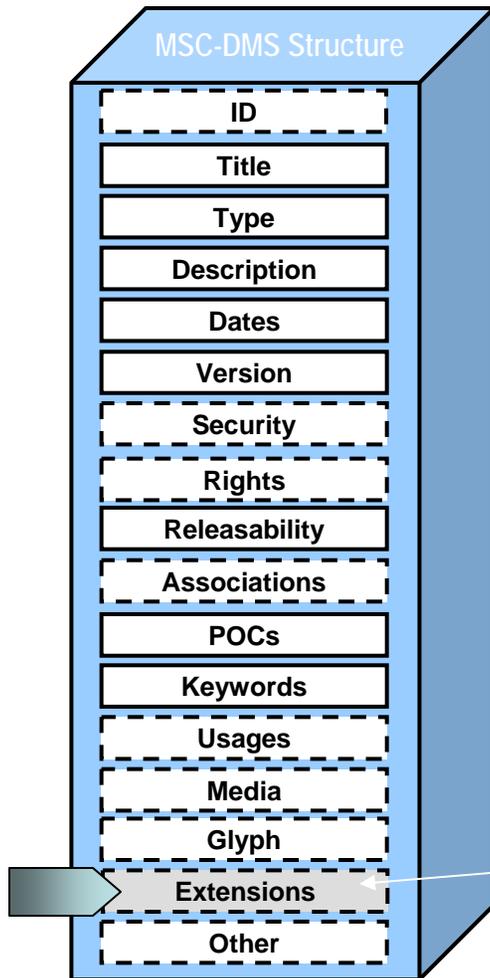
mandatory
 optional
 ● DDMS Based
 ⊕ Not in DDMS 1.4



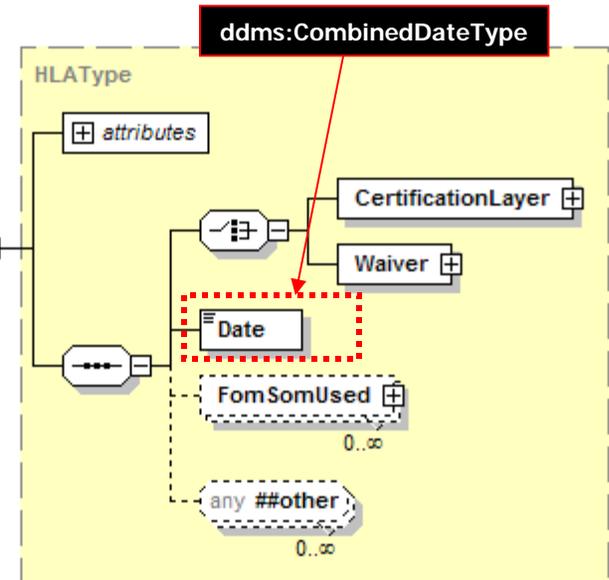
Specifies the various extensions that can be added to the core M&S resource metadata

legend

	mandatory		optional		DDMS Based		Not in DDMS 1.4
--	-----------	--	----------	--	------------	--	-----------------

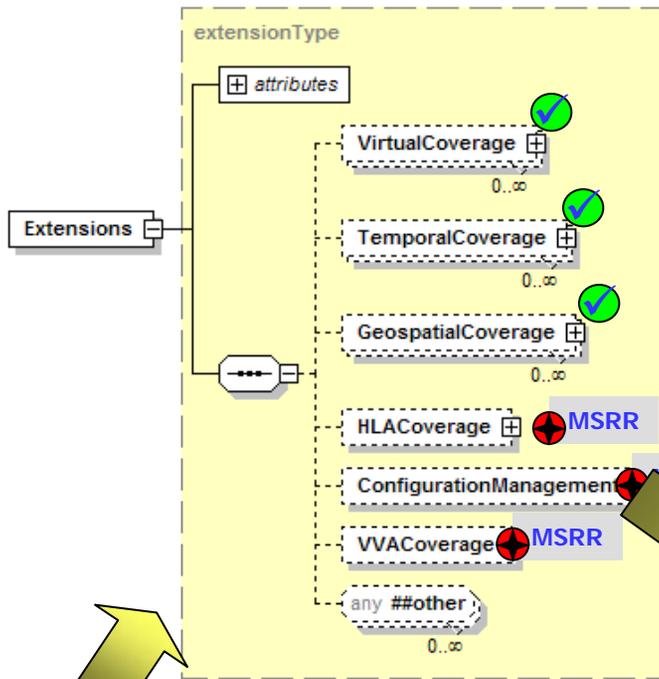
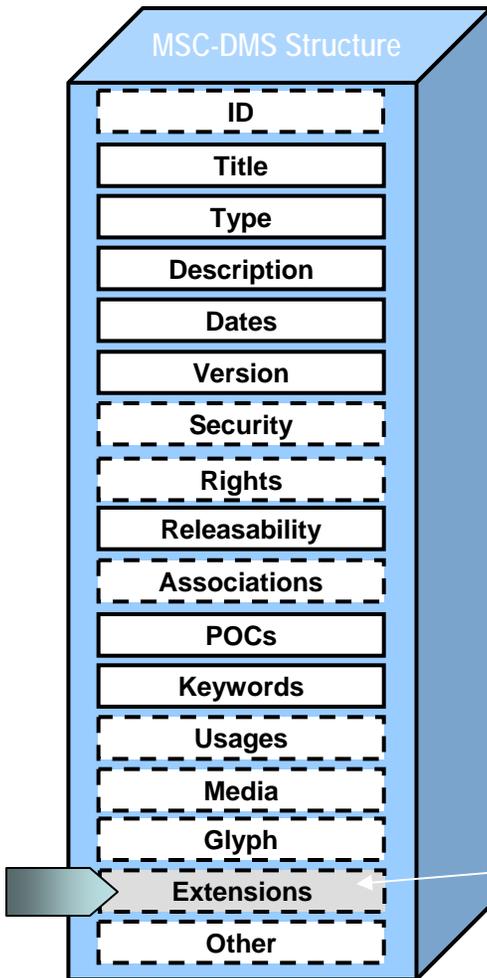


Specifies the various extensions that can be added to the core M&S resource metadata

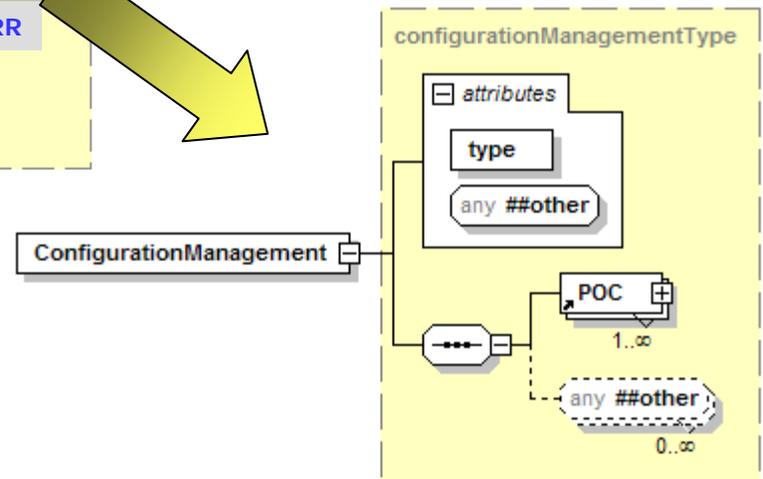


legend

- mandatory
- optional
- DDMS Based
- Not in DDMS 1.4



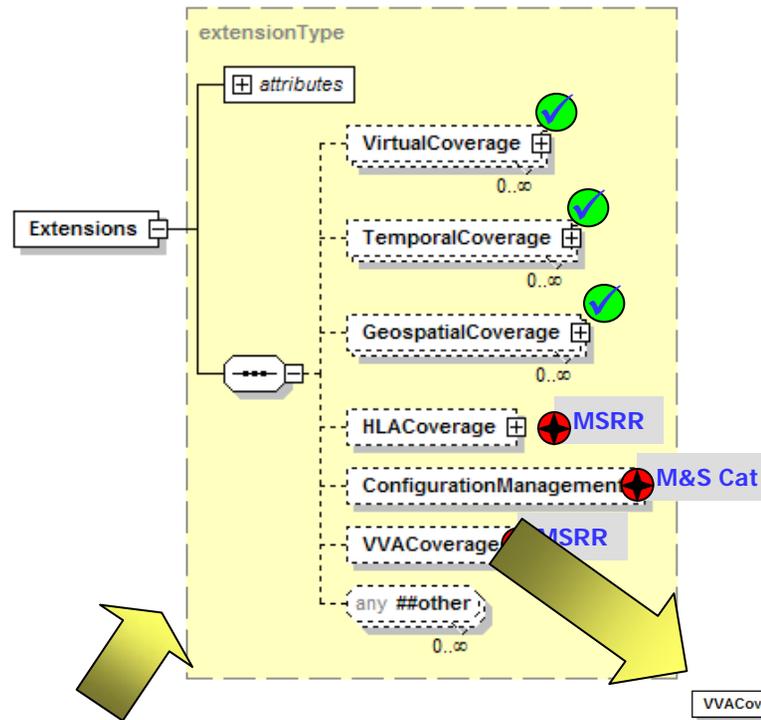
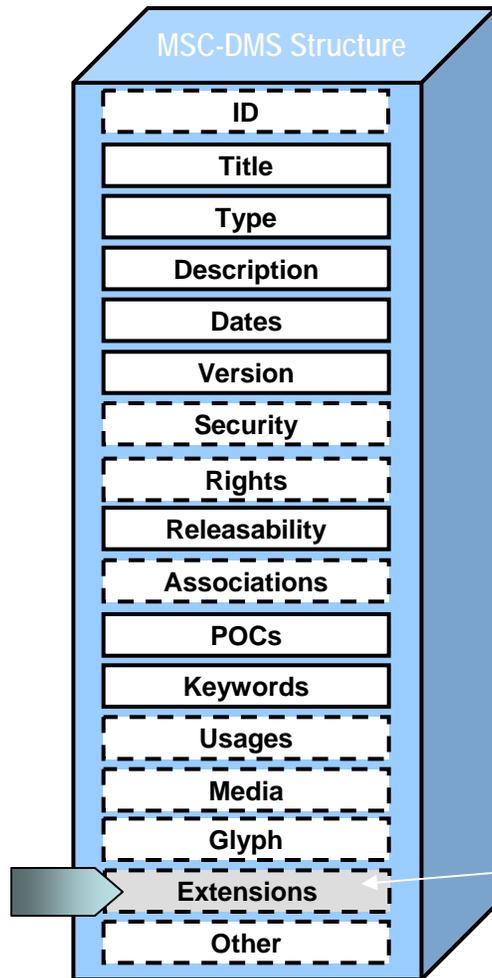
Specifies the various extensions that can be added to the core M&S resource metadata



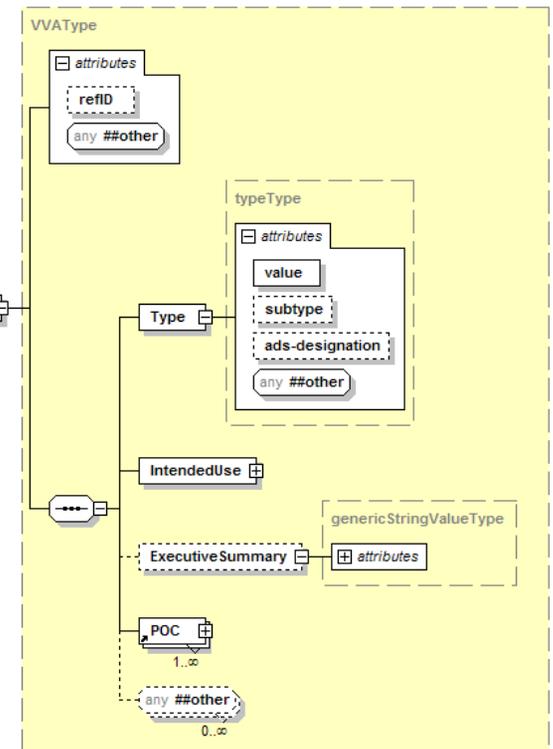
legend

	mandatory		optional		DDMS Based		Not in DDMS 1.4
---	-----------	---	----------	---	------------	---	-----------------

Supplemental Layer



Specifies the various extensions that can be added to the core M&S resource metadata

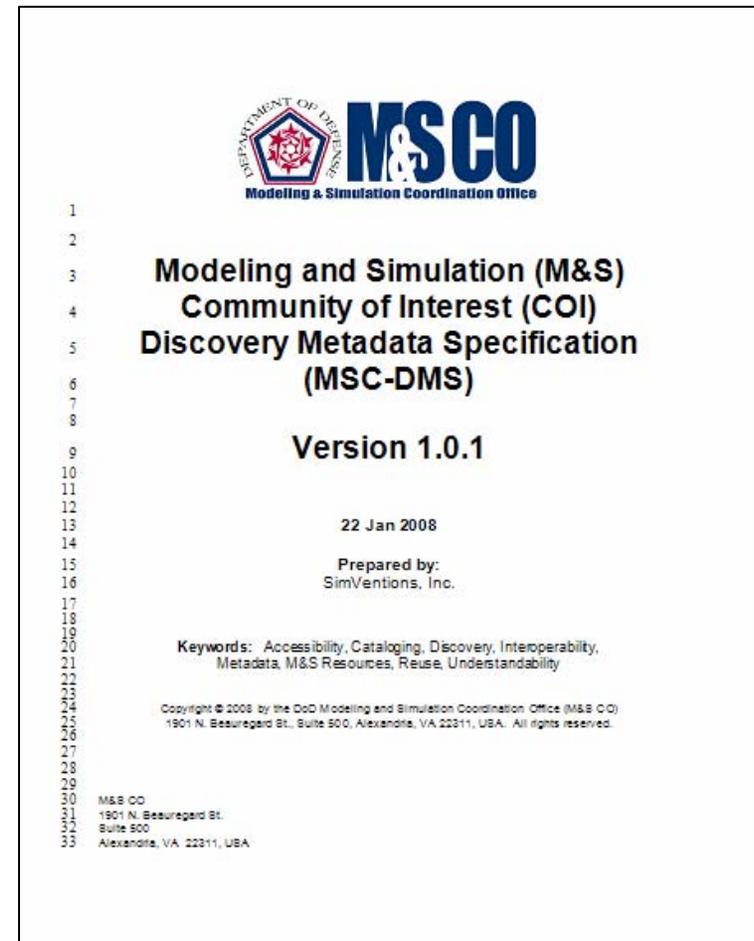


legend

mandatory
 optional
 ● DDMS Based
 ⊗ Not in DDMS 1.4

Summary

- MSC Discovery Metadata Specification and XML Schema
 - Version 1.0.1 - available
 - Version 1.1 – August '08
- Being employed in development of next generation M&S Catalog (POC: Kevin.Charlow@navy.mil)



Next Steps

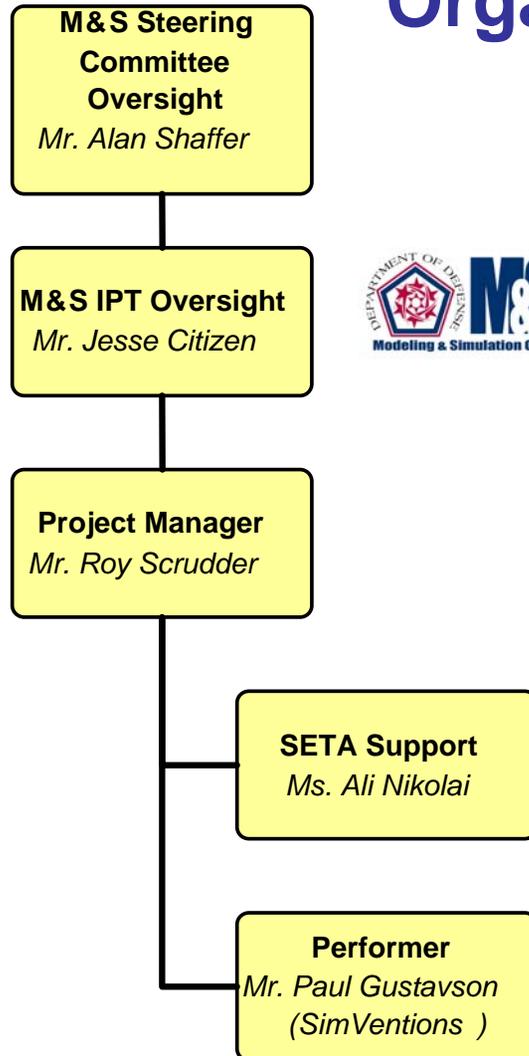
- Continue to evolve specification based on M&S community feedback
- Identify MSC-DMS constructs that M&S community would propose as update/recommendations for DDMS
- Register MSC-DMS to DoD Metadata Registry

For More Information

- Roy Scrudder roy.scrudder@osd.mil
 - POC for MSC-DMS prior to posting in DoD Metadata Registry
- Ali Nikolai Alberta.Nikolai.ctr@osd.mil
- Paul Gustavson pgustavson@simventions.com

Backup slides

M&S COI Discovery Metadata Organizational Structure



Community and Service POCs

Ken Persing (Air Force)
David Broyles (Navy)
Frank Landry (Army)
Col Eileen A. Bjorkman (Testing)
Steve Hunt (Analysis)
Jim Hollenbach (Acquisition)
Mike Meehan (MSIAC)

M&S Catalog Project

Richard Daehler-Wilking
Curtis Blais
Steve Hunt