1.9   The Modeling and Simulation Catalog for Discovery, Knowledge and Reuse

The Modeling and Simulation Catalog for Discovery, Knowledge and Reuse

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The DoD M&S Steering Committee has noted that the current DoD and Service's modeling and simulation resource repository (MSRR) services are not up-to-date limiting their value to the using communities. However, M&S leaders and managers also determined that the Department needs a functional M&S registry card catalog to facilitate M&S tool and data visibility to support M&S activities across the DoD. The M&S Catalog will discover and access M&S metadata maintained at nodes distributed across DoD networks in a centrally managed, decentralized process that employs metadata collection and management. The intent is to link information stores, precluding redundant location updating. The M&S Catalog uses a standard metadata schemas based on the DoD's Net-Centric Data Strategy Community of Interest metadata specification. The Air Force, Navy and OSD (CAPE) have provided initial information to participating DoD nodes, but plans on the horizon are being made to bring in hundreds of source providers.

1.0 INTRODUCTION

In order to manage and employ Modeling & Simulation (M&S) capabilities effectively across the Department of Defense (DoD), senior leaders and managers must have visibility into the DoD's M&S portfolio. Knowing which tools and data exist along with descriptive information concerning its relevance is vital to ensuring that organizations supported by M&S can find the tools that meet their requirements or determine the need to develop capabilities that fill identified gaps. This visibility is established through a discovery process (**Error! Reference source not found.**) that has at its core a search capability. The DoD M&S Steering Committee has commissioned the creation of the M&S Catalog to establish this search capability for organizations that are supported by M&S. This will enable a web-based discovery service that provides a "card catalog" level of detail about M&S tools, data, and services. By ensuring the metadata of their products is captured in the M&S Catalog, managers can expand their user base. Those organizations that use or are supported by M&S will have access to existing tools, data, and services.

2.0 DOD DATA NET-CENTRIC VISION

Modeling and simulation has become a common tool throughout the DoD. A major challenge involves knowing if the required M&S capabilities or data source already exists or needs to be created. Establishing visibility into the M&S resources across the DoD enterprise is one of the goals of the DoD Net-centric Vision. This effort is totally dependent on the descriptions and contact information (metadata) being posted in a common format on the Global Information Grid (GIG). Discovery services using a search engine with access to those descriptions can allow users to locate the product that best meets their requirements. The NCES (Net-centric Enterprise Services) Program (1) plans to provide a secure, collaborative information sharing

environment with access to decision-quality information through a Service Oriented Architecture (SOA) (2) that enables achievement of the DoD's data strategy. An NCES goal is to increase mission effectiveness by enhancing process execution across the DoD. The NCES Program provides four product lines:

1. Enterprise Service-Oriented Architecture Foundation
2. DoD Enterprise Collaboration
3. Content Discovery and Delivery
4. Web Portal

3.0 M&S CATALOG DISCOVERY PROCESS

The main product that will be focused on in this paper is "discovery"--the ability to locate data assets through a consistent and flexible search. The discovery process starts when an organization or developer begins to generate a new M&S product or capability, and it is enabled by the creation of metadata about that product or capability. The process requires that metadata be in an electronic format and accessible to some type of search tool or mechanism through which potential users can find the metadata and access the product or service. The steps associated with the M&S Catalog Discovery Process are depicted in Figure 1 below.
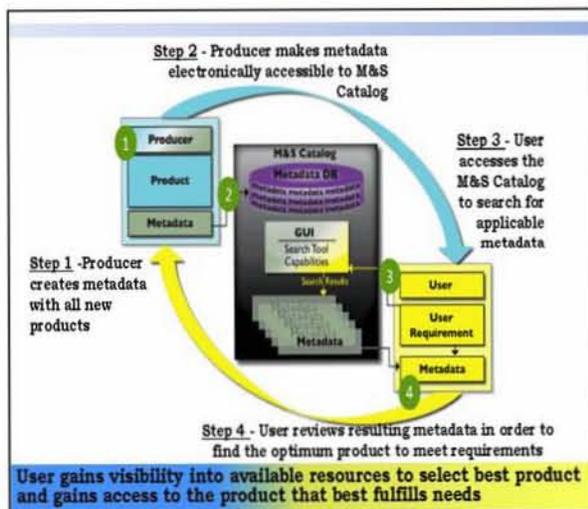

Figure 1. M&S Catalog Discovery Proces

4.0 METADATA

One facet of an enterprise-wide discovery capability is the ability to consistently describe data assets. The description of data is called metadata; defined as being "data about data." A common specification for the description (metadata) of data assets allows for a comprehensive capability that can locate all data assets across the enterprise regardless of format, type, location, or classification. To facilitate data asset discovery, the DoD has developed the DoD Discovery Metadata Specification (DDMS) (4) as the common set of descriptive metadata elements to be associated with each data asset visible to the enterprise discovery capability. The DDMS defines discovery metadata elements for resources posted to community and organizational shared spaces. The DDMS specifies a set of information fields that are to be used to describe any data or service asset that is made known to the Enterprise, and it serves as a reference for developers, architects, and engineers by laying a foundation for Discovery Services. The DDMS will be employed consistently across the Department's disciplines, domains and data formats.

5.0 M&S COMMUNITY OF INTEREST DISCOVERY METADATA SPECIFICATION (MSC-DMS)

An element of the DoD Net-Centric Data Strategy (3) is the formation of communities of interest (COI) to address data exchange issues common to that community. One of the tasks of a COI is to establish a common specification for the discovery metadata to be used within that community. The community discovery metadata specifications (DMS) are to use the DDMS as a foundational specification and add those metadata elements that are required for the community to accurately describe their products. It is critical that the community specifications include metadata elements that enable product owners to express the difference between their

products and other similar products. While the common metadata elements do not have to be identical to the DDMS, there must be a mapping from the common metadata elements in the community DMS to the DDMS.

The M&S COI (MSC) Discovery Metadata Specification (MSC-DMS) (5) specifies the set of information fields that are to be used to describe M&S tools, data or services which are to be made known to the Enterprise. It serves as a reference for metadata associated product developers, architects, and engineers. The DDMS and other standards, practices, and approaches have been cross integrated to formulate the MSC-DMS to be used across the Communities and Services for tagging M&S assets that will be made accessible via the GIG. All activities that publish the availability of M&S assets should use the MSC-DMS.

6.0 MSC-DMS M&S CATALOG ASSOCIATION

The early design requirements of the M&S Catalog recognized the importance of aligning the metadata used in the Catalog with the standards being established in the DoD enterprise and specifically within the M&S Community. Since the M&S Catalog is the primary major project currently utilizing the MSC-DMS, there has been close coordination between the teams developing each. Early in the first year of the M&S Catalog project, the develop team, to include representatives from the Navy's Space and Naval Warfare (SPAWAR) Systems Center Atlantic, the Air Force Agency for M&S (AFAMS), CAPE JDS, and the DoD M&S Coordination Office (M&S CO), reviewed and improved on a mapping from the individual Service MSRRs to the M&S Community of Interest (COI) Discovery Metadata Specification (MSC-DMS). Many suggestions for improvements to the MSC-DMS were developed and later incorporated into version 1.2 of the MSC-DMS. There has been ongoing coordination between the two teams to ensure that the development

of the M&S Catalog and MSC-DMS remain aligned.

As part of their efforts to address M&S capability gaps common to organizations across the DoD enterprise, the DoD M&S Steering Committee commissioned an M&S Catalog search tool to provide a web-based discovery service focused on M&S tools, data, and services.–The search tool capabilities selected for the M&S Catalog were guided by interviews with senior leaders, users, and technical personnel in the communities that participate in the M&S Steering Committee. The intent is to make the search tool as intuitive and effective as possible, to guide a user quickly to a manageable set of alternatives to evaluate. Additionally, in response to the request of senior level managers, the tool will have the capability to perform analysis of the characteristics of the search result set of resources.

The resulting visibility into the M&S world will provide significant benefits throughout DoD. Resource owners can use the catalog to maintain their own inventories as well as identify new customers. Resource seekers can rapidly find what they need and identify potential cost avoidances by learning of existing efforts. The department will achieve better resource management by ensuring resources are not applied to create existing capabilities, but instead focus on those areas where capabilities are lacking.

7.0 SOURCES

The key to the value of the M&S Catalog is the breadth and accuracy of the information it contains. A significant effort is being under taken to encourage organizations across the DoD enterprise to integrate the information about their products with the M&S Catalog. Metadata can be accepted from a collection such as a service M&S Resource Repository (MSRR) or directly from the manger of a product. The vision is to interface as closely to the origin of the metadata as possible so that the motivation to keep it current is high.

One of the primary tasks in the next phase of the M&S Catalog development is to significantly increase the number of sources integrated with the Catalog. In order to enable this, a major outreach program has been initiated and tools will be developed to reduce the level of effort required to create, maintain and integrate metadata. M&S Catalog products include any resource that can be used to support an M&S effort:

1. Services – Organizations that can provide design, development, or analysis support.
2. Tools – Software and hardware to support models and simulations.
3. Data – Data the model or simulation requires.
4. Subject Matter Experts – Domain experts that can provide guidance on the selection of model parameters, problem specific data, and/or validation for models.

8.0 HOW THE M&S CATALOG FITS INTO THE DISCOVERY PROCESS

The discovery metadata search mechanism to interface between the producers and consumers is the M&S Catalog. The metadata that is accessible through the M&S Catalog and the functionality of the discovery tool will determine how well a user can find the product that best meets their needs. The metadata format within the M&S Catalog needs to contain the elements that the user's community uses to differentiate the products they use. The user interface and the flexibility of the search tools will have a large impact on how successful the users are connected to the optimum products for their requirements. The design, format and content of all other elements of the discovery process must integrate smoothly into the M&S Catalog in order for the process to function well.

While many organizations have expressed an interest in providing metadata to the M&S Catalog, often there are limited

resources with which to produce and transform metadata. It has become apparent that the level of effort placed on the source organizations must be as minimal as possible to enable their participation. Providing tools and processes to aid them will not only increase the likelihood of the metadata integration, it will also support consistency in the metadata content and format.

9.0 CAPABILITIES

Based on the lessons learned from the earlier phases and the requirements generated from interviews with representatives of the communities belonging to the M&S Steering Committee, it was decided that the third phase of the M&S Catalog project would migrate to a COTS tool that offered a good fit to the desired capabilities. Market research was conducted, the offerings of several vendors were compared, and finally the Endeca Information Access Platform was selected and acquired (see figure 2). The current phase of the M&S Catalog now offers:

- Facetted search –Dynamically guided navigational search offering selections based on community driven taxonomies. Each subsequent selection searches within the previous results. Previously selections can be removed individually. This allows the user to create their own taxonomy through the metadata elements they select.
- Flexible support of different source metadata structures, including unstructured documents.
- "Tag clouds" – term / phrase occurrence analysis within the results set.
- Support of quantitative analysis on the search results(e.g., how many tools deal with air-to-air by source organization)
- Keywords – traditional search for specific strings that can be applied at any point in the navigational search process
- User determined search result format – the user selects the metadata elements to be displayed in the search results
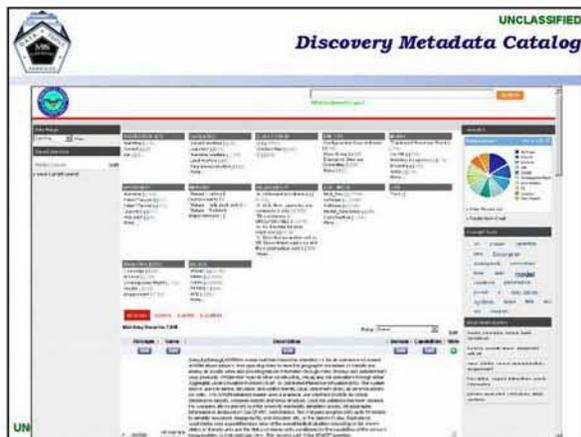
Figure 2. M&S Catalog User Interface

10.0 FUTURE EFFORTS OF THE M&S CATALOG PROJECT

In the coming months, efforts in the M&S Catalog project will be aimed at improving the capabilities of the tool itself, improving the data model used by the M&S Catalog, continuing outreach to sources (both new and current), development of metadata creation and transformation tools to enable source organization metadata efforts and search federation with other search engines.

Improvements of the tool itself will include:

- Flexible support of DoD-relevant taxonomies.
- Multiple user-interface screens addressing different needs.
- Resource ranking & comments by users
- Forums

DoD-relevant taxonomies were important in previous search tools because of the rigid structure of the search capability. The facetted search capability (presented in **Error! Reference source not found.** and **Error! Reference source not found.**) allows the user to develop their own path to the resources that meet their requirements. In essence it allows the user to develop their own tailored taxonomy that is relevant

to the particular resource requirements that guide their search. The different taxonomies found in different communities are driven by different search criteria or different descriptions. As the organizations providing metadata and user search criteria increase, the number of facetted search categories may grow significantly. Placing all supported facetted search selections on one screen may reduce the usability of the M&S Catalog. Different user interface pages will be developed with subsets of the facetted search options. The community taxonomies will be used to guide the determination of what facetted search selections will be listed on each user interface page.

In the search for pedigree, the best input often is the experience of others who have used a resource. The M&S Catalog will be adding the capability of users to rank and comment on resources. Additionally, often experience users can be a great resource for new users to determine the best methods with which to access or use a particular tool, data source or service. In order to take advantage of sharing of ideas and experience, a forum capability will be added to the M&S Catalog.

The number one priority of the M&S Catalog for 2010 is increasing participation by sources. Our efforts include outreach to the sources themselves, recruitment of senior leadership of the DoD communities enabled by M&S, and assistance to sources that want to participate. Such assistance includes development of tools to assist in metadata creation and maintenance, mapping to the M&S Catalog data model and electronic interface with the M&S Catalog.

11.0 CONCLUSION

Finally, upcoming work in 2010 includes the federation of the M&S Catalog with other search engines. The DoD Data Net-centric Vision established the DDMS as the common discovery metadata for federated searches. The M&S Catalog metadata

must be exportable in a DDMS identifiable format. Additionally, the M&S Catalog must be capable of accepting DDMS formatted search queries. These capabilities will initially be targeting federation with the DISA Enterprise Catalog.

The M&S Catalog is available to anyone with a DoD-approved Common Access Card (CAC) or External Certificate Authority (ECA) security certificate at https://MSCatalog.osd.mil.

12.0 REFERENCES

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