DATA INTEROPERABILITY: FOUNDATION OF INFORMATION SUPERIORITY

By Melanie Winters and Brian Wilczynski

In November 1999, the Department of the Navy Chief Information Officer (DON CIO) established the Data Management & Interoperability Integrated Product Team (DMI IPT) to address enterprise-level data management. Reinforcing the need for this effort was a statement in a 7 February 2000 memorandum by Art Money, ASD (C3I). In calling for a new data strategy for the Department of Defense (DoD), Mr. Money stated that, "Gaining and sustaining Information Superiority requires DoD to field information systems that are interoperable at the data level." This article summarizes the efforts of the DMI IPT and the related DON CIO data management strategy. Many of the recommendations of the DMI IPT have been adopted as part of the new DoD data strategy.

BACKGROUND

Interoperability problems encountered during Operation Desert Storm led the DoD to closely examine how data was managed and exchanged. As a result, data administration policy and procedures calling for the standardization of data within and across tactical and non-tactical functional areas were issued in 1991. After nearly a decade of effort, however, the situation has not markedly improved. The DON CIO, in support of its Information Technology Architecture (ITA) responsibilities (see "Architecting for Information Superiority" in the fall 1999 issue of CHIPS), developed a strategy aimed at improving interoperability at the data level. In previous efforts, successes were achieved among independent programs, but not across the entire Department. An enterprise approach to solving interoperability problems is the next step.

CURRENT SITUATION

Today, data is typically developed, obtained and maintained by individual systems. In addition to multiplying costs, this approach limits data sharing and interoperability; typically referred to as a "stove-piped" environment. Translations and manipulation of data have significant impacts on operational effectiveness and are costly; the need for unique systems interfaces reduces Information Technology (IT) return on investment (ROI). The objective is to create data once, share it across system boundaries, reduce the time required for decision-making, and avoid the cost of redundant efforts.

So, what exactly is data management? Data management is an integral part of the larger area of Information Management; it deals with the creation, use, sharing, and disposition of data as a resource critical to effective and efficient operations. It includes processes to monitor the production of data and facilitate its use within activities and automated information systems. The goals of data management are to promote interoperability, improve data quality, ensure security of data, and maximize the efficient use of resources.

To gain an understanding of the scope of data challenges within the DON, the DON CIO hosted a two-day meeting in August of 1999. The audience of 60 attendees, representing 28 organizations, received briefings from 17 Navy and Marine Corps Commands on their data-centric projects. The following themes emerged:

- Data problems are not unique to any one functional area or organization.
- There is a need for policy, process, supporting infrastructure, and a plan to leverage efforts.
- Data management requires senior management champions.
- Data management is not adequately addressed in budget or acquisition processes.
- In an era of network-centric warfare, addressing the issues has never been more essential.

Building upon the lessons learned in these two days, the DON CIO refined the next three points of the strategy.

POLICY

DoD policy addresses data management in many facets. Specifically, DoD policy directs organizations to "implement data administration aggressively in ways that provide clear, concise, consistent, unambiguous, and easy access to data, and that minimize the cost and time required to transform, translate, or research differently described, but otherwise identical, data." The policy also directs organizations to standardize and register data elements to meet the requirements for data sharing and interoperability among information systems throughout the Department of Defense. Although sound in its objectives, DoD data administration policies have not been adequately implemented across DoD organizations.

The Department currently lacks a SECNAV policy on data management that implements DoD policy. The DON CIO has developed a draft SECNAV Instruction (SECNAVINST) and has used the DMI IPT to validate and improve it. The proposed policy goes well beyond the data standardization approach of the past. The SECNAVINST calls for joint Navy and Marine Corps policy that implements a robust DON DMI infrastructure. Among the Roles and Responsibilities in the Instruction is the identification of the Functional Data Manager (FDM). FDMs, designated by Resource Sponsors, will be the focal points for data management within their functional areas. FDMs are considered key to the long-term success of an enterprise wide data management strategy. To provide the necessary operational focus, FDMs will, for the most part, be organizations involved in the production and maintenance of data within their functional areas.

While policy is an essential first step, it is not sufficient on its own. The next step is to develop and promulgate enterprise-level goals, the objectives that support each goal, and the strategies that lead to executing the objectives. This takes the form of a strategic plan.

STRATEGIC PLAN

The purpose of the DON DMI Strategic Plan is to provide overall guidance for managing data resources Department-wide. It identifies goals, objectives and strategies to move the Department closer to achieving the goal of maritime information superiority. The plan is based on guidance provided in both the DON Information Management and Information Technology (IM&IT) Strategic Plan and the DoD Data Management Strategic Planning Guidance. The Plan identifies six goals for data management:

DON DMI Strategic Plan Goals

- Unify DMI Infrastructure Efforts
- Provide DMI Processes, Procedures, and Metrics
- Provide a DON Metadata Repository, Tools and Supporting Services
- Provide DON Data Architecture(s)
- Reduce the Life-Cycle Cost of Data
- Provide Assured and Interoperable Data Services

DMI IPT

The DMI IPT is a collaborative effort by DON organizations to address the current situation of independent data management strategies and propose an integrated enterprise approach. The DMI IPT focus is on the development of processes, procedures and metrics necessary to implement the DON Data Management and Interoperability Strategic Plan. The inaugural meeting of the DMI IPT was held at the Naval Postgraduate School on 8 November 1999. Forty-four individuals, representing 29 Navy and Marine Corps Commands, attended. Standing members of the IPT include representatives from major activities that manage, operate, or develop databases.

To bring the tasks of the IPT to a manageable level, the efforts were initially focused into three sub teams: Management; Architecture & Standards; and Metadata Repository. The Management sub team is addressing the requirements associated with the production use of data within functional activities and information systems. This sub team is also addressing commands' and individuals' roles and responsibilities and reviewing data management requirements that need to be included in DON and DoD budgeting and acquisition processes. The Architecture & Standards sub team is defining the processes associated with the development of data architectures. Data architecture, as defined within DoD is "a framework for organizing the interrelationships of data, providing the incremental, ordered design and development of systems based on successively more detailed levels of data modeling." The process for developing data architectures includes the registration of data within existing systems and the development of standards that support the goals of data management. The implementation of DMI in the DON will result in data architectures that support the many communities of interest producing and using data. The Metadata Repository sub team is developing the foundation for providing awareness and access to data assets enterprise-wide. Accessibility to metadata is considered a key to information interoperability across business and warfighting systems and functions (more on metadata later). Early in the effort, a fourth sub team, Authoritative Data Sources, was created. The focus of this group is the myriad of issues associated with defining and identifying the primary sources of data within communities of interest. The inability to identify authoritative data sources was found to be a major factor in the ability to respond quickly to year 2000 data remediation efforts. The subject of authoritative data sources is yet another key element to a strategy that supports horizontal integration of information across different functional areas.

The DMI IPT will deliver DMI Implementation Planning Guidance to the DON CIO Board of Representatives in November 2000. This DON CIO guidance will recognize the need for centralized, collaborative planning and decentralized execution. Most importantly, it will reflect the results of DON-wide collaboration.

METADATA

Metadata is the focus in resolving interoperability problems associated with data. Metadata is "data about data"; it describes data characteristics. For example, the data element COUNTRY CODE has the following characteristics: the source of the code is Federal Information Processing Standard 10-4; the maximum number of characters is 2; the authority on country codes is the National Imagery and Mapping Agency (NIMA); the values are comprised of the letters A-Z. In addition to these characteristics, the metadata includes the list of approved values; such as "US" for "United States." Although this is a very simple example, consider the impact of information systems exchanging codes that are derived from different sources. In a tactical environment, friendly forces could be mistakenly identified as foes. Documenting metadata that describes the databases within the DON is a major objective of the DMI IPT. The metadata will be documented in a standard format within a DMI Repository (DMIR). The DMI IPT is defining the requirements, specification, and concept of operations for the DMIR. When operational, Navy Commands will register the metadata from their systems within the DMIR. Once captured, the metadata can then be analyzed to support the development of data architectures as well as identify redundancies and inconsistencies in existing databases.

BENEFITS TO BE REALIZED

Improved efficiency and effectiveness are the benefits of sound data management. Efficiencies can be significant. Consider the benefits, when multiplied across commands, of the following example from the Air Force: The United States Strategic Command (STRATCOM) engaged in a database consolidation effort in support of the development of its Strategic War Planning System. STRATCOM consolidated 23 databases into a single enterprise database. The number of data elements was reduced from 18,000 to 2,200. Over 20 million lines of code were reduced to 12 million, and 35 subsystems were consolidated into 6. STRATCOM estimates that they were able to reduce their operating costs by 20 percent and reduce manpower necessary to maintain the previous 35 subsystems and 23 databases by 125 billets - 20 percent of their support staff.

x 5 = 625

The benefits of improved effectiveness, particularly in the tactical environment, can significantly outweigh cost savings. During a recent analysis of metadata captured from two different shipboard threat-warning systems, differing representations for identifying threat levels were discovered. In one system, the values were 0 - 7, with 0 indicating "friendly" and 7 indicating "most lethal." In another system, the values were 0 - 9, with 0 indicating "high threat." Although these systems may not currently exchange these data values, the potential for exchange in the future may be a possibility.

The DON CIO recognizes the importance of addressing the larger area of information management and knowledge management. The current data management focus establishes the foundation for effective information management. Data management supports information and knowledge management, which facilitate decision-making.

SUMMARY

Effective decision support depends on the integrity and reliability of the information and knowledge base available to decision-makers. Data are the basic elements of information. The integrity of the data infrastructure affects the entire spectrum of the information and knowledge architecture and the reliability and speed of the decision process.

We cannot achieve data management goals without sound architectures and standards that are responsive to the needs of systems developers. The Joint Staff, through DoD policy, has stated that "Standards are the foundation for interoperability; their availability, use, and enforcement are the basis for achieving the ultimate goal of a seamless environment." Data standards are essential to interoperability and horizontal integration. Data standards issues have proven more complex than those associated with hardware and software, because they reflect diverse functional cultures and regional operational practices.

The DMI IPT is focused on developing the components of an infrastructure that will support the coordinated development of data architectures. Unfortunately, implementation will not come quickly or easily. The strategic goals, however, can be achieved with the appropriate level of support. This requires commitment by DON leadership in conjunction with the appropriate resource investment that supports implementing a strong DMI strategy. If the Department is to realize the full potential of its IT investments to support network centric warfare and achieve information superiority, we must have interoperability at the data level.

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