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NSWCCD-20-TR-1999-12+TR August 1999
Total Ship Systems Directorate
Research and Development Report

PROPOSED DOD GUIDELINES FOR IMPLEMENTATION OF A WEB-BASED JOINT IETM ARCHITECTURE (JIA) TO ASSURE THE INTEROPERABILITY OF DoD IETMs.

by

Eric L. Jorgensen

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Report Documentation Page

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1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
AUG 1999		**00-00-1999 to 00-00-1999**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Proposed DOD Guidelines for Implementation of a Web-Based Joint IETM Architecture (JIA) to Assure the Interoperability of DoD IETMs	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Naval Surface Warfare Center,Carderock Division,9500 MacArthur Blvd,West Bethesda,MD,20817-5700**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**		**65**	

Proposed DoD Guidelines for Implementation of a Web-Based Joint IETM Architecture (JIA) to Assure Interoperability of DoD IETMs.

by

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August 1999

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ABSTRACT

This Paper presents preliminary guidelines intended to serve as input to a planned DoD Handbook for the Acquisition and Deployment of DoD IETMs with the specific purpose of assuring interoperability of IETMs among various end-users. This work results from a study sponsored jointly by the Logistics Reinvention Office of the Office of the Deputy Under-Secretary of Defense for Logistics (DUSD(L)/LRO), the Joint Electronic Commerce Project Office (JECPO), and the Joint [Logistics] Commanders Group for Communication and Electronics (JCG-CE). The resulting Joint IETM Architecture (JIA) is an adaptive World-Wide-Web-Based Architecture for the deployment of DoD Interactive Electronic Technical Manuals (IETMs) based on the existing technology, industry standards, and commercial software products being developed for the World Wide Web. The version of the JIA described in this Report is for informational purposes in order to provide a preliminary overview to the DoD IETM community of the overall contents of a planned DoD Handbook.

The objective of the DoD effort to develop these guidelines has been to create an IETM architectural framework that fosters acquisition-management policies and procedures that will guide and standardize IETM acquisition, management, deployment, and display. The purpose of this study and the resultant Joint IETM Architecture (JIA) is achievement of a state of universal end-user interoperability that:

- will enable maximum interoperability of Technical Information accessed and displayed by a user so as to meet the needs of the Defense Logistics community in supporting the material readiness of the DoD forces;
- will serve as the basis for a formal DoD-wide adoption of the proposed approach in promulgating the required acquisition and field-support policy.

The policy recommendations stemming from this study are based on a series of pilot-demonstration programs carried out in FY99 that have shown the applicability and efficacy of the Architecture in achieving required quality and interoperability for IETMs which support a broad spectrum of candidate weapon systems of the Military Services.

The set of guidelines presented in this Report summarizes the recommended Web-based functional requirements for the following technical areas:

- Object Encapsulation and Component Interface.
- Intranet Server and Database Interface.
- Common Browser.
- Electronic Addressing.and Library Model

These aspects of a COTS-environment changeover from current IETM acquisition and maintenance procedures to a Web-based interoperable approach are defined and described.

ACKNOWLEDGMENTS

The author was assisted in the preparation of this document by the technical contribution and review of members of the Tri-Service IETM Interoperability Project Team, of which he is Team Leader. The more detailed input upon which much of this Architecture is based will be documented separately in a set of appendixes and other supporting papers for the final official release of the Handbook. Principal technical-team contributors for the JIA Effort include the following:

- NSWC, Carderock Division - John Junod, Annette Singletary
- OSD CALS Support Contractor: Bob Kidwell, Joe Brazy, Don Reynolds, Glen Copen, Tom Morris (ManTech Advanced Systems International, Inc., Fairmont, West Virginia)
- Service Support Contractors: Glenn Handrahan (AEWRA), Pushpa Merchant (PBM Associates), Gary Forrester (BTAS)

The Preliminary Draft of the IETM User-Interaction ("Look-and-Feel") Guidelines included in this report was developed by the Service Publication Panel of the Aerospace Industries Association, Mike Post (Boeing), Chairman, and invited representatives of the Tri-Service IETM Technology Working Group. It was a result of an AIA and Tri-Service IETMTWG Workshop 15-18 March 1999 at Naval Surface Warfare Center, Carderock, Maryland.

Funding for this effort came from the Office of the Deputy Undersecretary of Defense (Logistics) - Logistics Reinvention Office and the Joint Electronic Commence Project Office. The project was performed as a task of the Tri-Service IETM Technology Working Group, Joseph J. Fuller, Chairman. The Lead Performing Activity has been NSWC Carderock Division, Code 2052, Bethesda MD - Eric L. Jorgensen, Project Leader (jorgensenel@nswccd.navy.mil)

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PREFACE

Guidelines contained in this Report have been prepared by the Project Leader of the Tri-Service IETM Technology Working Group IETM Interoperability Team, in advance of the delivery of the actual Final Draft of the DoD Joint IETM Architecture Handbook scheduled for the Fall of 1999. The Report is being published in response to requests from many interested parties for a preliminary summary as to what the JIA will contain when actually released as a formal DoD Handbook. Since the formal DoD-wide coordination process for the draft JIA Handbook requires at least an additional 6 months after it is available in a form ready for DoD coordination, the expected release of the Official Handbook will not be before the second half of 2000. The present version of the JIA Guidelines is thus intended for informational purposes only and is not intended to be an official procurement guide. It is, however, an update of the technical information contained in a previously released paper on the JIA[1], and has been reviewed by the technical-team members from the various Services. The basic concept of the earlier paper remains the same and most technical changes are in the nature of clarifications to the previously published technical details. Some new material has been added. The information has been reformatted to appear as an official-guidance document so it can be utilized as part of the current Navy submission to the ARMY LOGSA Office that is formally preparing the actual JIA Handbook. Statements made in directive form will not, of course, apply in any official sense until the Handbook is promulgated.

Comments from the interested Public are not being formally solicited at this time, but Mr. Jorgensen will welcome questions and constructive comments.

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[1] Jorgensen, Eric L. ***Proposed Web-Based Joint IETM Architecture for the Interoperability of DoD IETMs***. CDNSWC-TSSD-98-10, 10 Aug 1998.

Chapter 1. SCOPE

1.1 Scope

This Report provides technical guidance (1) for acquisition of electronically presented maintenance-related logistics-support Technical Information, which includes both Electronic Technical Manuals (ETMs) and Interactive Electronic Technical Manuals (IETMs), and (2) for implementation of an environment for the deployment of interoperable IETM products. Within the scope of this document, the term IETM will refer to both ETMs and IETMs.

1.2 Objective of the JIA Development Effort

The objective of the DoD Effort leading up to this guidance document was to establish a high-level Joint IETM Architecture (JIA) to guide and standardize the acquisition, management, deployment, and display of IETMs that:

- will enable, for the end-user, maximum interoperability in the use of Technical Information to meet the needs of the Defense Logistics community in supporting the material readiness of the DoD forces; and

- will also serve as the basis for a formal DoD-wide adoption of the proposed approach in promulgating the required acquisition and field-support policy.

To reduce the risks of implementation and to demonstrate utility of the approach, the Study Team conducted a series of FY99 pilot-demonstration programs[2]. This program successfully demonstrated the applicability of the Joint IETM Architecture to accommodate IETMs for the whole spectrum of DoD weapon systems and the capability of the entire range of IETM technical-data suppliers of the Military Services to provide such JIA compliant IETMs.

[2] Fuller, Joseph J. ***Plan for DoD-Wide Demonstrations of a DoD Improved Interactive Electronic Technical manual (IETM) Architecture***. CDNSWC-TSSD-98-006, July 1998.

1.3 Application.

The guidance provided in this Report is intended to apply to all Department of Defense IETMs at all maintenance levels.

1.4 Background

The transmission and electronic presentation of digital data within the Department of Defense (DoD) is quickly becoming the dominant method for communicating and accessing the Technical Information needed to operate and maintain the military weapon systems required to support field operations. In response to directives from the Office of the Secretary of Defense, all of the Military Services have ongoing efforts to convert paper-based technical documentation into digital format. The Services are replacing existing maintenance and logistic-support Technical Manuals with legacy-data-conversion products in the form of Electronic Technical manuals (ETMs) and the newer Interactive Electronic Technical Manuals (IETMs). Since this information is needed to sustain war-fighting capability in Joint and multi-unit operations, a uniform approach throughout DoD must be developed for acquiring, managing, fielding, and viewing the digital products in order to support in-theater maintenance of the weapon systems supporting these Joint operations. The guidance contained in this document is the result of a DoD-wide study conducted in response to a requirement of the Joint Logistics Commanders Group for Communications and Electronics (JCG-CE) to develop a common user interface for this digitized information[3].

This Report provides the guidance for a new coordinated procedure for acquiring and deploying IETMs to replace the current practice of independent procurement of electronic Technical Information using divergent technologies and deploying stand-alone formats. This new process, in turn, will be guided by an overarching technical Architecture that permits the IETM applications to interoperate and work together at the

[3] Memorandum for DUSD (Logistics) from Joint Logistics Commanders, 10 June 1997. Subj: Recommendations to Modify Tri-Service Interactive Electronic Technical Manual (IETM) Technology Working Group Charter to Incorporate Goals of the Joint Commanders Group for Communications and Electronics (JCG-CE) Electronic Publications (ETP) Panel.

user interface, without requiring that all programs employ the same IETM implementation, authoring system, or support infrastructure. This Joint IETM Architecture (JIA) is applicable for development and deployment of IETMs throughout DoD. Since the most effective approach to acquisition of each individual IETM must, of course, be based on individual Program and Service requirements and restraints, the Architecture permits a wide range of solutions and specific implementations so that such procurements can be based on sound business decisions.

Thus, regardless of the source and peculiar format of logistic-support source data, the JIA will provide the benefits of interactivity in Technical Information to any war-fighter for viewing and utilizing the Weapon System support data. The resultant process for managing and deploying digital information is directed at making the most effective use of existing resources and will provide vitally needed IETM interoperability.

This guidance document includes a comprehensive initial release of the JIA and guidance regarding Service Implementation. It is intended for immediate use in the acquisition and deployment of IETMs in all components of the DoD.

1.4.1 *IETM Interoperability Problem*

In 1992 the DoD issued several Military Specifications for Service-wide use in the acquisition of IETMs that are now being acquired for many of the DoD's major weapon systems. However, as individual systems have matured, issues in the area of interoperability among differing IETM presentation systems have arisen. The individual Services have noticed substantial incompatibility between these IETM systems and the growing inventory of legacy-data Electronic Technical Manual (ETM) systems (to which the Specifications were not directed). The result has been that although authoring systems and the presentation systems developed for an individual IETM were interdependent, they were incompatible with other IETM or legacy-based ETM systems. An IETM authored by one activity usually could not be viewed using a presentation system developed by another activity, nor could it electronically reference or incorporate the legacy-ETM information when needed to support the Technical Information.

Initially, this situation was not a problem for a weapon-system Acquisition Manager who acquired IETMs, because the developer, typically a prime contractor, was able to control both the IETM and the display system for the dedicated user population for any particular weapon system. But, as the use of IETMs became more widespread, and as they began to be deployed at multiple sites, it has become more important to establish a consistent infrastructure to manage and distribute IETM updates to the field sites and to provide life-cycle support for the numerous types of IETMs. In this environment, the fact that differing IETMs cannot interoperate (i.e., cannot be viewed on the same standard presentation system, or electronically reference each other to any meaningful level of internal granularity) has become a major impediment.

1.4.2 *Tri-Service Approach to Solving the Problem*

Starting in 1997, the DoD Tri-Service IETM Technology Working Group (IETMTWG), then chartered by the OSD CALS Office of DUSD(L), sponsored a DoD-wide study based on an earlier Navy NAVAIR Project, which developed a Navy IETM Architecture (NIA)[4]. At the request of the OSD CALS Office, the IETMTWG expanded the NIA project plan and approach into a DoD-wide effort that involved modifying, prototyping, and testing a version of the NAVAIR-initiated interoperability methodology which could be applicable to all of the Services. The approach was to utilize an expanded set of Tri-Service requirements and demonstrate the suitability of a DoD IETM Architecture on a spectrum of DoD weapon systems. At the same time, the proposed IETMTWG plan was presented to the Technical Publications Sub-panel of the Joint Commanders Group for Communications and Electronics (JCG-CE) as a means of meeting some of the major goals of the JCG-CE Publications Panel. These goals included the achievement of field interoperability for IETMs. The proposed approach was approved and the JLC recommended, by a memorandum of 10 June 1997, that the OSD CALS Office implement this plan as a joint effort of the JCG-CE and the IETMTWG. This DoD-wide effort technically started in late 1997 and continued through September 1999. The OSD CALS office has since been reorganized as DUSD(L)/LRO (Logistics Reinvention Office

[4] Jorgensen, Eric L., ***Proposed Web-based Architecture for the Interoperability of Naval Aviation IETMs,*** CDNSWC-TSSD-98-005 March 1998.

of the Office of the Deputy Undersecretary of Defense for Logistics), which is currently the chartering activity for the IETMTWG and the sponsor of this JIA Task.

1.5 Objective and Primary Goal for the Architecture

The objective for the JIA is to establish a technical framework for acquisition and deployment of the whole spectrum of Electronic Technical Manuals, so that when the sharable and interoperable Technical Information is distributed to the work location of end-users, they will be able to view and utilize that data through a common user interface, no matter what the authoring source or data format. In so doing, the DoD will be able to establish a unified approach to the acquisition, management, and use of existing ETMs and the newly procured IETMs. To obtain this objective, the overall approach for JIA development has been to base it on the use of existing COTS (Commercial Off The Shelf) Internet and World-Wide-Web technology. In this light, the JIA is not a new or even a redesigned technical architecture. It is the architecture of the INTERNET and the World Wide Web, profiled for DoD IETMs and implemented on secure DoD intranets. As such this document does not, by design, contain many, if any, new technical specifications. It is primarily a reference vehicle for shifting the inventory of DoD IETMs to a form and format suitable for long-term use on the Defense Information Infrastructure (DII), as it emerges and is available for the distribution and use of maintenance and job-aiding information.

The primary goal of the JIA is to achieve end-user-level interoperability of the IETMs delivered to and used by the entire DoD Operational Community. In this context, an ETM or IETM is defined as having end-user interoperability when it can enable a user with one common, commercially available display device, such as a portable personal computer:

(1) to view and interact with Technical Information from any source and of any internal format; and

(2) to automatically access and view, by means of an electronic-link reference in the displayed Technical Information, additional information in any other ETM or IETM with which the link connects him.

The JIA has been developed to provide interoperability for all levels of Electronic Technical Manuals including all five established DoD ETM/IETM Classes from the digitized page-oriented Electronic TMs to the highly integrated Interactive Electronic Technical Manuals. For purposes of this guidance document and the recommendations contained herein, the term "IETM" will be used to refer to all classes of ETM/IETMs whether the existing class definitions call them ETMs or IETMs.

1.6 Application of Guideline Document to the IETM Acquisition Process

This guidance document describes the portions of the Joint IETM Architecture applicable to end-user interoperability so that three major constituencies can acquire and/or develop needed capabilities for an effective IETM by acquiring these IETMs and planning for their in-Service life-cycle support in such a way that all of the Technical Information they contain is fully accessible by all end-users. The guidance contained in this document has specifically been designed so that these three acquisitions constituencies can separately and independently procure their portion of an overall IETM operational capability. Because of the prevalence of the Web-based architecture underlying the JIA and JIA-compliant COTS software products, they can be assured that the many IETMs procured under the JIA guidance will interoperate when the parts are brought together in a specific deployment in the field.

The three targeted constituencies are:

(1) The creators and developers of the IETMs themselves (both with regards to the IETM content and the selection of presentation software employed to display that content);

(2) The developers of the IETM user-infrastructure for both the distribution infrastructure and the user-site intranet; and

(3) The procurers of the common user display devices with the JIA-compliant browser software installed on these devices.

The guidance document is, of course, also provided for the DoD Policy Officials and Acquisition Program Managers who are responsible for policy and direction of these constituencies.

The following table highlights the relevance of the four proposed requirement areas (described in detail in the body of this document) to the three constituencies.

Target IETM Constituency

Requirement Area	IETM Developer	Infrastructure Provider	User Device Provider
Object Encapsulation & Component Interface	Principal Requirement for IETM Form		
Server & Database Interface	Rules of Cooperation between IETM developer and Infrastructure when server extensions and/or a DBMS need to be installed as part of delivered IETM.		
Common Browser	Statement of the capability which can be assumed of user-device. I.e., any additional functionality must be provided as a software component in the IETM.		Statement of minimum capability to be met in procuring COTS devices
Addressing Model and Library Index	Used as guide for preparing electronic address for references to other IETMs external to IETM being provided. Also contains requirement for index data (i.e., metadata) format.	Must provide for server remapping and Domain Name Services (DNS). Format of metadata available for index server.	

Chapter 2. APPLICABLE DOCUMENTS

Essentially all of the technical specifications for the JIA are widely accepted commercial specifications and are documented for DoD in the latest version of the DoD Joint Technical Architecture[5]. In the technical sense the JIA is not a new architecture but is the architecture of the World Wide Web as applied to DoD intranets in accordance with the JTA. Additionally any guidance contained herein relating to an actual JIA implementation is presumed by the to be subordinated to the DoD regulations and requirements for communication security, Public Key Encryption, and information assurance which apply to the environment in which the IETM is utilized, what ever they may be now[6] or in the future.

Chapter 3. DEFINITIONS

This nominal section is included here to parallel the numbering system of the planned DoD JIA Handbook, which will include definitions up front. In this report, the actual definitions and ACRONYMS related to this report are provided as useful but not required information and are included at the end of this report as Chapter 10.

Chapter 4. GENERAL REQUIREMENTS FOR THE JOINT IETM ARCHITECTURE

4.1 Overview of the Joint IETM Architecture

The JIA is firmly based on the proven and widely accepted Internet and World Wide Web technology, but is directed at implementations on private, contained, and controlled DoD intranets. Such intranets can be configured as a private DoD World-wide network, as a combat-capable unit-wide local intranet, or simply as a group of computers in close proximity, hard-wired in a local Ethernet configuration. They can also be configured as a

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[5] ***DoD Joint Technical Architecture (JTA) Version 2.0***, 26 May 1998.

[6] Deputy SECDEF Memorandum, 6 May 1999, Subj: Department of Defense Public Key Infrastructure (PKI)

single display device (portable or workstation personal computer) which operates as both an IETM browser and a personal single-user Web server. The technology for implementing such intranets is low-risk, easily implemented, and widely understood by the IETM-software community. The proposed Architecture is based entirely on the commercial standards and COTS technology being made available for use on the World Wide Web. A dedicated intranet constituting a JIA IETM implementation is composed of Web browsers, Web servers, and a network to connect them if they are not contained in the same computer. As will be described more fully below, an IETM implementation on an intranet may also include other optional Database Servers and Application Servers in addition to the principal HTTP Web-servers.

The overall concept of the JIA is to utilize the group of emerging technologies that the commercial marketplace is rapidly adopting as the standard for distributable electronic documents. These, in general, are based on the technology of the Internet and the World Wide Web. For security and operational reasons, the DoD will not utilize the actual public Internet or the World Wide Web itself, but will employ essentially the same technology and COTS products in a private and dedicated DoD intranet environment.

As noted, a major objective of the JIA is to achieve end-user interoperability of both proprietary and legacy IETMs. This will be accomplished by encapsulating or packaging them into a common View Package (VP – the name given to the encapsulated object of the IETM) format, which can be electronically distributed to DoD intranets and eventually viewed by an end-user employing a single user-information interface (i.e., a Web browser). This process is referred to in this guidance document as "object encapsulation"; that is, the process of “object encapsulation” creates a valuable IETM View Package. Such a capability will require the employment of the following technical capabilities:

(1) an authoring framework which [regardless of which authoring tools are used] can effectively create and manage IETM source data and subsequently create interoperable IETM View Packages for delivery to the Government distribution and user activities;

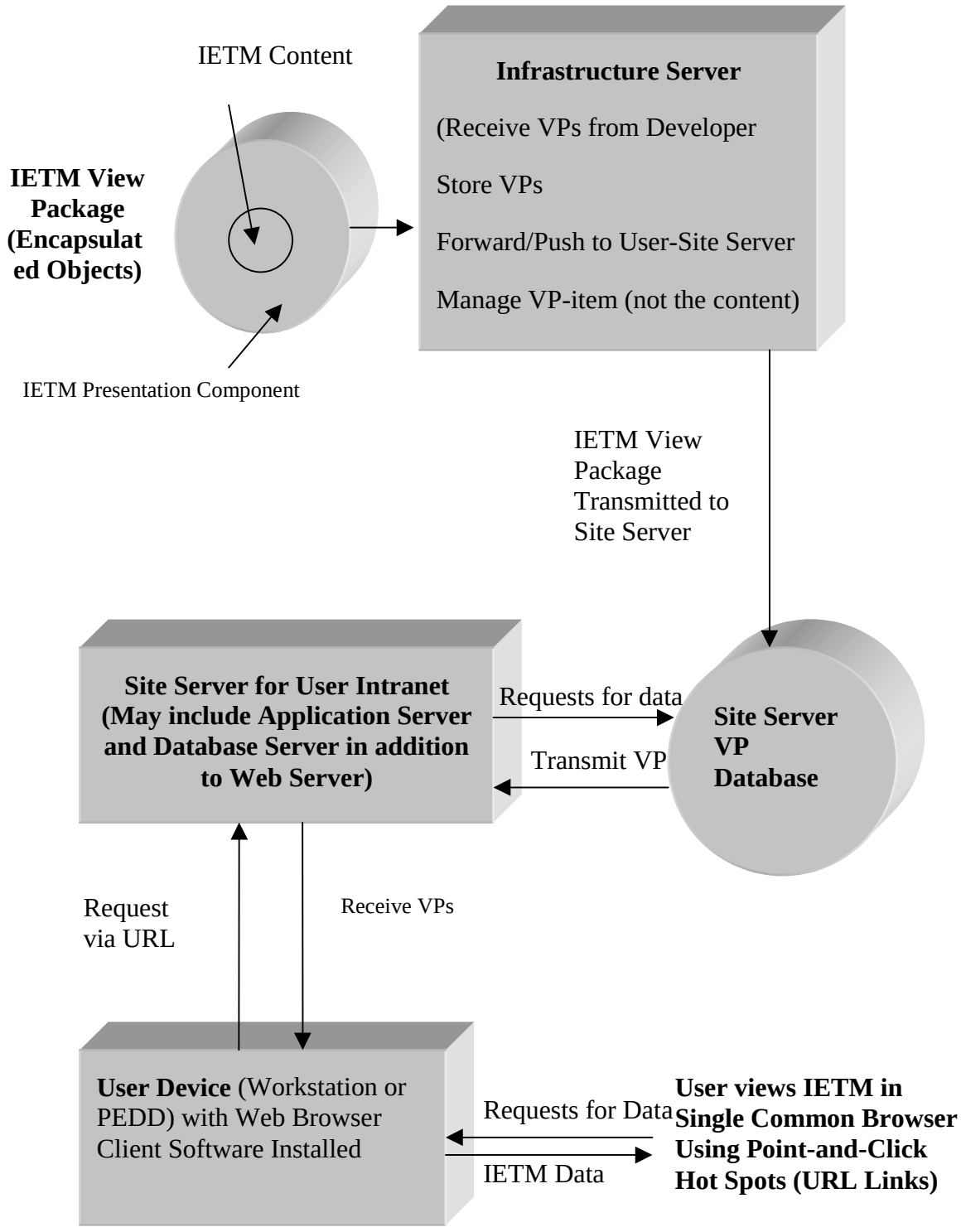
(1) an Infrastructure that permits a military agency to distribute, manage, and deliver these IETM View Packages; and

(2) a viewing device and a methodology for the end-user to access and view the required Technical Information, and to retrieve relevant data from other IETMs, including those of other Services, as necessary.

In order to achieve interoperability, the interface requirements recommended by this guidance document, while specific, are constructed so as to encourage innovative and effective solutions, especially in light of the constantly expanding technology base of the commercial environment. Achieving this balance has required some decisions that may need to be reexamined over time. However, whenever possible, the design will conform to open standards and/or de facto Internet standards widely implemented by multiple vendors, with the clear intent to maximize the use of commercially available software products.

Figure 1 shows the flow of an IETM and the associated information access processes in a typical implementation of the JIA. It illustrates the employment of the JIA by the original IETM developer, the management Infrastructure repository, the user-site intranet server, and the end-user who selects the next object to view via a point-and-click Web-browser interface. The “Presentation Component” referred to in Figure 1 can be either a client or server software component or implied (i.e., omitted) in the cases in which they are preinstalled in the standard browser.

Figure 1 – Flow of an IETM and the Information Access Processes in the JIA



The basic Architecture is not intended for, nor constrained to, any specific operating system, and can be adapted to Microsoft NT, DII COE (Defense Information Infrastructure Common Operating Environment), Netscape, or Unix implementations or a combination thereof for DoD applications. Individual Services or Programs may restrict their IETM applications to one of these operating environments, but neither the JIA nor the DoD Joint Technical Architecture (JTA) upon which it is based, requires a specific operating system. In technical terms, the "glue" (i.e., the communication protocol) that holds an intranet together (as in a JIA implementation) is the Web protocol, HTTP (Hypertext Transfer Protocol), operating over the communications protocol, TCP/IP (both listed in the DoD JTA), not the requirement for a standard operating system. Any TCP/IP network (e.g., an intranet) can easily accommodate multiple operating systems on its various server and client computers.

The approach to developing a solution for the problem of interoperability among IETMs from various sources has been to adapt commercial and industry applications involving electronic documentation for which there is widespread vendor-product support and these are essentially all Web-based products to some degree. Taking into account the rapid changes that have been occurring in Internet technology, the JIA has been designed to be extensible, flexible, and able to accommodate the predictable rapid growth in technology for all aspects of the Internet, the Web, and the emerging electronic-documentation applications being developed to operate on the Web.

Updates to any guidance document for the acquisition of JIA-compliant IETMs must, of course, be based on a continuing study of emerging Military requirements, and compared with the current state of commercial technology and available COTS commercial products to assure that they still met the DoD requirements in the future. The primary areas relating to the JIA in which requirements of the Military and commercial communities may differ are those involving communication security (COMSEC) and Information Assurance, and the overall administratively imposed requirements for operational presence on the DII (e.g., operating system limitations, restrictions on use of downloadable components, etc.)

4.2 Characteristics of the Architecture Which Must be Preserved in Future JIA Implementations.

As the JIA matures, certain requirements detailed in this guidance document are expected to be rendered obsolete by events and/or emerging-technologies. In such cases, developers and their DoD customers will need to refine and update some of the technical details discussed herein. However, the following non-technical functional and operational characteristics must be preserved even as specific requirements are modified and updated by technological progress.

4.2.1 *Characteristics of the JIA for the User*

The principal characteristic of the JIA for the user is that it enables an end-user with a single display device and a single graphic user interface (i.e., a Web browser) to read and utilize any DoD IETM accessible to that device, no matter which Service or Program originated the IETM. In performing an assigned task, the user will access and view the IETMs with either a workstation personal computer in a shop environment or a PEDD (Portable Electronic Display Device). The portable device can be configured either as a network client attached to the operational unit intranet or it can be reconfigured to operate in stand-alone or detached mode. In either case, the display of the information on the user interface is identical, and the user cannot determine from the look-and-feel of a screen display the mode in which the device is operating.

The major effect of the JIA on the user is that all Technical Information is viewed through a common (i.e., single) and very familiar Web browser interface. The JIA conforming IETMs should not employ externally launched viewing applications (typically called “helper applications”) which are not managed (i.e., structurally closed after use) by the browser. Other elements of the JIA, while very important, are intended, by design, to be invisible to the end-user. To access an IETM, the user will simply select a URL (Uniform Resource Locator; the form of electronic address used by the World Wide Web) using one of the many access-screen or menu-select options available. Selection options include such approaches as a Windows favorites list, explicit entries in a predefined pick list, a pre-assembled list of active IETMs on a squadron “Home Page”,

a hot-spotted index graphic, or a standard job-assignment form listing needed technical references as hot spots. An important characteristic of the JIA is that all of these features are common practices borrowed directly from the World Wide Web community. From the user's perspective, the referenced IETM content simply appears next in the display-device's browser window.

A major characteristic of IETMs that conform to the JIA is that all required browser software components are automatically loaded (i.e., installed) into the browser with no active user involvement. A major benefit to the user organization is that no explicit software installations are required to utilize an IETM, even with a device employing a brand new "out-of-the-box" JIA-conforming browser. Depending on the established browser security level, the user may, at times, need to explicitly accept software components that require installation, by a single-click acknowledgment. Other than that action, no explicit installation action should be needed because the browser installs the components automatically. This is an essential user-friendly feature of the JIA. Thus, there should be no need for a trained and certified system administrator to install user software. This required feature is a part of the simplicity of the JIA approach and one of the largest potential cost savers.

Another key characteristic of the JIA is the focused use of the primary Web-based access methodology, i.e., the "point-and-click" user interface. If one IETM contains a reference to another IETM, the user should be able to "click on" the highlighted reference and the referenced IETM should appear in the same browser window replacing the referencing information (assuming, of course, the referenced IETM exists on the user's intranet). This second IETM can, in turn, reference a third IETM, etc. To return to the original IETM, the user can simply use the "Back" arrow on the browser interface, effectively reversing the sequence of references. An important characteristic of such browser management is that the browser manages the software and data components utilized along the way. The user need not launch or close out application software. Success in this area is measured by the extent to which the user is not aware that a browser-managed system-clean-up action is going on. Modern Web browsers can handle many levels of such nested referencing with no performance degradation, a very powerful feature. From

the user perspective, the JIA is thus intended to make the use of disparate IETMs as easy and "seamless" as possible by use of modern technology. Because of the nature of the Web-browser technology employed, the user experiences a great deal of common "look-and-feel" in the interactive (navigation-control) area, even if the individual IETM user-interface for the content varies.

JIA implementations should also facilitate a common practice on the World Wide Web of employing search engines for accessing IETMs such as those employed by the well-known companies Yahoo and Excite. The JIA Library Model and the required standard HTML/XML-encoded Metadata Package are specifically designed to facilitate the inclusion of search engines on a JIA-conforming intranet. In these search engines, the user will enter a "string" or list of key word(s) or reference designator(s), and the search engine will identify IETM references available on the user's intranet. The JIA does not specify a specific search engine, but a rich selection of commercially available search engines build their indices from XML- and HTML-encoded sources and can easily be employed on a JIA intranet. The ability to get all the information needed to perform a task in a timely and convenient manner has been, from the beginning of the IETM concept, one of the important performance-enhancing capabilities of IETMs. This JIA implementation, using low cost commercially available technology, should permit even greater capability in this area.

4.2.2 *Characteristics of the JIA for the IETM Developer*

The principal significance of the JIA to the IETM developer is that all software components and data needed to make an IETM accessible on the JIA display device are packaged into a single digital product (i.e., the encapsulated objects), which can be easily combined and installed as a set of data files (a View Package) onto an intranet-server file system and subsequently automatically delivered to the user as the IETM is accessed. There should be no additional separate path for this delivery and installation of user software other than the primary delivery path for the encapsulated object.

This object-oriented methodology required by the JIA is a primary benefit to the IETM developer in that the developer is free to choose whatever authoring and development

environment he prefers. The JIA does not dictate how the IETM is to be developed nor what the internal format of the IETM object must be. The external interfaces are specified but they are in accordance with most of the modern electronic-document authoring environments that are rapidly being adapted to operate on the World Wide Web and, as such, should operate equally well on a JIA-compliant intranet. Additionally it is easy to verify most aspects of JIA compliance at the contractor's site, in that proofing tools for the IETM objects are also easy to set up in the developer's facility, and it is not necessary to utilize a military environment to verify the IETM. The JIA browsers are made up of readily available software products, which the authoring activity can easily procure without going through DoD supply channels. The design philosophy for the JIA is to use the best readily available commercial practices for developing and deploying IETM products.

While the technology needed to bundle all of the IETM components into a single digital package is complex, it is readily available in off-the-shelf COTS Web-based software products. A foundation principal of the JIA is that the products developed for the Internet can be used unmodified to develop IETM products for a JIA-compliant intranet. This process is in sharp contrast to a conventional IETM application where the IETM product is not only a MILSPEC custom format but is delivered as two separate items, the IETM content package and the IETM presentation-system software program.

4.2.3 *Characteristics of the JIA for the DoD IETM Distribution Infrastructure*

The primary characteristic of the JIA to the DoD IETM Distribution Infrastructure is that encapsulated IETM View Packages can be distributed without requiring that the distributing system "know" what is inside the electronic capsules. The Infrastructure activities can therefore consist simply of electronic-package distribution centers, for which the DoD has substantial experience, and not data-processing centers, which are much more difficult to operate and staff.

Within the JIA, a complete set of IETM-content and associated presentation components (see Fig. 1) is called an IETM View Package. All View Package delivery to the end-user network is accomplished through standard Web-based interaction. A feature of this

concept is that the View Package can be passed, unmodified, from server to server as part of the JIA electronic-distribution system. The key JIA concept for creation and use of the Infrastructure Server is that the IETM View Packages are composed of self-contained digital objects that appear to the Infrastructure simply as large standard binary-formatted digital files, which can easily be transferred over any intranet using common FTP (Internet File Transfer Protocol) processes or transmitted on a common CD/ROM. A View Package can be received from a developer, stored, forwarded, and delivered from one server to another without any need for the Infrastructure agents to know the internal structure of the View Package itself. Thus, the Infrastructure site can function more as a supply center than as an information-systems center.

The specific design of and development of any specific DoD or Service Infrastructure was not in the scope of the JIA effort itself. Such an Infrastructure design will undoubtedly be a complex, difficult, but important task that will be complicated by the impact it will have on many existing DoD and commercial business practices. However, this key JIA element, which enables the IETM View Packages to be processed as an item of supply (with no requirement to manage the internal content or structure of the object), will make this task much more manageable.

4.3 Baseline Requirements for Implementation of the Joint IETM Architecture

This section summarizes four categories of initial recommendations for the baseline requirements for implementation of the JIA and for development of JIA-compatible IETMs and Infrastructure capability. These requirements are described in more detail in the individual chapters that follow.

In addition to requiring the use of the de facto standards of the Word Wide Web, such as the HTTP, FTP, and TCP/IP networking protocols utilized by the Internet and by virtually all commercial Web-based intranet products and COTS systems, the JIA has specific functional and interface requirements in four areas. These are: (1) Common Browser; (2) Object Encapsulation and Component Interface; (3) Electronic-Addressing and Library Functions; and (4) Intranet Server and Database Interface. Performance

requirements are needed in all of these areas to guide the process of attaining and providing for the interoperability to view and access disparate IETMs by the end-user.

4.3.1 *Common Browser*

This requirement will apply to the procurers of the user PEDDs (Portable Electronic Delivery Devices) and individual workstations, since installation of a standard browser is required for these devices. A browser software component, which is not included in the IETM View Package, must be pre-installed on the user device. However, the providers of the IETM must also be aware of the details of this minimum requirement since their IETM must be developed in such a manner that it can be viewed using any JIA-compliant browser. A usable IETM cannot exist without a browser, of course, because a browser is essential for IETM access.

Two products dominate the Web-browser commercial marketplace: Microsoft Internet Explorer and AOL/Netscape (soon to be iPlanet) Navigator. The Common Browser requirement is that the configuration of each should be such that they will be functionally equivalent in any JIA intranet. It is the goal of the JIA that either browser can be used to view JIA compliant IETMs.

The minimum configuration of the browser to be specified in the planned JIA Handbook will most likely require some extensions to the commercially released products which can be made via specified plug-ins and controls; e.g., viewing capabilities common in Military IETMs, but not in the general marketplace, such as CGM (Computer Graphics Metafile) or the common PDF (Portable Document Format) used for legacy TMs. Additionally, for all practical purposes, the JIA will require support for XML, HTML 4.0 with CSS-2 support, and Java-Script. Thus, the JIA requires the use of the newer versions of these browsers at the time that this guidance document is being released. While this requirement is detailed here in some detail, it is fully expected that imposing this requirement on an actual user device procurement will be a mere formality. Such a procurement should require no additional consideration as such basic browser capability is expected to be available on virtually any general purpose single user COTS computer device available form commercial sources.

4.3.2 *Object Encapsulation and Component Interface*

A definition is needed for the delivery, transport, and structure of the integrated collection of software components and data contained in the IETM View Packages. In addition to IETM content and presentation components, the encapsulated object must include interfaces between multiple components when they exist, and the automated mechanisms for placing the IETM on the targeted intranet. It must also include the capability to automatically install these components on a presentation device in a manner sufficiently simple so that no professional system administrator is needed at the user site. From an architectural viewpoint, actual Object Encapsulation can be ordered so as to either operate at the user workstation (i.e., using the client software) or at the server installation. The JIA Object Encapsulation Process is described in the more detailed chapter following in terms of four Architectural Types: two client-centered and two server-centered. These are designated respectively as C1, C2, S1, and S2, and are described in Chapter 6. Any of these types (or a combination thereof) is an allowable Object Encapsulation approach under the JIA. This Object Encapsulation requirement constitutes the primary guidance required to document to the IETM developer in what logical form the DoD customer requires the IETM View Package be prepared and delivered to the Government.

4.3.3 *Electronic-Addressing and Library Functions.*

This is the overarching requirement that holds the collection of IETM information together by means of digitally encoded and executable-link references. The requirement itself will define the syntax and mechanism for building and executing the automated links to the IETM content and the IETM presentation software. Two additional areas regarding administration and enforcement of the recommendations are needed so that the enterprise-wide addressing concept will work. The Electronic Addressing and Library Model requirement will define these aspects, which will include the administration and allocation of the DoD-wide IETM "address space", the actual indexing or URL-based electronically-processible numbering system to which all the Services and their suppliers must subscribe. The requirement will also discuss the important area of the library model

or the search-and-access mechanism, which can be used to perform an intelligent content-based access to another IETM when the exact specific locator (i.e., a URL) is not known. To support the proposed Library-Search functionality, the requirement will also specify and require metadata files (encoded within a 'meta' tag in HTML or XML), that will serve as the primary searchable indices associated with each IETM.

A specific technical and administrative impact in any real implementation of this addressing model is that the JIA utilizes a concept of virtual URLs which in turn imposes a requirement on the Infrastructure to processes the associated Domain Name Service (DNS) to assign the virtual URLs in an IETM to a specific server on which the referenced IETM is located in terms of its network address on the intranet being utilized. This is not a technically difficult issue, as some DNS is needed for any intranet to operate, but there may be an additional IETm related administrative burden to add an additional IETM specific DNS to an existing network to execute JIA compliant IETMs. This is described in more detail in Chapter 7.

4.3.4 *Intranet Server and Database Server Interface*

For those IETMs that require the services of both an Intranet Server and a user-site Database Server, the IETM supplier must provide the proper software extensions to the basic JIA intranet Web-server for access to the Database Server if they are not already in place. This requirement identifies the need for cooperation between the constructors of the end-user intranet Infrastructure and the IETM provider, who, in turn, need to establish the interfaces and protocols involved. The JIA is designed to recognize the fact that, in most cases, it will be necessary to install software using conventional system-administration practices on fielded servers in order to achieve needed functionality. (Note that this will not to be the case for the components fielded on JIA-conforming user browsers.) The guidance, detailed more fully in Chapter 8, documents the requirements that an IETM provider must take into account when proposing or delivering such a capability for a JIA intranet.

4.4 Communications-Security and Information-Assurance Requirements

All IETMs developed to be JIA compliant must also be designed to be usable within the DoD Information Infrastructure as it matures and becomes more available for Logistics-Support operations. The functional area of using and deploying of IETMs in the field will be one of these Logistics-Support areas, and will probably form a part of what is being called the Global Combat Support System (GCSS). As such, the IETM applications will inherit the requirements for applications on the GCSS (or the name ultimately given to the collection of Logistics-Support Applications of the DII), especially in the communications-security and information-assurance area. Note that these requirements apply to unclassified IETMs as well as classified IETMs. Requirements for DoD IETMs classified Secret and above will be in addition to these requirements and are not covered in this guidance document.

The specific communication-security technologies involved, and accordingly the associated policies, are subject to constant revision over the next few years. However, communication-security requirements of some kind will certainly exist and IETMs will be required to conform to those requirements. Thus, it is likely that most of the specific IETM requirements and those of the associated Infrastructure implementation will apply to the network elements (i.e., browser implementation and settings, and Web servers) and not to the specific IETM View Package itself. That is, the communication and information-assurance security will involve user and server authentication and will be layered around the IETM accessing and viewing processes; and will not be part of the IETM-specific View Packages or the actual implementation. The principal exception to this statement is that the downloadable software components involved in an IETM (including diagnostic routines and software agents) should be digitally signed and issued a certificate by one of the official IETM management activities. These activities would be the same activities that would authorize or issue the IETM vURLs referred to in the Addressing Model Requirement discussed in Chapter 7. It is, however, very clear that in accordance with emerging DoD policy[7] any security mechanism implemented in any DoD IETM must be limited to those that employ only the certificates issued by the

official DoD Public Key Infrastructure (PKI). In other words, proprietary or any other non-DoD security methodologies, no matter how much sense they make, should not be used if they in any way require the administration of a certificate (i.e., digital key) program which provides ujnique (i.e., other that the official DoD PKI issued) certificates to users.

4.5 Requirement Permitting IETM Use in a Stand-alone Environment

A unique feature expected of a typical Military-JIA Intranet, as opposed to more conventional Private-Sector intranets, is the capability of operating PEDDs (or other portable display devices) as stand-alone devices. Portable devices are more likely to be disconnected from any network during the time when an IETM is actually being viewed in support of a maintenance task. In many cased the portable user device is connected to the intranet network only occasionally, for the purpose of receiving needed information or for purposes of configuration management. These incidents will involve the downloading of new or updated information, as well as the uploading of feedback reports, the ordering of parts, and the reporting of other logistics information.

4.5.1 *Occasionally-Connected User Devices*

Since it is possible to carry out all the functionality of a distributed intranet, using a single device, by installing a personal Web-type server on the portable device, those applications are considered conforming to the JIA. If needed, it is also possible to install other servers that might be needed for an advanced IETM. For some database-oriented IETM applications, when the PEDD is used in stand-alone mode, there will be a need to explicitly install on the PEDD the database-management system (DBMS) which performs the database-server function.

To be fully JIA compliant, as applications are developed, a substantial requirement exists to build configuration-management facilities into the downloading system that is supplying data to the user devices. However, with these self-contained intranet features

[7] COMSEC references

in place, it will be possible to access any object loaded onto the device in exactly the same fashion as from the Site Server.

4.5.2 *Dual-Mode IETMs and the JIA*

Two options also exist for viewing IETMs in a stand-alone environment and which do not require the installation of a Web server on the stand-alone device. These are considered in this guidance to be compatible with the JIA concept. In these cases, individual Services may sponsor dual-use implementations of some IETMs, utilizing a stand-alone version for primary Service use, and at the same time maintaining the option to incorporate the IETM unmodified in a JIA-compliant intranet (and hence achieve a JIA-compliant IETM) with little or no additional effort.

One approach to such dual-mode use is to take advantage of the fact that both the Netscape and Microsoft Web browsers can directly access a file system on a local computer without using a server (including a CD/ROM mounted on the computer's file system). These applications are commonly called "disk webs", and are used by book publishers to distribute CD/ROM versions of their publications. This approach is, in general, limited to static presentations such as book replicas. A disk web can limit its internal URL references to a restricted syntax called "relative addressing" in which the server is implied as the "current server" and is not actually specified in the URL. In this case, it is possible to mount the same IETM system on a JIA-compliant server or on a local computer's file system.

A second option for JIA-conforming dual-use IETMs involves a legacy-data implementation and format for which an additional JIA-conforming Web-enabled presentation component has been developed that requires no alterations of the original electronic information for presentation on an intranet. In such a case, the same information can still be viewed on the original stand-alone viewer or on a JIA browser.

4.6 Building an Integrated Product-Support Database

While out of the official scope of this guidance document, it is also herein recommended that the Joint IETM Architecture be considered for possible application to fielded

weapon-system-support applications other than IETMs, such as job-site training, diagnostics, and logistics support. The Joint IETM Architecture can apply to any of the components of what might be called an Integrated Product Support Database (IPSDB). Using a JIA approach, such a de facto IPSDB could be developed without employing a total custom formally integrated system redesign. Functions which could benefit strongly from the application of the JIA include training products used to support a weapon system in the field, on-line parts-ordering functions, parts information, and remotely operated diagnostics procedures traditionally known as test program sets. In developing integrated support for a weapon system, it should be the DoD position to discourage the development of disparate support products for individual weapon-system-support functions. Instead, it is recommended that a strategy be developed for using the proposed unified IETM Architecture to provide a coordinated IPSDB functionality, which incorporates, fielded technical training, diagnostics, and logistic support products. This can be accomplished without the expense and substantial effort of an integrated system design. All that may be needed to start such a development is the enforcement of an addressing model, such as that proposed for IETMs, which would permit independent applications to form a "web" of content related linkages. This may in fact be all the needed information to effect a meaningful integration as far as the user in concerned. For example, he can get his parts data or a refresher training module, from the IETM and return with a simple clicks or a "back" function. The family of general-purpose commercial products being developed utilizing Internet World Wide Web technology can provide all the functionality needed in these applications. These can be adopted instead of the "Stove-pipe" application software traditionally employed by individual weapon-system suppliers in the development of custom DoD product-support systems.

4.7 Defining the JIA

The following four chapters detail the individual requirement that define the JIA as summarized in this introductory chapter. Chapter 9 closes with an additional proposed requirement that may be needed to assure that the ability to access a JIA compliant IETM is also the ability to utilize the JIA compliant IETMs in support of a common operations

or maintenance task. This chapter details a recommendation for achieving a meaningful level of common "look and feel" for the IETMs developed under the JIA guidelines.

Chapter 5. COMMON BROWSER

The approach of the Joint IETM Architecture is to use de facto Industry Standards, and in the case of the JIA browser, to be able to use de facto software to the extent that the browser provided for a device purchased in a routine computer store is adequate to serve as the starter browser for a JIA IETM.. What little customization that may be needed can be accomplished after the fact by visiting a DoD "plug-in site", which containes the auto-install provision for the needed IETM plug-ins such as the latest PDF viewer or a standard graphics viewer. It is expected that to the procurer of user devices, the requirement for a JIA browser will be essentially a non-issue. Accordingly, requirements for a common browser are based on the Industry practice, in which two particular commercial products together have captured essentially the entire Web-browser market. While it is possible to develop, assess, and evaluate a long list of needed and desirable requirements for the common IETM browser, such an exercise would serve little purpose in light of economic and marketplace realities of such de facto standard products. New Web browsers are complex software products that are very expensive to develop. Furthermore, products currently being offered in the marketplace free of charge effectively preclude development of additional commercial general-purpose browser products. At this writing, these two products are AOL/Netscape Navigator (soon to be renamed as the iPlanet Browser to reflect a new alliance with Sun Microsystems) and Microsoft Internet Explorer. Except for a few proprietary capabilities, these two products are functionally identical. For the traditional HTML Web pages that dominate the WWW, they perform similarly.

This Common Browser requirement over time will likely through the official DoD JIA handbook specify the appropriate version of each of the two dominant commercial browser products cited and a set of standard extensions (i.e., controls and/or plug-ins) to these browsers. The specifics will be updated over time. These extensions will most

likely include common DoD data viewers for file formats such as PDF, CGM Version 4 Web Profile for Graphics, CALS raster images, and possibly a CALS Table viewer.

What is important in this Common Browser requirement to IETM developers is the situation that the inherent capabilities of the JIA-compliant browser will include basic presentation methods, either intrinsic to the commercial browser or added to meet JIA requirements, so that the component portion of an Encapsulated Object (View Package) can be treated as though already installed on the presentation device. Accordingly, these particular browser components should not be included in the IETM View Package. Currently built-in browser support includes components such as HTML 4.0 (HyperText Markup Language) layout, GIF (Graphics Interchange Format) and TIFF (Tagged Image File Format) viewers; and JPEG (Joint Photographic Experts Group) display.

The goal of the JIA is that all DoD IETMs be compatible with both the Internet Explorer and Navigator/iPlanet browser products.

At the time of the writing of this guideline document, there remain some issues regarding these two browsers and the emerging DoD communication security requirements. Only one version of the Netscape browser has been approved as meeting the new PKI security requirements at this point. This security issue is much broader that the use of Web browsers for IETMs on the GCSS (Global Combat Support System), as is effects the use of such browsers for any applications on the GCSS. It is, however, the expectation of the vendors and Defense Department officials that these issues will be resolved in the near future and that both browsers will be approved for use on the GCSS.

Chapter 6. OBJECT ENCAPSULATION AND COMPONENT INTERFACE

A fundamental principle underlying the Joint IETM Architecture is that developers of IETMs can deliver, as a single View Package, all capability in the form of Technical Information and software components needed to install and use an IETM on a standard DoD Intranet. This requirement provides the IETM suppliers with a description of the framework in which they are to package and deliver the digitally encoded IETM. This View Package will contain both content and software components that have been

combined into Encapsulated Objects, and delivered as a contract package for electronic archiving or subsequent store-and-forward management. Consequently, there is no need for separate delivery of an IETM presentation device or piece of viewer software for separate installation onto the user's presentation device. Rather, the View Package will contain intrinsically the capability to be automatically installable onto the end-user intranet at the time it arrives at the intranet. The specific methodology for accomplishing this is not specified in this guidance other than to require that it must operate on the two JIA target browsers and a generic Web-server including the capability of Microsoft Internet Information Server and the Netscape Suitespot Server.

6.1 Core Object Encapsulation

This requirement is applicable primarily to IETM developers; i.e., to those involved in the preparation of IETMs for delivery to the Government. Fundamentally, it provides that all components, content, and software be encapsulated into a single IETM View Package for transport to the user intranet in a form which is accessible and viewable on an end-user presentation device. It applies irrespective of the method employed for information delivery, whether on-line or via a high-density data bundle such as a CD/ROM.

The Encapsulated (data and software) Objects will eventually be delivered by the Service Infrastructure to the field-user activities as though they were simple binary data packages. These packages will be treated by the Infrastructure as file-oriented data destined for a DoD Site intranet Web-server. The View Packages will appear simply as a generic "bucket of sequenced bits" that are processible by the server, but for which the content is of no concern to the Infrastructure. The Infrastructure activity need only assure that these bits remain packaged together. The View Package is a set of industry-standard binary files, each of which is assigned a JIA notional locator (e.g., a URL, or Uniform Resource Locator, conforming to the JIA Electronic Addressing Model) that contains sufficient information to support its installation as data in the Intranet Server file system (See Chapter 7 for details). Until the point of receipt by the intranet server, the View Package

is processed as a single object. Only at the server is the View package broken down into its constituent parts.

The complexity and degree of integration of these View Packages will vary greatly among differing IETMs. Some will simply be a two-part collection of one software component and one data set. The simplest form will be a single set of data with all of the needed software contained in the standard JIA browser. In other forms, a system of software components and possible multiple data sets will be spread out among several servers and the browser device when the IETM is operational. For example, this latter case might apply when there are background software agents that might be concurrently performing diagnostics and system monitoring. Another emerging technology requiring the use of more complex IETM Encapsulated Objects entails the use of software agents acting as an intelligent mentors which insert training aids into the job-aiding presentation when the agent (a computer program) determines they are needed. Between these extremes is a spectrum of complexity, each level requiring a somewhat different object-encapsulation approach. The "object" nature of such View Packages is that all the intelligence required to construct the operational IETM on the target intranet is contained within each View Package object itself. Thus, there is no single standard for the internal constructs of the View Package in the JIA, and the absence of such a standard is a distinct characteristic of the object-oriented approach used by the JIA in defining requirements.

6.2 Object Encapsulation for Various JIA Architecture Types

In practice, the implementation of an IETM intranet may be simpler (as is the case with basic HTML pages) or more complex (as is the case with most custom servers) than that implied by the baseline operational flow of Encapsulated Objects (Figure 1) described in the introductory chapter of this guidance document. The following breakdown of anticipated IETM View Packages by Architecture Type is presented in order to categorize these variants and to provide guidance that is more specific in the implementation of these variants. These variants have been developed to reflect the reality of the differing approaches currently taken to implement large Web sites in the commercial sector. They are not intended to be a new specification of how IETMs

should be developed differently. Any particular IETM intranet implementation will typically contain a mixture of these Types. The four Architecture Type categories described represent a continuous spectrum of variation rather than a discontinuous set. Thus, for some applications, it will be difficult at times to categorize all implementations precisely. However, the overall guidance applies in all cases.

Definitions of these Architecture Types are given in Table 1. The Type definitions are grouped into two categories:

(1) IETM Architecture Types C1 and C2. With Type C Object Encapsulation, the various components of the IETM come together in the browser (i.e., client) software. The server merely manages the separate components for file and delivery purposes. No actual computations are performed on the site Server. These Types require only a browser and a generic HTTP based Web-server.

(2) Architecture Types S1 and S2. For Type S Object Encapsulation, the computational process is hosted on the site Server where the IETM software comes together with the IETM Technical Information and the server is the location where the computational processes are accomplished. Only the last step of rendering an image on the screen is performed by the browser. For these server-centric Types, the technology for incorporating the additional servers into a Web-type environment is less mature with respect to standardization, and available commercial products are much more diverse. This segment of the market place is just now emerging, and it is much dominated by proprietary products. However, the products have been developed to meet real commercial requirements and are very powerful for highly interactive presentations. They are, in particular, effective for large-scale IETMs which are frequently updated from an authoring database.

Table 1 - IETM Architecture Types

Type	Characteristics	Examples
Type C1: Basic HTML/ XML Pages	HTML/ XML page(s) with only browser-resident components. Requires no component licensing. Most will work on any browser. Includes HTML 4.0 scripts. Client processing only. "Plain vanilla" HTTP server.	HTML with Java script, GIF, JPEG, frames XML + CSS or XSL Style Sheets When standardized by JIA Policy, PDF and CGM files.
Type C2: Simple Down-loadable Component	Viewer-specific data set plus custom automatically downloadable non-HTML viewing component Uses "plain vanilla" HTTP server.	.docf iles plus MS WordView control Legacy Systems reprogrammed as custom browser or presentation system operating inside a standard browser shell/container.
Type S1: HTML Plus Application Server	Two-tier architecture in which Web page includes reference to server application(s), which must operate before page, is delivered to client as HTML/ XML. Data and components managed on server. Utilizes File Base on Server. Requires HTTP server with S/W components for server-side computations. Permits both client *and* server processing.	MS Front Page Webs MS Design-time Controls CGI Server Apps DynaWeb
Type S2: HTML with Database Server	Three-tier architecture that includes a Web page server with pages functioning like a template; e.g., for calls to a database manager, which contains most of the IETM content. Can include server and components for custom functions. Requires a DBMS server (e.g., Oracle) in addition to the HTTP server. Permits both Client *and* Server processing.	Raytheon AIMSS 4.0 Boeing Data Courier GD TechSight Web MS ASP w/ODBC Calls

Properties of Client-Based Architecture Types

Architecture Types C1 and C2 share the common important properties of not requiring installation or operation of unique software on the server. Thus, the server can be treated as an electronic bookshelf. As far as the server is concerned, the two parts of a Type C2 Encapsulated Object (the content and the associated software components) are simply treated as files. Type C1 Encapsulated Objects have no included software components that need to be downloaded from the server. Additionally, any contemporary HTTP server can be employed and it does not matter what operating system is employed. Thus, for Type C1 and C2 IETM applications, interoperability is very low-risk in the sense that, with these, any IETM View Package can be accessed using any server. For IETMs of Types C1 and C2, only a generic server is required and no JIA-specific server requirement is required. Both Types are considered pure encapsulated-object Types; however, for Type C1, the component part of the object can be implied (i.e., omitted), as its presence can be treated as preinstalled on any JIA-compliant browser and need not be included in the transported IETM View Package. For Type C2 encapsulation, the software component is downloaded from the server to the browser the first time the IETM is accessed.

The Type C definitions are closely tied to specific versions of HTML and XML, a situation that is further clarified in this document. HTML/XML is herein specified as employing both HTML version 4.0 and XML version 1.0, both International W3C (World Wide Web Consortium) recommendations (i.e., de facto standards) which have been formally approved. An important consideration behind this decision is that essentially all the major software vendors support these W3C recommendations, whereas no complete agreement exists as to support of delivered products based on the previous HTML 3.2. The XML standard has elicited widespread vendor promise of support as a user-extensible expansion of HTML. XML lags behind HTML 4.0 in maturity, but the W3C recommendation is sufficiently complete so that software has been provided by major vendors, and shows promise of becoming a Web-based tagging standard that is more suited to the preparation of complex IETMs than HTML. In particular, it will be

much easier to convert the large DoD inventory of SGML-tagged source data to XML for a JIA-compliant presentation than it is to convert it to HTML.

6.2.1 *Properties of Server-Based Architecture Types*

For Type S1 and S2 IETM applications, particularly for the server application software, current de facto Industry practices for encapsulating the differing Application Server packages are much less certain to achieve the stage of W3C Recommendation. Several company-proprietary approaches are available for standardizing, such as Microsoft's design-time controls, and Active Server Pages (ASP). Additionally, a variety of third-party middle-ware products exist to perform the integration of Web-Servers and Application Servers. However, the technology and the state of de-facto COTS industry standards are not sufficiently mature at this time to propose any one of them as a DoD standard, a practical necessity if all IETMs are to operate on a single server.

However, this is not the only method to achieve operational interoperability with server-based solutions on a particular intranet. There are two possible approaches for a working solution:

1. The various IETM providers must put their own physical server(s) plus the IETM View Packages on the user intranet (very feasible with the state-of-the-art and capacity of today's portable computers and plug-in network standards); or
2. All IETM creators must use the same set of server components (i.e., the Application Server) and install the standard components on all intranets employed in the community throughout which the IETMs are interoperable.

In general, option 2 is only feasible for a tightly controlled community and not applicable to the general DoD situation. With the current situation described above, multi-unit DoD forces, such as would be involved in a Joint Operation, would have to rely on option 1 for interoperability of Application Server based IETMs (i.e., S1 or S2). The JIA is intended, in this case, to be a facilitator to assure that this "bring your IETM preloaded on a Web-Server" approach is feasible and it will be possible to achieve interoperability by adding the new server on the Joint network, a feasible practice.

6.2.2 *Elements Diagrams for the Architecture Types*

The following diagrams more fully describe the differing Architectural Types for Object Encapsulation (View-package packaging and subsequent installation on an intranet).

Figure 2 illustrates the requirement of a client-based Architecture (Types C1 and C2) with two kinds of software elements: Web browsers and Web servers. In general these are hosted on separate devices connected by a TCP/IP network (i.e., LAN); however, an intranet can also be set up in a single display device without a network. In the case of IETM Architecture Types C1 and C2, these two kinds of elements are all that is needed.

Figure 3 illustrates the requirement of Type S1 for an additional element, the Application Server, sometimes referred to as a Web-server extension because it effectively operates in the same operating system as, and is an extension of, the HTTP server.

Figure 4 illustrates the requirement of Architecture Type S2 for a Database Server which hosts most of the IETM content, and which may or may not be hosted in the same device as the Intranet server. A Type S2 application usually includes aspects of a Type S1, since it requires an Application Server to process the information-access and request dialog between the Intranet server and the separate Database Server. Note that while the distinction between these two Types may, at times, not be clear, they differ in general as to where the primary information content is stored; i.e., in the server files or Database Management System (DBMS) managed databases.

Figure 2 - Elements for Architecture Types C1 and C2

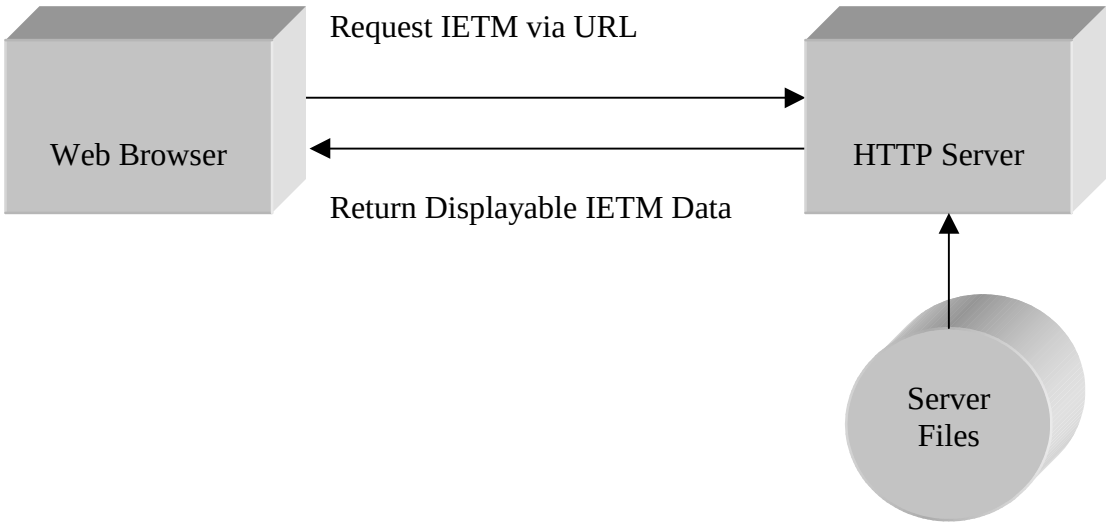


Figure 3 - Elements for Architecture Type S1

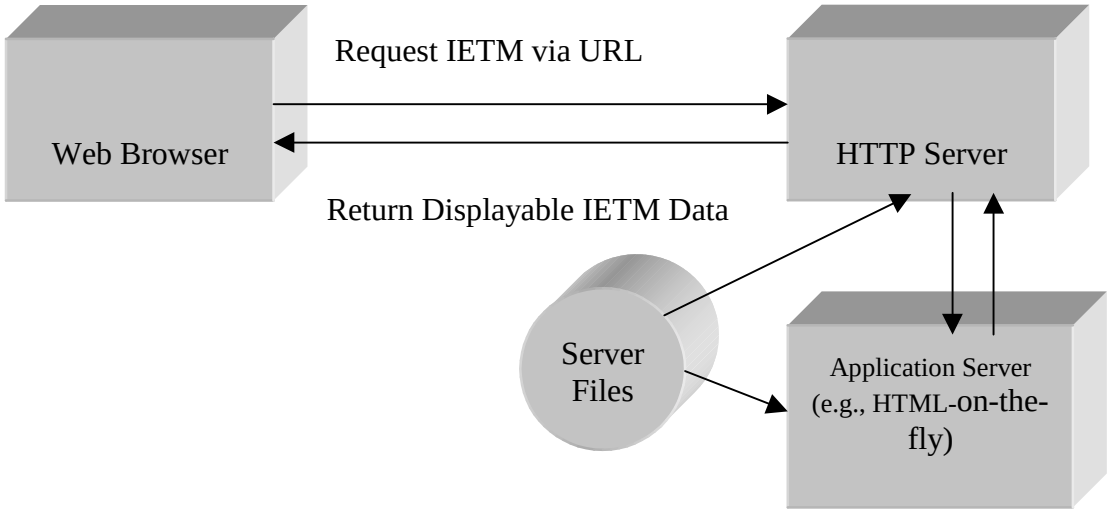
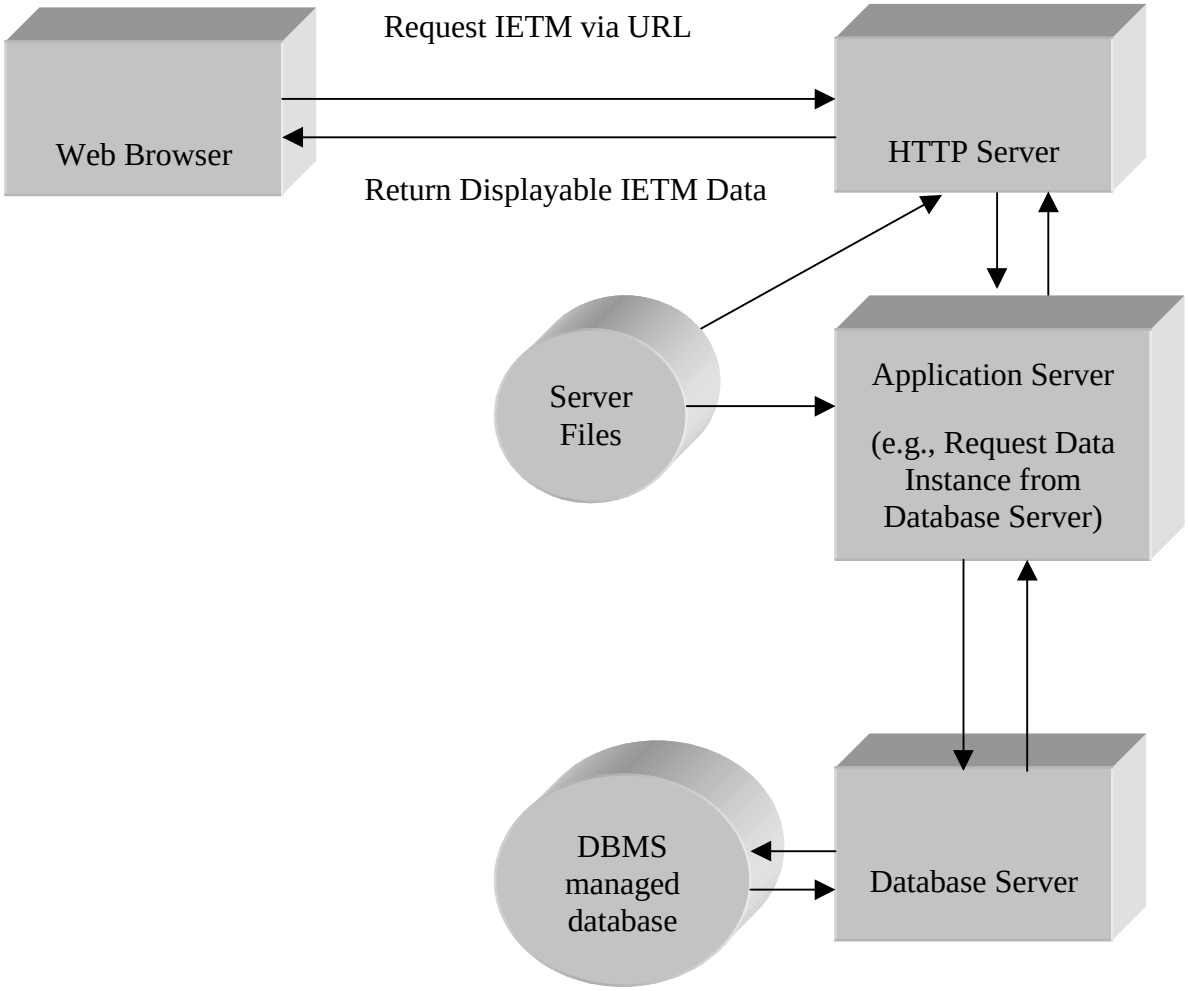


Figure 4 - Elements for Architecture Type S2



6.2.3 *General Advisory for the Deployment of the Differing Architectural Types*

The following paragraphs present what are believed by the author to be helpful suggestions for deployment of the various Architectural Types of IETMs. They are, however, at this time presented as optional guidance that can be followed if the IETM developer or program-office customer believer they apply to their particular situation.

Where appropriate, the C1 Type is much less problem prone and typically yields better performance that the other Types, particularly when the IETM is principally preauthored and contains static information that remains the same from one presentation to the next. Since this is the case with most existing printed (legacy) Technical Manuals, a great deal of formerly printed TM material lends itself to Type C1 presentation. The format control needed to preserve the usability and contextual content of paper TMs is available with HTML 4.0 with Cascading Style Sheets and static XML coded information. The technology is very good, and the preparation tools are inexpensive, but powerful, for most legacy-data conversion applications.

The high end of the spectrum, the Type S2 application with a DBMS managing the information and including true interactive features such as context filtering and program sequences, is best suited to large weapon-system IETMS. An additional feature of all Server-based systems is that it is much easier to manage the security features at the Server rather that manage the security in every client that accesses the IETM server..

Type C2 applications are the most vulnerable to computer virus infection in that they may host computer viruses and bring them to the user device with a download. Every downloaded component should be very thoroughly screened upon downloading, often a daunting circumstance. As such, it is the advice of this document the Type C2 implementation should be limited to the presentation of legacy applications where it is cost-prohibitive to do other than this. In these cases it is typically less expensive to re-code the existing application as a plug-in than it is to convert over to a new authoring environment. Emerging DoD security concerns over downloadable components may render the employment of Type C2 difficult to implement in a DoD system that must conform to the new information-assurance and operational-security requirements.

Downloadable software components are a major concern in such environments to the extent that they may be banned or severely restricted by cognizant external authority.

A possible compromise for the situation, in which a program manager deems it necessary to have a custom software component down-loaded to the client device, is to provide for an software-component install page which is separate from the IETM. This install page would meet the automatic-install requirement for JIA-compliant downloadable components but would entail no actual IETM data display. This would permit the downloadable software component to be placed under greater security scrutiny at the time of download (e.g., Virus scan, digital signature check, one time opening of software-install permission on the browser, etc.). Subsequent to that process, the IETM could be employed under the more efficient normal use mode (i.e., without all the security checking in place but with no permission to download software components).

The primary reason for electing a Type S1 solution often comes as a result of the business case for a legacy-conversion process. An application-server-based Web front end to a legacy application is often the least expensive method of Web-enabling a legacy application of any sort. However, tt times the size of the Type S1 file base may be a limitation in very large IETM data collections, in which case, the IETM would be better managed using an established Database Management Environment intended for large data stores (i.e., Type S2). JIA total Object Encapsulation (i.e., encapsulating the total unmodified legacy application with a Web front end) is primarily intended for use with existing legacy IETM systems. By creating a single interface to the legacy application, and by packaging the application as described in this document, a legacy IETM may made to comply with the JIA standards.

In summary, it is advised that either type C1 or S2 implementations be used for new IETMs. C2 and S1 implementations should be limited to legacy conversions for which a substantial economic case can be made.

Chapter 7. ELECTRONIC-ADDRESSING AND LIBRARY FUNCTIONS

7.1 Electronic Addressing

This requirement Chapter is the most technical of the four principal requirement areas, but it is the operational key to usable interoperability between two of more IETMs. While much of the discussion below is in the form of technical jargon, it is a vocabulary widely understood among developers of any intranet using Web-based protocols.

7.1.1 *Requirements applicable to IETM developers*

Implementation of the electronic addressing function in the IETM View package requires the following:

(1) A mechanism and format (i.e., coding format and associated syntax) for encoding electronic addresses into an IETM View Package;

(2) A defined name space and address approach (i.e., electronic numbering system);

(3) Searchable index information for each IETM entry point that conforms to an established convention so that a intelligent search engine can locate an IETM reference on an intranet when the specific locator address is not known.

7.1.2 *Requirements applicable to developers of IETM infrastructure*

Execution of the electronic addressing function in a deployed IETM also requires the following:

(1) A network service which assigns the virtual server reference in the IETM to the actual server IP address upon which the target IETM resides.

There are two mechanisms for providing this service in a particular implementation. The simplest for a small network is to modify the "Hosts" file in operating system of every client device (this file exists in all UNIX and Windows environments) to contain the required virtual server-to-network-IP-address mappings. The other is to employ an additional Domain Name Server (DNS) which contains the needed server-name-to-IP-address mappings (or to modify the principal DNS if the only purpose of the intranet is the use of IETMs). Note, this minor but important service is the only modification of an

existing intranet needed in order to put IETMs on the intranet. Employing the "Hosts"-file option doesn't require any addition to the infrastructure but does require that all the devices that might read the IETMs have their "Hosts"-file modified every time an IETM is added to the intranet, while the IETM DNS permits configuration management function to be performed one time at one site.

7.1.3 *Core Electronic Addressing Requirement*

The syntax for JIA electronic addressing will be based on the existing Universal Resource Locator (URL) standard for the World Wide Web, because it is widely implemented in virtually all Web-enabled vendor products. For such an implementation, an occurrence of a legitimate URL string of characters is automatically made "hot" in the vendor application. A mouse click on that hot spot by the end-user will launch a Web-browser information request from the intranet on which the browser is operating. The browser, in turn, will locate the file referenced by the URL and display it on the screen. In addition to requiring a standard URL syntax, this Electronic Addressing and Library guidance also requires that each of the Services maintain and publish a permanent registry of all valid references to the IETMs issued by that Service. Once published, this pointer to such a valid reference should not be changed, though the logical data may be updated. If deleted, the URL data request should return a "section canceled" (or some appropriate human readable message). This type of permanent URL is called a persistent URL. In order to assure that URLs are indeed persistent URLs, the JIA requires the use of virtual URLs (vURLs), as described below. These are URLs that use an administratively-assigned syntactically-correct server reference in the Internet URL syntax; however, the referenced server exists in name only. That is, a server by that name does not actually exist on the Internet or the DII and the name is used for data-management purposes only. When the IETM is actually installed on a intranet network, the vURL is remapped to the actual server on which the IETM data resides employing either the devices "Hosts" file and/or the IETM-specific Domain Name Services (DNS) in accordance with standard World Wide Web practices.)

The specific requirement for a JIA-compliant intranet is that it establish the capability for the remapping of these vURLs, which reference a virtual server, into the actual server and file-system locations on the intranet under use.

Guidance for establishment and use of vURLs is documented in Figure 5. Initially these DoD addresses will probably be claimed on a first-come-first-serve basis, to be eventually replaced by an official assignment authority. If earlier implementers use reasonable "ServerNames" and "LibraryNames" (see Figure 5) unique to their community, they can be continued in the official registry when it is established.

Figure 5 - Guidance for Establishing vURLs in the JIA

vURLs will be authored and maintained as follows:

HTTP should be the Web-page protocol to be utilized in this Architecture and construction of vURLs will use standard Internet conventions (i.e., the URL starts with "HTTP:// and is followed by ServerName/LibraryName/FileDirectoryBreakdown which may be terminated by a moniker [#,?] followed by a parameter known to the target). Format:

http://ServerName/LibraryName/FileDirectoryBreakdown{# or ?]MonikerParameter

ServerName is a unique name applying to the entire set of IETMs that is designed to operate from the same server. It will be assigned by the Service IETM registry. The specific rules for assigning such names will be determined by the Service IETM registries.

[The assigned Server name may be a single name (e.g., 'acb123server') or in the form of 'natsf.navy.mil' as though it were an actual server on the Intranet. If an Internet notation is employed, it is possible for a management activity to actually install such a server on the Intranet. They could maintain all of their cognizant URL references on that site in the form of acknowledgment as valid reference even if the actual content is not included on that site. However, the use of single names (i.e., no 'dots') is recommended to make it much clearer that a IETM-peculiar Domain lookup is needed when the IETM is mounted on an intranet. Single server names should be longer than 3 characters to eliminate the situation of being confused as an Internet domain such as 'mil' or 'org'.]

The LibraryName/FileDirectoryBreakdown breakdown notation should be unique across all DoD IETMs and should be administratively assigned as though it were the IETM number in the form of a Unix file-system reference with forward slashes such as

"/navyietmlibrary/f18/ef/engine/ge/" or "/servicetmlibrary/tmnumber/systemnotation/…". The allocation of this "name space" will be managed by the Service IETM Registries. To permit distributed allocation authority, the higher (i.e., first) index field would be unique to the individual-Service registry.

Additional Directory breakdown of files within the IETM reference is merely a further extension of the assigned FileDirectoryBreakdown name and content for a section within an IETM and may be null for the top-level reference.

Sample: "/navyietmlibrary/f18/ef/engine/ge/diagnosis/test3".

Optional specific-IETM-defined monikers may be utilized. These are most commonly used for carrying a bookmark reference of a detailed database access parameters in the URL. These are indicated by a '#' or '?' at the end of the URL followed by a string of information which is processed by the IETM (and not the Web Server).

Thus, the JIA will require only that an Electronic-Addressing system exists and that it use the URL syntax. The administrative task of establishing, assigning, and enforcing the administration of the address space for IETMs will be the responsibility of some standing management activity which will manage an IETM Registry for each Service.

7.2 The Library Functions

This Electronic-Addressing requirement also includes a requirement for an on-line search-oriented Library that is implemented by the inclusion of standard ASCII-encoded tagged metadata package to support on-line searches. This metadata package will be encoded in the HTML or XML index page and tagged as 'metadata'. This index page should be attached to each IETM View Package at the View Package root. This metadata is a set of searchable keywords and other identifying information in a standard format that is associated with each IETM and can be used by a search engine to identify sought references.

Establishing the area-library or searchable-access mechanism is an area in which the most difficult task will not be technical. The challenge for an administrative activity will be in securing DoD-wide agreement for adopting a standard format for the searchable metadata. A JIA implementation can operate without metadata by relying on hard-coded URLs for linking the Intranet and IETM information together. However, the real-world

experience of the World Wide Web has shown that, in practice, users rely extensively on search engines to locate reference information any need for which was unforeseen by the content authors. Two basic approaches exist for developing a searchable data base of such metadata: one is to create it after the fact by utilizing a semi-automated third-party indexing service or mechanism (the approach commonly used on the World Wide Web); the other is to require the content providers to author, in a structured format, a searchable information data set. The method preferred by the JIA is to employ an ASCII-encoded HTML/XML data set with each searchable index being indicated by a set of user-defined XML tags in the context of a "metadata" tag.

In summary, every IETM View Package should contain a referencable default root file in its top directory (by intranet de facto standard named "default.htm" or "default.html") which actually kicks off the IETM (it can automatically link to the actual start point for the IETM if a different start point is required) and an index file named "index.htm" or "index.html" in the same root directory and which contains the required metadata.

Chapter 8. SERVER AND DATA-BASE INTERFACE

The simplest way for the JIA to achieve IETM interoperability across the DoD is to utilize only generic Web-type servers. Such an approach will not require that additional software be overtly installed on either the servers or the browser device. However, many legacy systems and some highly innovative new IETM applications require some sort of custom server extensions beyond those of the standard Web-type server and, most likely, database interface components. For these complex IETMs, which require extended services operating on an intranet server, the installation of the IETM on the Server will involve two processes. One process will be to extend the intranet Web-type server by installing extended services. The other process will be to install the IETM information and any included downloadable browser software. Some of the general guidance relating to many of these JIA support issues needed to support these additional services is discussed below.

The server capabilities needed are highly dependent on the type of the Architecture being utilized by a particular implementation. For Types C1 and C2, virtually any commercial

HTTP server can be employed. In these cases, only the Object-Encapsulation and Software-Component Interface requirement discussed earlier in this guidance document is needed to outline the requirement to IETM suppliers for the packaging of their IETM View Packages. This ease of installing the Type C IETMs onto a Web-type-server makes them the preferred type for the support of Joint Operations when an ad-hoc electronic library needs to be quickly assembled.

In the case of Type S implementations, the developer of the IETM will need to provide software and data components and the detailed instructions on how to install them as one or more additional servers, i.e., the Application Servers and/or the Database Servers needed for Type S IETM applications. The concept of auto-install that is embodied in the JIA for the browser components, in general, will not apply to the administration of these back-end servers. While it is the goal of the JIA that browser devices will require no system administration, the JIA servers will still require an administrator for the installation of server software components. In the case of a Type S Architecture, the provider of the IETM will have to arrange separately for the installation of server components on the target intranet. The intent of the guidance in this document is to assure that this one-time installation is fully documented by the IETM supplier and is as simple and automated as possible, so that field-system administrators can easily add it to an existing server site.

Provision of definitive guidance in the JIA regarding these add-on servers is complicated by the fact that new technology is continually emerging and evolving in the server marketplace today. There is economic pressure on software vendors to develop a competitive advantage (i.e., proprietary non-standard features) in their server products, since it is widely recognized that profits will be made only in the server marketplace, as opposed to the browser marketplace. Vendors will seek to make their profit in the Server market, and a direct result will be a proliferation of proprietary server products, a situation that will continue to complicate the standardization of DoD servers. Unless the DoD chooses to go back to demanding full MILSPEC software, there is little the DoD can do to change the marketplace for these products.

Specific considerations for developing both Application and Database Server capability in a JIA-compliant intranet are summarized below.

8.1 Type S1 Server Support

Type S1 applications require software extensions beyond the simple HTTP or Web-type server. The most common approach is to use an entirely proprietary Web+application server which, when installed, automatically provides all specific custom-application software. These proprietary products offer powerful functionality because of the custom server software, but create a software-maintenance requirement for the life of the product. The server software must typically be modified to upgrade the functionality of the IETM. The general guidance is that such applications of S1 IETMs should be limited to either of two basic classes of IETMs: (1) a wholesale move of a stand-alone legacy application to a Web based approach, or (2) a situation in which the primary purpose of the server is to provide these custom services and the intelligence of the server is the purpose of the IETM.

8.2 Type S2 Server Support (Database Interface)

Type S2 Architecture applications are a particularization of the general Type S application. They involve server applications in which the IETM content is primarily resident in a DBMS-managed database, and the Object Encapsulation in the file-based Web pages serves as organizing shells or templates. In fact, in an IETM for which the format has stabilized, there may be no need to modify the portions of the Encapsulated Objects managed by the Web-type and Application servers when content changes are made. Only the database instance needs to be modified. Virtually all database vendors are marketing a Web-enabled variant of their DBMS. This is an emerging area in which new products are being developed and made available to the COTS marketplace on a continuing basis. Many of these are applicable to IETMs. It is neither possible nor desirable to restrict or standardize the Type S2 solutions at this time, as affordable COTS technology is just now emerging in the marketplace.

It will be necessary that Type S applications for DoD IETMs support the “occasionally connected” scenario, in which a PEDD is to be downloaded with an IETM and then

detached from the intranet in order for the technician to perform work at the maintenance site. This procedure requires that a local copy of the Application and/or Database Servers be installed on the portable display device and that some facility be established to keep the local copy of the database synchronized with the main database on the intranet. IETM developers must be sure that this requirement is properly addressed when developing a S2 IETM application. As is typically the situation with these Type S applications, the available solutions to support the mobile user, while powerful, are proprietary and not amenable to standardization. Despite this lack of standardization, these COTS products can be deployed on a JIA intranet, largely a byproduct of being developed for commercial application on the World Wide Web which requires such interoperability.

8.3 Updating DBMS-Managed Information on a Server

The Type S2 Architecture application is the most likely mature architecture for traditional Class 4 IETMs (i.e., those based on MIL-PRF-87269[8]); however, the technology and the collection of product to support these Web-oriented database applications is currently very immature, and definitive products are still emerging in the marketplace. An area particularly needing continuing assessment regarding its role in the JIA is the updating and synchronization of databases in the field. In practice, the least risky way to update such databases is to use the tools applicable to the particular Data Base Management System (DBMS) being utilized. Most DBMS vendors have very good but proprietary data-replication facilities for this very purpose. The JIA concept of best commercial practices would dictate that such capability be utilized as long as it operates over a TCP/IP network (i.e., an intranet).

Chapter 9. MAINTAINING A COMMON LOOK-AND-FEEL AMONG DIFFERING IETMS

While the use of the common browser does standardize many of the user-interaction features, it is very likely that a custom component will contains its own set of unique

[8] Military Specification, MIL-PRF-87269 ***Data Base, Revisable: Interactive Electronic Technical***

user-interaction features layered under the higher-level browser toolbars. These features often conform to a proprietary look-and-feel dictated by the COTS product being employed. However, a requirement still exists for a procurement-guidance document which can be employed to minimizing the differences in look-and-feel among various disparate IETM presentation components that operate in the JIA environment. From both the Training and the Job Performance perspective, the effectiveness of each product is enhanced when it is displayed in accordance with a standard style, even if the actual underlying IETM presentation components vary and are proprietary in nature.

9.1 Joint DoD/Industry Effort to Develop a User Interaction Guideline

A preliminary set of standard proposed "Look-and-Feel" Recommendations is included in this guidance document and listed below. It represents a meaningful attempt to prepare guidance for the suppliers of IETMs and IETM software products associated with the Aerospace Industries Association (AIA). These guidelines permit the use of contractor selected authoring and presentation products while, at the same time, preserving the essence of a common DoD Look and Feel if the software products adhere to the guidelines. This proposal is the result of a Joint workshop between members of the individual Services (selected by the Tri-Service IETM Technology Working Group members) and the AIA Service Publications Panel. The AIA members are experienced practitioners in IETM development and have a broad knowledge of the practical side of adapting commercial products without calling for expensive custom modifications. The recommendations contained below are, however, intended to apply to all DoD IETM applications and not just to Aerospace systems. The approach used in this report greatly reduces the existing performance requirements to those few that are really needed, and tightens down those few remaining requirements to be as specific as possible. While not an official position at this point in time, the consensus of the group that developed these guidelines was that these would eventually replace the user-interaction requirements sections of MIL-PRF-87268[9], the IETM specification.

Manuals, For the Support of

[9] Military Specification, MIL-PRF-87268 ***Manuals, Interactive Electronic Technical: General Content, Style, Format, and User-Interaction***

IETM TMCRs (Technical Manual Contract Requirements) and other procurement instruments can require that delivered IETM View Packages conform to both the JIA performance requirements and the included Look-and-Feel user-interface requirements. By doing so, it will be possible to obtain a meaningful level of common DoD IETM look-and-feel interface without requiring the acquisition of a custom IETM system. It is expected that either the AIA or the Tri-Service IETM Technology Working Group (or both) will publish this document in the near future so it can be cited in functionally specified IETM procurement documents.

9.2 Preliminary Draft of User-Interaction Requirements for DoD IETMs

The following is a Preliminary Draft of IETM User-Interaction ("Look-and-Feel") Guidelines developed by the Service Publication Panel of the Aerospace Industries Association and the Tri-Service IETM Technology Working Group at a AIA and Tri-Service IETMTWG Workshop 15-18 March 1999 at Naval Surface Warfare Center, Carderock, Maryland.

User-Interaction Requirements for DoD IETMs

The following guidelines should be observed in preparing IETMs and the associated viewing software components for the Department of Defense:

9.2.1 *Display Format (Text/font, graphic, table, lists, Object Embedding)*

-Use Best Commercial Practices

-Use of multiple frames (formerly "panes") is not a requirement

9.2.2 *Browse Capability*

-Browse capability should be available

-User controlled access mode

-No tracking of activities

-Not rigidly tied to IETM controls

9.2.3 *Link Behavior/Navigation*

-Persistent visual indication of link(s) to additional information should be available.

-There should be a visual indication of how the link behaves (e.g., goto, gosub, relational)

-If you are executing a link that is not a goto or exit link, you should be able to return at anytime to where the link began.

9.2.4 *Control Bars*

-The User Navigation Panel (Tool Bar) should provide the necessary choices/options available at the current time.

-The User Navigation Panel is required with an optional toggle capability to turn it off.

-The User Navigation Panel should remain accessible by persistent visible indication.

-Use the standard icons when applicable in the User Navigation Panel.

9.2.5 *Icon Standardization*

-An icon should show its name or function when the cursor is stalled over the icon.

-Suggested Icons for standardization:

+Next

+Previous [Chronological]

+Return [Chronological]

+Back [Logical]

+TOC

+Exit

+Find/Search

+Undo

+User Navigation Panel Minimized

+Processing Indication

+Parts (IPB/RPSTL)

+Suggested Changes/Feedback

+Training

+Multimedia Icon

+Sound/Voice Icon

+Full Motion Video Icon

+Animation Icon

+Graphic

+Diagnostics

+Warning

+Caution

+Note

+Hazards per AIA PUB 119 / Icons included in MIL-STD-38784

+Print

+One way link (Goto)

+Two way link (Gosub)

+Relational link

+Browse

9.2.6 *Selectable Elements (Hot-Spots)*

-All Hot Spots must be visually indicated (e.g, fill pattern, reverse video, outline, button, underline…)

-There are three acceptable modes of visual indication of hot-spots (selectable areas).

-Persistent visual indication that an area is hot

-Cursor changing shape/color

-Object changes while cursor over area (e.g. IPB callout expands…)

-There should be an indication of link destination (target) when the cursor passes over the hot-spot

9.2.7 *Warnings, Cautions, Notes*

-User must acknowledge pop up warnings and cautions before proceeding.

-Pop up alerts should be centered on the screen

-A persistent icon should appear on the screen when alert is applicable.

-Alerts should appear in standard colors: Red – Warning, Yellow – Caution, Cyan – Note

9.2.8 *Search & Lookup*

-Use the standard icon to get the user into a search mode.

-The user should be presented with the search options available.

-At a minimum, a Keyword search against valid entry points (TOC/List of Content) should be available

-The system should provide a search capability against Metadata (e.g. Keywords, tagged data, indexable data, searchable data, etc.) when it exists.

9.2.9 *Session Control (Suspend, Resume, Nested Sessions)*

-The user should be able to suspend a session at any time. (e.g., Break, Emergency, No Parts)

-A subsequent resume should be capable of re-starting the session at the same point it was suspended.

-At the time of resume, the user should be advised that some key parameters/condition settings may be out-of-date (e.g. aircraft safe for maintenance, temperature change, or other people worked on the end-item/platform during the suspension)

-The system should support the three Exit Modes:

- -Complete (Save and update history)
- -Abort (Don't save or update history)
- -Suspend (See above)

9.2.10 *Context Filtering*

-The system should have the ability to perform context filtering on effectivity as a minimum.

-The system should provide the user a mechanism for entering/modifying configuration parameters.

9.2.11 *Screen Resolution and Color Guidelines*

-Presentation system and graphics developers should consider the use of standard "safe" colors visible across multiple presentation systems.

-Presentation systems should not presume any fixed display resolution, or size.

9.2.12 *Information Access (Indices, Electronic TOC's, etc.)*

-A Table/List of all key entry points should be made available for user access.

-Access should be provided via a Hierarchical Breakdown such as:

-SSSN (MIL-STD-1808)

-LCN

-AECMA 1000D

-Functional and Physical Hierarchy

-Graphical Interfaces are acceptable.

9.2.13 *Dialogs*

-Support should be provided for both pop-up dialog box and in-line dialogs in the display frame itself.

-Developers should use Best Commercial Practices for entering data in dialog boxes (e.g. radio buttons, check-boxes, fill-ins, combo boxes, scrolling selection lists, etc.)

9.2.14 *Sound*

-Developers should use Best Commercial Practices when implementing sound.

-The user must take action to hear the sound. (No automatic playing of sound.)

-User controls muting and volume via system controls (versus embedded controls within the application). Optional: Application can provide convenient access to the system controls.

9.2.15 *Voice I/O*

-Voice I/O should be used only as supplemental input/output and navigation. Keyboard and pointing devices should be the primary input, and visual display should be the primary output.

9.2.16 *Graphics*

-Developers should use Best Commercial Practices for graphics format and display.

-Preferred Vector Graphics Std: CGM - WebCGM Type 4 Profile (moving towards ISO Std)

9.2.17 *Hardware User Interface: Point and Click, Voice, Selection Keys, A/N Keyboard, Touch Pad, etc.*

-Point and click capability on target display should be assumed.

-Developers should accommodate the limitations of the target display device.

-Alphanumeric Input Capability must be provided, if not in hardware, then in software.

9.2.18 *Performance (Response Time by Context)*

-Developers should implement a 2 second response time goal.

-If the response time is greater than 2 seconds, the system should provide visual feedback to the user.

- Use a standard cursor for Processing Indication.

9.2.19 *Printer Output*

-Printer Output is strongly discouraged.

-Print capability should be used primarily for graphics.

-All printer output should have version number and/or printed date/time stamp

-When customer requires printed output:

-Printer output should not have to conform to normal Paper TM Specifications

-Satisfactory Options:

-"pre-composed" files (such as Adobe PDF) can be attached

-"on-the-fly" composition for printing (of logical element) built into the viewing application

-Screen Print. Preferred method: print data content of Active Window only.

9.2.20 *User Annotations (e.g., comments, user notes, redlines, bookmarks)*

-There should be a persistent visual indication that an annotation exists.

The default initial presentation of annotations is to appear minimized.

-If there are levels of annotations (e.g., Public, Private, etc.), they should be visually differentiated.

9.2.21 *Feedback to Originator (e.g., TMDRS, Form-2028, AFTO 22)*

-A single user interaction should be available to select the function. (e.g., a Button, double mouse click)

-The preferred user interface is a form.

-The system should provide an output compatible with the user environment.

-There should be a “Form fill-in completed” function before returning to the IETM (e.g , “submit”, “done”, “okay”, “close-out”.)

- The system should automatically generate an Electronic locator (e.g., Address, Version, …) and to the greatest extent possible, relevant fields on the Form should be automatically filled-in. (e.g. User Id, System State, etc.)

9.2.22 *Administrative Information (e.g. Effectivity, Authorization, Distribution, Val/Ver)*

-Administrative information should be displayable.

9.2.23 *Interface to External Systems*

-A single user interaction should electronically link to external references (e.g. another IETM) or external systems (e.g. CAMS, IMDS, FEDLOG, GCSS, Supply Support/Parts Ordering, etc.).

9.2.24 *Rapid Action Changes (IRAC)/Critical Safety Interim Messages*

-A visual indication of the existence of a critical change must be displayed in context.

-A single user interaction should be available to access the change.

-The user should be provided with a visual indication for critical messages at the start of the IETM.

9.2.25 *Major Data Types (e.g. Troubleshooting, Procedural, Parts, Descriptive, etc….)*

-Because of differences in user cultures and requirements this area cannot be addressed by providing guidance. Lessons learned may be a better way to address this category

Chapter 10. DEFINITIONS AND ACRONYMS USED IN THIS REPORT.

10.1 Definitions

browser A client program which runs on a user's computer and which, by means of hypertext links, enables retrieval and display of information available on the World Wide Web or, as used in this Report, on an intranet.

Communications Security (COMSEC) Involves all measures taken to safeguard the handling of information on an information system. It includes [1] emanations security (EMSEC); [2] electronics security (i.e., prevention of interception of non-communication electromagnetic radiation which can provide system information; [3] transmission security (TRANSEC); and [4] cryptographic security.

Information Assurance Defensive Information Operation measures, including: [1] protection of the information infrastructure by prevention of unauthorized access or attack, and [2] defense of the information infrastructure by detecting, surviving, and responding to attacks. Information assurance has the following properties and capabilities:

(1) Availability of the information to the user when needed.

(2) Integrity; freedom from unauthorized tampering.

(3) Authentication; existence of controls to provide assurance that only authorized users have access to the information.

(4) Confidentiality; protection from accidental release.

(5) Non-repudiation; protection from false denial; capability of verification.

(6) Restoration; assurance that information and infrastructure can survive an attack, and that the system can resume operation after the attack.

Internet A system of linked computer networks, international in scope, that facilitates data communication services such as remote log-in, file transfer, electronic mail, and newsgroups. The Internet is a way of connecting existing computer networks that greatly extends the reach of each participating system. It was originally developed in the 1970s by the DoD on the ARPAnet. In common usage, the terms Internet and World Wide Web are often used interchangeably, however, there are applications and protocols operating on the Internet that are not part of the World Wide Web. The term "internet", written with lower-case "i", is often

used to refer to a WAN, or a group of LANs connected by means of a communications protocol.

intranet A dedicated communications network of one or more LANs utilizing the protocols of the Internet. As used in this Report, the term "intranet" designates an entirely self-contained system with controlled access and centralized management through an assigned infrastructure.

LAN (Local Area Network) A network contained within a single physical site or activity (one or more buildings), as contrasted with a WAN.

URL (Uniform Resource Locator) An alphanumeric string that describes the location and access method of a resource on the Internet; for example, the URL http://www.. . . describes the type of access method being used (http) and the server location which hosts the Web site.

WAN (Wide Area Network) A communications network of several physically or organizationally separate locations, as opposed to a LAN. The Internet is an example of a world-wide WAN. Workstations and computers within a given activity are generally connected to each other with a LAN, by means of wires or radio waves.

World Wide Web ("WWW" or "the Web") A global network of servers on the Internet that provide access to hypertext-linked (http) databases and files (documents, usually written in HTML) by means of a browser. It was developed in 1989, and is now the primary platform of the Internet. Web pages store retrievable hypermedia information (graphics, sound, animation, video) in addition to text.

10.2 ACRONYMS Used in This Document

DUSD(L)/LRO - Logistics Reinvention Office of the Office of the Deputy

Undersecretary of Defense for Logistics

ETM - Electronic Technical Manuals

FTP - Internet File Transfer Protocol

GCSS - Global Combat Support System

GIF - Graphics Interchange Format

HTML - HyperText Markup Language

HTTP - Hypertext Transfer Protocol

IETM - Interactive Electronic Technical Manual

IETMTWG - Tri-Service IETM Technology Working Group

IPSDB - Integrated Product Support Database

JCG-CE - Joint [Logistics] Commanders Group for Communication and Electronics

JECPO - Joint Electronic Commerce Project Office

JIA - Joint IETM Architecture

JPEG - Joint Photographic Experts Group

JTA - DoD Joint Technical Architecture

LAN – Local Area Network

NIA - Navy IETM Architecture

PDF - Portable Document Format

PEDD - Portable Electronic Display Device

PKI - Public Key Infrastructure (PKI)

TCP/IP – TeleCommunications Protocol/Internet Protocol

TIFF - Tagged Image File Format

TMCR - Technical Manual Contract Requirements

URL - Uniform Resource Locator

VP - View Package – the name given to the encapsulated object of the IETM

VURL - virtual URL