

Mapping of JTA Version 3.1 Core Standards to TRM Version 1.0 Services and Interfaces

The Aerospace Corporation

Introduction

According to the DoD Joint Technical Architecture, "The JTA is structured into service areas based on the DoD Technical Reference Model." Because of the evolutionary nature of these two documents, developing a detailed mapping of the JTA standards to both service areas and interfaces as defined in the TRM can provide insight into ways to improve both documents in order to make them easier to understand and apply to DoD Information Technology systems. Also, a detailed mapping provides a reference correlation between the JTA standards and the TRM services and interfaces. A software developer required to implement a JTA-compliant system can utilize this correlation to determine what JTA standards are available for specific services. Finally, the principles used in developing the mapping form the basis of a valuable case study in the application of the TRM.

The document from which this case study is excerpted contains a mapping of the JTA core standards to the TRM services and interfaces. With some noted exceptions, all of the standards referenced in the JTA core are mapped to one or more services and/or one or more interfaces defined in the TRM, using the definitions of the services and interfaces in TRM Version 1.0. Our understanding of the definitions of the service areas and interfaces defined in the TRM has evolved as a consequence of the process of doing this mapping, but there are still some ambiguities raised and not resolved. Section 2 of this case study provides a list of the principles used in performing the mapping, and a discussion of the issues that arose in interpreting the TRM in various situations. Examples are provided.

Mapping Principles and Issues

This section describes the guidelines that evolved in the process of mapping from the JTA standards to TRM service areas and interfaces. For some standards, the authors could not determine definitively, either from the JTA write-up or from any documentation freely available about the standard, whether any services are identified in the standard, and/or whether any interfaces are specified. In these cases, the authors made a preliminary assessment based on whatever information was available.

Some of the situations encountered in mapping JTA standards to the TRM are listed below. For convenience, the situations are grouped into categories. Most of the standards fell into one of the categories described under General Cases below. The remaining subsections describe the other categories of standards, with a description of the approaches used to resolve the mapping for each.

1. General Cases

The most straightforward mapping is when a standard clearly identifies a service described in the TRM, including both the interfaces to it and its behavior. We considered this to be the nominal case. In this case, the standard was mapped to the appropriate TRM service area and also to a direct interface, generally 3D or 4D depending on

the layer in which the service resides. In most cases, direct interfaces are provided by a service in one layer to user services in the layer above it. To illustrate, a 4D Interface is used by applications in Layer 4 to access services provided in Layer 3; a 3D Interface provides services to Layer 3 from services provided in Layer 2; and similarly for the other interfaces. However, in some situations, standards which mapped to services in the Application Platform Entity provided interfaces to other services in the same layer; those standards were mapped to the 3X Interface instead of the 4D Interface. Note: one corollary of this process is that a mapping to a direct interface cannot exist without a corresponding mapping to a service area. (Ex: 2.2.2.2.1.3 ISO/ IEC 9075-3 -1995 Information Technology - Database Languages – SQL mapped to Data Management Services and 4D Interface; 2.2.2.2.1.4.5.1.1 ANSI/SMPTE 292M-1998, Television - Bit-Serial Digital Interface for High-Definition Television Systems mapped to Physical Environment Services and 3D Interface; 2.2.2.2.1.11.2 OMG document orbos/ 98-06-01, CORBA services DCE/ CORBA Internetworking Service mapped to Distributed Computing Services and 3X Interface.)

Some of the standards mapped to two or more different services, particularly the Information Security standards and the Distributed System standards. The Information Security standards were considered to map to the Security Services, even though there may not be any actual services identified or any interfaces specified in the standard. Then, depending on the standard, there might be an additional service identified, and/or interfaces specified. Similarly, Distributed System standards were typically mapped to both Distributed Computing Services and also to whatever other service the particular standard identified. (Ex: 2.6.2.2.2.2 IETF RFC-1510, The Kerberos Network Authentication Service mapped to Security Services, Communication Services and 4D Interface; 2.2.3.1 ISO/IEC 9579: 1999 Information Technology – Remote Database Access for SQL mapped to Distributed Services, Data Management Services and 4D Interface.)

In general, standards that specify protocols were mapped to the Communication Services at the Application Platform Entity layer; if a standard also specifies an interface, then it was also mapped to direct interfaces, logical interfaces, or both. (Ex: 2.3.2.1.1.1.1 IETF Standard 10/ RFC-821/ RFC-1869/ RFC-1870, Simple Mail Transfer Protocol (SMTP) Service Extensions mapped to Communications Services and 4D Interface; 2.3.2.1.1.1.6 IETF RFC-951, Bootstrap Protocol mapped to Communication Services and 3L Interface; 2.3.2.1.1.1.2 IETF RFC- 777, Lightweight Directory Protocol (LDAP) mapped to Communication Services, and 4D and 3L Interfaces.)

2. Design Considerations

Some JTA standards do not identify any services defined in the TRM, nor specify any direct or logical interfaces. Rather, these standards specify processes, procedures, and/or guidelines for a person to follow in designing a system. We mapped this type of standard to what we tentatively refer to as Design Considerations. The main example of this type of standard is a user's or programmer's guide. Most of the standards that were mapped to Design Considerations were not also mapped to any TRM service areas or interfaces, but there were some exceptions: there were some multi-volume

standards, where some volumes identified a service and/or interface, and another specified guidelines or procedures; also, some of the standards from JTA Section 2.6 (Security Standards) specified programmer guidelines, although they were considered to map to security services. This kind of standard was mapped to Design Considerations in addition to whatever other mapping was appropriate. Suggestions for other ways of dealing with these JTA standards are solicited. (Ex: 2.2.2.2.1.2 M021 CDE 2.1/ Motif 2.1 User's Guide mapped to Design Considerations; 2.3.2.1.1.1.1 IETF RFCs 2045-2049, Multipurpose Internet Mail Extensions (MIME) mapped to Communication Services, Design Considerations, and 4L Interface; 2.6.2.3.1.1 FIPS-PUB 140-1, Security Requirements for Cryptographic Modules mapped to Security Services and Design Considerations.)

3. Data and Data Formats

Standards that specify data formats are mapped to logical interfaces because they specify the format to be used for the exchange of information, usually between services in the same layer. In the case of human-readable formats, there may be no relationships specified in the standard between services, but they were still mapped to the 4L Interface. (Ex: 2.3.2.1.1.1.8.2 IETF RFC-1738, Uniform Resource Locators mapped to the 4L Interface; 2.4.2.5.2.2 MIL-STD-6040, United States Message Text Format (USMTF), mapped to the 4L Interface.)

In some cases, the standard specifies a data format whose purpose is included in the description of a service in the TRM, even though the standard does not specify any behavior. In these cases, the relevant TRM service area is cited, even though there are no direct interfaces specified. (Ex: 2.3.2.1.1.1.2.1 ITU-T X.500, The Directory -Overview of Concepts, Models, and Services - Data Communication Networks Directory mapped to Communication Services and 4L Interface; 2.6.2.3.1.1.2 MIL-STD-2045-48501, Common Security Label mapped to Security Services and 3L Interface.)

Standards that specified data content were mapped to the 4L Interface because this seemed like the closest fit, since the data format was also specified. A special case of that type of standard are standards that specify character sets. These standards were mapped only to the 4L Interface, since they specify a format for the representation of characters, even though, in the JTA, they are listed under a TRM service area such as Internationalization. (Ex: 2.2.2.2.1.4.3 FIPS PUB 10-4, Countries, Dependencies, Areas of Special Sovereignty, and Their Principal Administrative Division mapped to the 4L Interface; 2.2.2.2.1.8 ANSI/ISO 8859-1:1987, Information Processing – 8- Bit Single Byte Coded Character Sets, Part 1: Latin Alphabet No. 1 mapped to the 4L Interface.)

4. Other Cases

Standards that only specify algorithms are considered to map to logical interfaces because no services or direct interfaces were specified in the standard. (Ex: 2.2.2.2.1.4.4 MIL-STD-188-196, Bi-Level Image Compression for the National Imagery Transmission Format Standard mapped to the 4L Interface)

Standards that specify communication transmission formats, such as those in JTA Section 2.3.2.3, also identify Communication Infrastructure services. Since the standard specifies the interface to the communications link itself, not the data transmitted across it, it was mapped to the External Environment Entity. This type of standard also mapped to an associated 1D Interface. (Ex: 2.3.2.3.1.1.1 MIL-STD-188-181B, Interoperability Standard for Single Access 5-kHz and 25-kHz UHF Satellite Communications Channels mapped to External Environment Entity and 1D Interface.)

The Java Virtual Machine allows applications to run on a variety of platforms without the need to rewrite or recompile the application. The standard that specifies the Java Virtual Machine was mapped to the Software Engineering Services because it describes a platform that enables Java applications to run on any computer without rewriting or recompiling; and to the 3X Interface because it contains a description of the interfaces required for compiled bytecode to invoke the JVM services. (Ex: 2.2.3.4.2 Java Virtual Machine (JVM) mapped to the Software Engineering Services and the 3X Interface)

Some sample mappings of the JTA to the DoD TRM, excerpted from the complete mapping document, follow:

2.2.2.2.1. 3 Data Management Services	ISO/ IEC 9075: 1992, Information Technology - Database Language - SQL, as modified by FIPS PUB 127- 2: 1993, Database Language for Relational DBMS (Entry Level SQL)	Application Platform Entity - Data Management Services and 4D Interface	This standard maps to the Data Management Services because it describes a database management language. This standard maps to the 4D Interface because it provides the ability to retrieve information from an RDBMS using SQL.	<ul style="list-style-type: none"> ² These services support the definition, storage, and retrieval of data elements from Database Management Systems (DBMSs). [JTA] ² Database management system services, which provide data administration, managed objects functionality, and controlled access to, and modification of, structured data. ... DBMS services are accessible through a programming language interface, an interactive data manipulation language interface such as SQL, or an interactive/fourth-generation language interface. [TRM] ² Direct Interface: transfer of information [TRM]
	ISO/ IEC 9075- 3 - 1995 Information Technology - Database Languages - SQL - Part 3: Call- Level Interface (SQL/ CLI)	Application Platform Entity - Data Management Services and 4D Interface	This standard maps to the Data Management Services because it describes a database management language. This standard maps to the 4D Interface because the TRM defines API's to be 4D Interfaces.	<ul style="list-style-type: none"> ² The SQL/Call Level Interface (CLI) addendum to the SQL standard provides a standard CLI between database application clients and database servers. The following API is mandated for both database application clients and database servers. [JTA] ² Database management system services, which provide data administration, managed objects functionality, and controlled access to, and modification of, structured data. ... DBMS services are accessible through a programming language interface, an interactive data manipulation language interface such as SQL, or an interactive/fourth-generation language interface. [TRM] ² The API is defined as the interface between the application software and the application platform across which all services are provided. [TRM] ² Direct Interface: transfer of information [TRM]
2.2.2.2.1. 4.1 Document Interchange	ISO 8879: 1986, Standard Generalized Markup Language (SGML), with Amendment 1, 1988	4L Interface	This standard maps to the 4L Interface because it describes the rules for applying a system of markup tags.	<ul style="list-style-type: none"> ² SGML is a meta-language, providing the rules for designing and applying a system of markup tags rather than the specific set of tags. [JTA] ² Logical Interface: supports understanding of information [TRM] ² Layer 4: Applications Software layer. [TRM]

	HTML 4.0 Specification, W3C Recommendation, revised 24- Apr- 1998, Rec- html40- 19980424.	4L Interface	This standard maps to the 4L Interface because it contains a specification for representing structural, presentational, and semantic information in combination with the contents of the document.	² For hypertext documents intended to be interchanged via the Web or made available via organizational intranets [JTA] ² Logical Interface: supports understanding of information [TRM] ² Layer 4: Applications Software layer. [TRM]
--	---	--------------	--	---

JTA Section & Service Area	Currently Mandated Standard	TRM Mapping	Mapping Justification	Notes
2.4.2.1 Activity Modeling	IEEE 1320.1- 1998, IEEE Standard for Functional Modeling Language— Syntax and Semantics for IDEF0.	Application Software Entity - Engineering Support and 4L Interface	This standard describes a modeling language. Modeling is included in the Engineering Support service of the TRM. This standard does not map to any direct interfaces because its services are not used directly by Mission Applications components. This standard maps to the 4L Interface because it describes modeling language semantics and syntax for developing structured graphical representations to assist in the analysis of the system.	<p>² IEEE P1320.1, IDEF0 Function Modeling, is the standard that describes the IDEF0 modeling language semantics and syntax, as well as associated rules and techniques, for developing structured graphical representations of a system or enterprise. [JTA]</p> <p>² Modeling and simulation services provide the capability to capture or set object characteristics or attributes and parameters of a system of objects, and to portray the relationships and interactions of the objects to assist in the analysis of the system. [TRM]</p> <p>² Logical Interface: supports understanding of information [TRM]</p> <p>² Layer 4: Applications Software layer. [TRM]</p>
2.4.2.2 Data Modeling	DoD Manual 8320.1- M-1, DoD Data Standardization Procedures, April 1998 (which mandates the use of the DDM).	Design Considerations	This standard maps to Design Considerations because it contains guidelines and procedures related to the approval, development and maintenance of common data standards.	<p>² The activities addressed in this manual include the identification, development, review, approval, implementation, and maintenance of data standards. [http://www-datadmn.itsi.disa.mil/8320_1m1.html]</p>
	FIPS PUB 184, Integration Definition for Information Modeling (IDEF1X), December 1993	Application Software Entity - Engineering Support and 4L Interface	This standard describes a modeling language. Modeling is included in the Engineering Support service of the TRM. This standard does not map to any direct interfaces because its services are not used directly by Mission Applications components. This standard maps to the 4L Interface because it describes modeling language semantics and syntax for developing a logical model of data to assist in the analysis of the system.	<p>² FIPS PUB 184 is the standard that describes the IDEF1X modeling language (semantics and syntax) and associated rules and techniques for developing a logical model of data. [JTA]</p> <p>² Modeling and simulation services provide the capability to capture or set object characteristics or attributes and parameters of a system of objects, and to portray the relationships and interactions of the objects to assist in the analysis of the system. [TRM]</p> <p>² Logical Interface: supports understanding of information [TRM]</p> <p>² Layer 4: Applications Software layer. [TRM]</p>

2.4.2.3 DoD Data Model Implementation	DoD Manual 8320.1- M-1, DoD Data Standardization Procedures, April 1998	Design Considerations	This standard maps to Design Considerations because it contains guidelines and procedures related to the approval, development and maintenance of common data standards.	² The activities addressed in this manual include the identification, development, review, approval, implementation, and maintenance of data standards. [http://www-datadmn.itsi.disa.mil/8320_1m1.html]
--	---	-----------------------	--	--

JTA Section & Service Area	Currently Mandated Standard	TRM Mapping	Mapping Justification	Notes
2.6.2.2.1 Application Software Entity Security Standards	DoD 5200.28- STD, The Department of Defense Trusted Computer System Evaluation Criteria, December 1985	Application Platform Entity- Security Services and Design Considerations	The TCSEC provides a standard for security features, and more importantly, system assurance. It covers product development and influences application software development. It maps to the Security Services because it addresses security requirements for application software from the acquisition stage through the development phase. It also maps to Design Considerations because it provides developers with criteria for a system's security features.	² To provide a standard to manufacturers as to what security features to build...To provide DoD components with a metric with which to evaluate the degree of trust that can be placed in computer systems for the secure processing... To provide a basis for specifying security requirements in acquisition specifications. ... The trusted computer system evaluation criteria will be used directly and indirectly in the certification process. [http://www.radium.ncsc.mil/tpep/library/rainbow/5200.28-STD.pdf] ² The DGSA identifies the following security services that may need to be provided through implementations in information system components.... Authentication service ... Access control ... Integrity service ... Confidentiality service ... Non-repudiation services ... Availability service ... System management services ... Security labeling ... Information security management services [TRM]

	NCSC-TG- 021, Version 1, Trusted Database Management System Interpretation, April 1991	Application Platform Entity- Security Services, Application Software Entity - Database Utilities, and Design Considerations	This standard maps to the Security Services because it provides technical guidance in specifying and identifying system security, particularly for database management systems. It is mapped to the Database Utilities for this paragraph since it defines aspects of the services in this service area. Since it defines criteria and guidelines for implementing a secure database system, it is also mapped to Design Considerations.	<p>² The interpretations in this document are intended to be used in conjunction with the TCSEC itself; they apply to application-oriented software systems in general, and database management systems (DBMSs) in particular. Although the interpretations, as noted, are general enough to apply to any software system which supports sharing and needs to enforce access control (e.g., transaction processing systems, electronic mail systems), in the interest of simplicity, the discussion, and thus the terminology, will be directed toward DBMSs. [http://www.radium.ncsc.mil/tpep/library/rainbow/NCSC-TG-021.txt]</p> <p>² The DGSA identifies the following security services that may need to be provided through implementations in information system components.... Authentication service ... Access control ... Integrity service ... Confidentiality service ... Non-repudiation services ... Availability service ... System management services ... Security labeling ... Information security management services [TRM]</p> <p>² Database utility services provide the capability to retrieve, organize, and manipulate data extracted from a database management system. [TRM]</p>
	FORTEZZA Application Implementers' Guide, MD4002101- 1. 52, 5 March 1996	Application Platform Entity - Security Services and 4D Interface	This guide defines security services as defined in the TRM, so it is mapped to Security Services. This standard maps to the 4D Interface because it defines interfaces that can be used by an application to invoke the services provided by the Fortezza card.	<p>² This document appears to be a guide and complements the FORTEZZA Cryptologic Interface Programmers' Guide. Since the document is export-controlled, no direct quotes were taken from the document.</p> <p>² Confidentiality service ensures that data are not made available or disclosed to unauthorized individuals or computer processes through the use of data encryption, security association, and key management. [TRM]</p> <p>² Direct Interface: transfer of information [TRM]</p>
	FORTEZZA Cryptologic Interface Programmers' Guide, MD4000501- 1. 52, 20 October 1997.	Application Platform Entity - Security Services and 4D Interface	This standard maps to the Security Services because the Fortezza technology uses cryptography to provide a confidentiality service. This standard maps to the 4D Interface because it describes a set of C based interfaces that can be used to access the services of the Fortezza card.	<p>² This document defines the commands of the Fortezza Cryptologic Interface (CI) Library. The CI Library provides the software developer with an interface to the Fortezza Crypto Card (hereafter referred to as the "Card") while isolating the developer from the cryptologic details of the Card. [http://www.armadillo.huntsville.al.us/Fortezza_docs/cipg152.pdf]</p> <p>² Confidentiality service ensures that data are not made available or disclosed to unauthorized individuals or computer processes through the use of data encryption, security association, and key management. [TRM]</p> <p>² Direct Interface: transfer of information [TRM]</p>

<p>2.6.2.2.2.1 Data Management Services</p>	<p>NCSC- TG- 021, Version 1, Trusted Database Management System Interpretation, April 1991</p>	<p>Application Platform Entity- Security Services and Application Platform Entity - Data Management Services and Design Considerations</p>	<p>This standard maps to the Security Services because it provides technical guidance in specifying and identifying system security, particularly for database management systems It maps to the Data Management Services because this JTA paragraph defines services for database management. This standard maps to the Design Considerations because it defines criteria and guidelines for implementing a secure database system.</p>	<p>² The interpretations in this document are intended to be used in conjunction with the TCSEC itself; they apply to application-oriented software systems in general, and database management systems (DBMSs) in particular. Although the interpretations, as noted, are general enough to apply to any software system which supports sharing and needs to enforce access control (e.g., transaction processing systems, electronic mail systems), in the interest of simplicity, the discussion, and thus the terminology, will be directed toward DBMSs. [http://www.radium.ncsc.mil/tpep/library/rainbow/NCSC-TG-021.txt]</p> <p>² The DGSA identifies the following security services that may need to be provided through implementations in information system components.... Authentication service ... Access control ... Integrity service ... Confidentiality service ... Non-repudiation services ... Availability service ... System management services ... Security labeling ... Information security management services [TRM]</p> <p>² Central to most systems is the management of data that can be defined independently of the processes that create or use it, maintained indefinitely, and shared among many processes. [TRM]</p>
---	--	--	--	--

References:

1. DoD Technical Reference Model, Version 1.0, November 5, 1999
2. Joint Technical Architecture, Version 3.1, March 21, 2000
3. Mapping of Joint Technical Architecture (JTA) Version 3.1 Core Standards to Technical Reference Model (TRM) Version 1.0 Services and Interfaces, Aerospace Report No. ATR-2001(3583)-1, 2 March 2001

Page intentionally left blank.