

# **Modeling Composable Data Schemas for Data Visibility for Adaptive Planning and Force Sourcing Processes**

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Topic 10: Collaborative Technologies for Net Centric Operations

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## **Modeling Composable Data Schemas for Data Visibility for Adaptive Planning and Force Sourcing Processes**

Current war fighting challenges have prompted the Department of Defense to transform the Global Force Management process. As part of this transformation, the primary conventional Joint Force Provider (JFP) mission was assigned to U.S. Joint Forces Command (USJFCOM or simply JFCOM). In order to execute this mission, JFCOM needs visibility into Service authoritative data sources (ADS) for force structure from units down to individuals, force readiness, force and equipment availability (e.g., unit deployments and mobilizations), force location and force apportionment to plans. This information is needed to support the rotational, emergent, contingency force sourcing, exercise, and individual augmentee capability requirements of Combatant Commanders (CCDRs). The current business processes are brittle and slow because the data comes from multiple disparate sources both within and among the Services. Current processes require extensive manual processing to help answer force or capability availability questions. This paper describes the process used to transform JFCOM's 47 critical force analysis information exchange requirements (IERs)<sup>1</sup> into composable data schemas that provide JFCOM with a common view of the data from these disparate sources. Differences in the processes used by the Military Services to prepare and train the force required the design of multiple schemas. In preparing this paper, each schema was tagged for discovery, access and dissemination at the data object level in compliance with the DoD Net Centric Data Strategy.

### **Why do we need data visibility?**

The tempo of current military efforts have highlighted the need to change not only the business process used for adaptive planning, force management and readiness, but also the way the systems used to support these processes expose and consume data not only for the intended users but also for unanticipated users<sup>2</sup>. A user in this context can be either a person or a system. Data is fragmented across systems and sharing capabilities are limited. Although the global force management (GFM) business processes are intertwined with adaptive planning and execution (APEX) and readiness, there has been little coordination among these communities towards finding materiel solutions that meet the informational requirements needed to support all three communities. Instead, the adaptive planning and readiness efforts were driven primarily by the development of materiel solutions for their communities and not based on operational requirements<sup>3</sup>. This has resulted in interoperability problems as these systems cannot exchange information.

Thus, the force analyst has to look at different systems to manually collect the data needed to determine force readiness and availability.

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<sup>1</sup> Force Management Integration Project (FMIP) Phase III Enhanced Force Data Visibility Workshop information requirements (IRs)

<sup>2</sup> Adaptive Planning Roadmap II, SecDef, March 2008

<sup>3</sup> JFCOM/J3, 2008. *FMIP Educational Brief*, Jan 08 Update

Figure 1 below shows the processes and tools used for force sourcing and analysis. The effort starts when force/capability requirements are received either for ongoing or emergent operations, exercises, individual augmentees to fill positions requiring a specific skill set, or from force requirements derived from an operational plan. The force requirements are first validated by the Joint Staff and then force sourcing and analysis begins. The middle section of the figure lists the Joint and Service tools used to determine the availability and status of the force pool. The JESS and FPAT tools are used by joint force analysts and providers to help determine and record sourcing solutions for current and future operations. Determining a force sourcing solution involves not only units, but also requirements for equipment, training, readiness information, mobilization/demobilization history, and tasks for which a unit is trained and equipped (capabilities). Service systems provide information on unit and personnel readiness, training and mobilization, but the information is dispersed across the different systems. A man-in-the-loop is required to assemble the data into information that can be used to support sourcing decisions. Systems such as JOPES, SORTS and DRRS provide visibility into the commitment and readiness status of the force pool. The eJMAP tool provides individual augmentee requirements. JITMS is used to develop, plan, and execute exercises. After a sourcing solution is completed and approved, the joint force provider must still have visibility of force preparation and deployment to ensure CCDRs' requirements are indeed satisfied. A living plan<sup>4</sup> is the concept of monitoring the course of actions as an OPLAN is executed, and having alternative options as contingencies occurred. The CFAST tool supports this concept. The key point to notice in Figure 1 is the lack of connectivity between the tools used to do the sourcing and analysis<sup>5</sup>.

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<sup>4</sup>. "Living plans" reflect a decision by the DOD leadership, promulgated through strategic guidance, to dedicate continuous planning resources and effort to specific contingency plans based upon their visibility, priority, likelihood, or risk to national security.

<sup>5</sup> Force Management Integration Project Education Brief January 2008 Update, JFCOM/J34

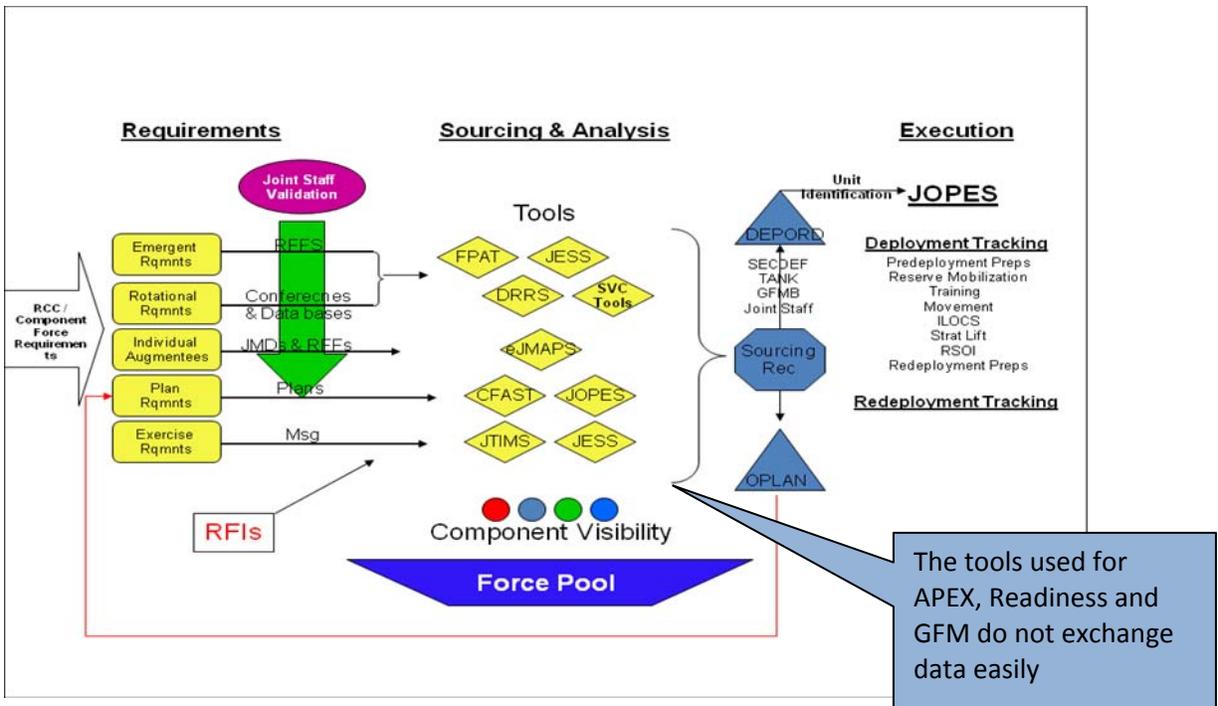


Figure 1 Force Management Processes

One of the root causes for the interoperability problems that exist among the GFM tools is the lack of standardization on the information exchange requirements used not only for the GMF process, but also for the adaptive planning and readiness processes. When this information capability gap was briefed at the Adaptive Planning Executive Council<sup>6</sup>, the Joint Staff J8/MASO was tasked to conduct an analysis to define the IERs needed for GFM, identify and map the IERs with the authoritative data sources (ADS) used by the Services, and compare those ADSs with the ones interfacing with DRRS. In order to assemble quickly composable capabilities in a net-centric environment, the first order of business is to determine what data is required and where the data is located.

### Data Provenance and Pedigree

The GFM community identified 87 IERs needed to support their business processes. Of the 87, an initial set of 47 were decomposed into data elements<sup>7</sup>, and the rest will be defined in the future.. During November and December of 2007, DISA and the Join Staff/J8 conducted technical exchanges with the

<sup>6</sup> JSAP J8A 00280-07 On 30 Aug 07, the Adaptive Planning Executive Council tasked the Joint Staff, J-8 to conduct a Data Summit to address the data and authoritative data sources (ADS) that support the Global Force Management, the joint force provider, adaptive planning and force readiness processes. Data summit is planned for two Phases: 1) Phase 1- Reconcile data elements and ADS' between the Force Management Integration Project Phase III Enhanced visibility and the Defense Readiness Reporting Systems and 2) Phase 2 – Gain understanding of the responsibilities for data and tool governance among key stakeholders.

<sup>7</sup> JFCOM/J3, 2008. FMIP Educational Brief, Jan 08 Update, Slide 10

Services to map the 47 IERs data elements with the Services ADS tools. Below is a summary of the Services ADS as originally identified in the Data Summits.

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#### **Air Force identified ADS**

SORTS (Status of Resources & Training System)  
MILPDS/PAS (Military Personnel Data System)/(Personnel Accounting System)  
MPES (Manpower Programming and Execution System)  
DCAPES (Deployment and Deliberate. Crisis Action Planning and. Execution Segments)  
GCSS-AF (Global Combat Support System – Air Force) Data Services  
ART (Air Expeditionary Force Reporting Tool)  
GSORTS  
JOPES (Joint Operational Planning and Execution System)  
DRRS (Defense Readiness Reporting System)  
National Geospatial-Intelligence Agency (NGA) Geofile  
UMP (Unit Manpower Personnel)  
UMPR (Unit Manpower Personnel Record)  
ECAST  
LOGDET (Logistical Detail)  
ASPEN (provides mobilization information)  
DMS (Defense Message System)  
WMP 3 (War & Mobilization Planning 3)  
Human Analysis

#### **Army identified ADS**

DRRS-A (Defense Readiness Reporting System - Army)  
MDIS (Mobilization Deployment Integration System)  
SLAMIS (Standard Line Item Number (LIN) Automated Management Information System)  
JOPES (Joint Operational Planning and Execution System)  
GSORTS (Global Status Of Readiness and Training System)  
ITAPDB (Integrated Total Army Personnel Database)  
DMDC (Defense Manpower Data Center)  
Human Analysis  
Alternate Sources  
    WAMS (Work Action Management System)

#### **Navy identified ADS**

TRMS (Type Commander Readiness Management System)  
WebSked (Web-Enabled Scheduling System)  
NMCMPMS (Navy Marine Corps Mobilization Processing System)  
MOVREP (Movement Report)  
JOPES (Joint Operation Planning & Execution System)  
GSORTS (Global Status of Resources & Training System)  
Human Analysis (spreadsheets)  
OPNAV (Office of the Chief of Naval Operations) instructions  
FFC (Fleet Forces Command) messages

#### **Marine Corps identified ADS**

MCTFS (Marine Corps Total Force System)  
MDR (Master Data Repository)  
SORTS (Status of Resources & Training System)  
TFSMS (Total Force Structure Management System)  
HQMC PPO MSG (mobilization messaging system)  
GSORTS  
JOPES (Joint Operation Planning & Execution System)  
MARES (Marine Corps Automated Readiness Evaluation System)  
MIMMS (Marine Corps Integrated Maintenance Management System)  
AMSR (Aviation Management Supply and Readiness Reporting)

A lot of work was accomplished by identifying the ADS tools for each of the elements for the Force Management Integration Project (FMIP) IERs. However there was little discussion of the data formats, code values or taxonomies used in the different tools. For certain IERs data elements more than one ADS tool was identified, but the ADS tool mapping did not include any information on how to link different data elements coming from different systems.

For example, before identifying a unit as being available for deployment, the unit readiness and availability needs to be determined. Readiness information requirements include data on not only units, but also on personnel, supplies, equipment and training. The detail level of readiness information varies depending on the reporting context and is only valid for a specific period of time. For joint readiness reporting, the commander provides broad band data on a specific set of status indicators to assess the ability of the unit to execute its designed and assigned missions.

Another process for joint readiness reporting is based on the Mission Essential Task List (METLs). The METLs try to identify critical readiness deficiencies on the tasks for which a unit is trained. The METLs help the military Services develop tactics for rectifying these deficiencies.

The information from the military Service readiness systems is needed to calculate the number of pieces of equipment available for deployment. There is not an easy way to link equipment information available from the readiness and Services systems. The readiness systems only include the commander's best estimate for the equipment status. The estimate is for the overall equipment assigned to the unit and not individual pieces of equipment. Military Services maintenance systems maintain records of equipment under service, but the records might not include any information regarding who owns it.

Figure 3 shows that the data needed at critical decision points in the GFM process must come from multiple ADS tools.

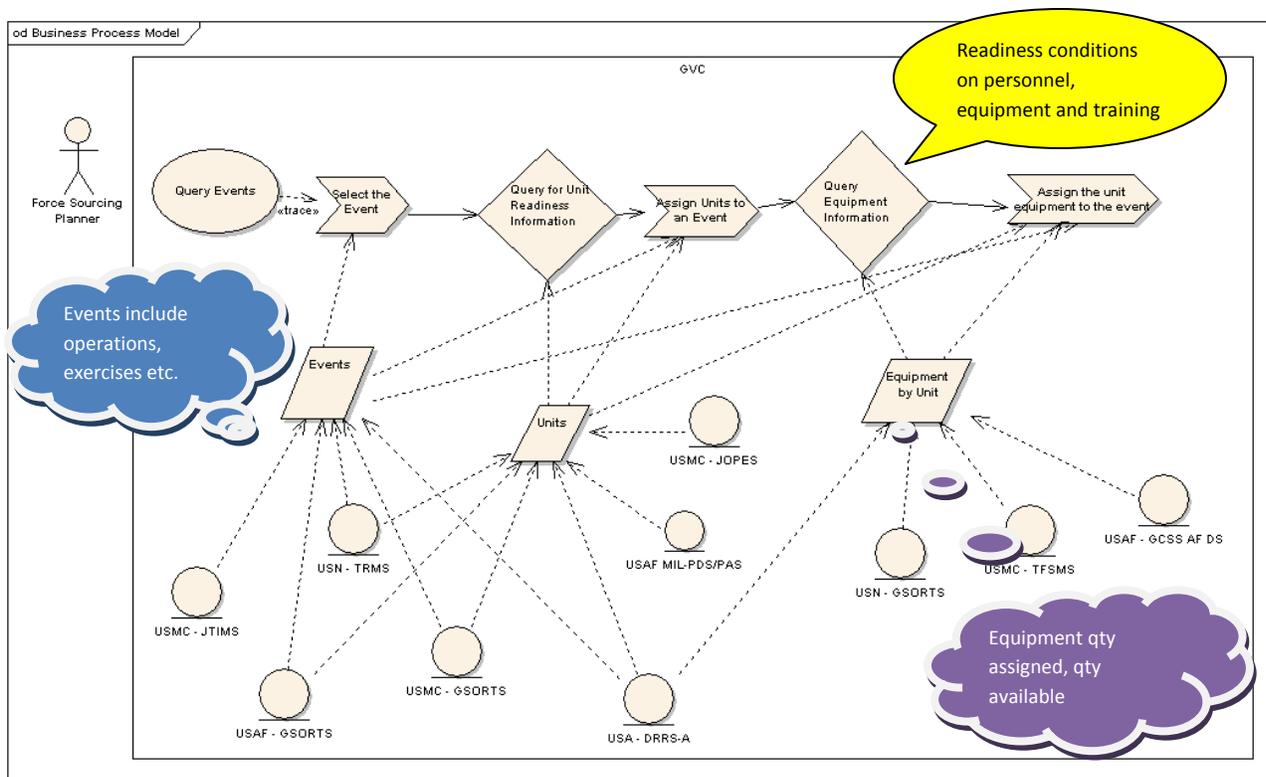


Figure 3 Workflow for Querying Data from Unit and Equipment ADSs

Additionally, Figure 3 Workflow for Querying Data from Unit and Equipment ADSs shows a hypothetical workflow activities and decision points for querying data for sourcing military units to an event after a Request for Forces (RFF) is received. Finally, the diagram lists the data sources that retrieve the information needed for each activity.

The sequence of activities to determine what units are available for an event listed in the RFF is as follows:

1. The force provider receives an RFF for units with heavy trucks for an exercise
2. The force provider queries for the exercise listed in the RFF
3. The Event information is retrieved and displayed. The event information includes units that have been already assigned to the event based on the ADS event information retrieved from the Services
4. The force Provider queries for unit readiness information. If unit readiness is not "Ready" due to equipment, the equipment readiness would provide some explanation and a second group of "Almost Ready"/"Ready by <date>" units could be assembled.
5. The force provider selects a unit for an event
6. The force provider queries to determine the quantity of trucks assigned to the units and the number available for the exercise.
7. The force provider allocates the unit equipment to the exercise (event).

The event information includes the readiness information for the units already assigned to it. According to the JSAP, the ADS tools for readiness information comes from SORTS, TRMS, and DRRS-A. If available the equipment data can come from SORTS, TFSMS, DDRS-A, etc. The FMIP Tech Exchanges data mapping were done for data at rest and adding context to the data will require additional data elements to link the disparate data sources. In other words, no IERs were identified to link aggregated reporting data to specific detail record. A roll-up unit equipment readiness status report in SORTS cannot be linked to any equipment record in a maintenance system.

The data differences go beyond data syntax or semantics. The differences also extend to doctrine and process. For example, the tactics, techniques, and procedures (TTP) used to report readiness assessments vary by Service and who is receiving the readiness reports. There are no common metrics across the Services to report readiness information at the lowest deployable entity level or METLs. The rating assessment reporting into GSORTS is at the unit level and is based on the Unit Commander's estimate, and not on the information coming out of the systems used to track equipment maintenance, health, training, current unit's position and personnel records.

SORTS provides the unit commander's assessment on the overall readiness of the unit to perform its designed mission, its personnel, supplies on hand, its equipment condition, training of its personnel, and a forecast on when the readiness assessment might change (if not at peak readiness) and remarks with further explanation. DRRS provides readiness information using the Mission Essential Task List (METLs), which are based on the Universal Joint Task List (UJTL). According to the CJCSM 3500.04C (UJTL instruction), "UJTLs are a common language and common reference system for joint force commanders, combat support agencies, operational planners, combat developers, and trainers to communicate mission requirements"<sup>8</sup>.

The APEX, Readiness, and Global Force Management communities' share common vocabulary terms, but these terms are used in different contexts and business processes. The operational gaps in the systems used by these communities must be closed so data can be exchanged seamlessly. In addition, a capability to link the information as it is processed by these communities must be built. The aggregated information provided to the Commanders must be traced and linked to the operational systems used to rollup the information. Unfortunately no Communities of Interest (COI) have stood up to identify the functions that span across their business process and the vocabularies needed to support those processes.

Efforts to define a single data model to support these communities will be ineffective not because of the differences in data formats, but from differences in the TTPs used by the Services. The approach proposed in this paper is to concentrate on developing an extensible core vocabulary based on the data models used today in the operational environment, but only include those concepts common across the communities. Any extensible vocabulary will also have to conform to NII's Universal Core (UCORE) initiative in support of the Net-Centric Data Strategy (NCDS) implementation.

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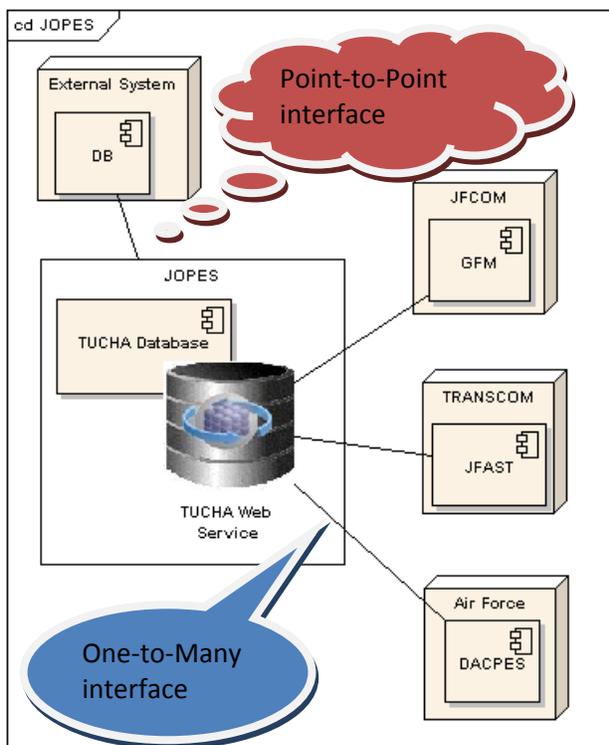
<sup>8</sup> CJCSM 3500.04.c Universal Joint Task List July 2002.

## Data Modeling for Composable Capabilities

The APEX Concept of Operations described the problems in the current joint APEX processes as:

*DOD requires the planning and execution capabilities to rapidly analyze and balance military requirements, resources, and readiness across the force, with a full understanding of the opportunities and risks, to provide DOD leaders with military options for whole of government planning and implementation<sup>9</sup>*

The improvement for joint strategic planning requires tighter linkage of all plans, the integration of force sourcing, readiness, logistics and transportation process with those of adaptive planning. One of the technical challenge for achieving this integration and interoperability is to replace the stovepipe point-to-point interfaces with one-to-many interfaces using a Service Oriented Architecture (SOA).



One of the main paradigm challenges for implementing a SOA is to shift designing interfaces to exchange data from one database to another or from system-to-system. The point-to-point interfaces can be replaced with one interface using a XML vocabulary that is understood by many systems. Often these independent services encapsulate a single business function that can be orchestrated with other services to support an end-to-end business process. For example, JOPES interfaces with many systems to exchange information on the requirements for transportation of a generic unit and cargo. This information is known as the TUCHA file. "Each generic unit in TUCHA has a unit type code (UTC). Each UTC includes the unit generic name, the, unit equipment, the number of different cargo category codes (CCCs) associated with the unit,"<sup>10</sup>. JOPES could have a web service exposing the TUCHA

information and systems needing this information could request it by invoking the web services. An orchestration service calculating a course of action for transportation could call the TUCHA web service to calculate the cargo requirements, and the output could be fed into a transportation web service to check on the feasibility for transportation.

<sup>9</sup> JFCOM, J9 Adaptive Planning – Joint Concept Develop and Experimentation. "Adaptive Planning Concept of Operations", Version 1.0.

<sup>10</sup> [http://www.almc.army.mil/alog/issues/MayJuno4/alog\\_joint\\_force.htm](http://www.almc.army.mil/alog/issues/MayJuno4/alog_joint_force.htm)

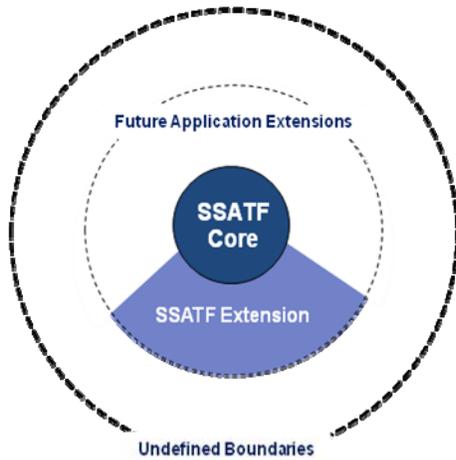


Figure 4 Extensible Schemas

Often COIs concentrate on developing vocabularies that are exclusive to the community without considering how information is exchanged with other communities. A past DoD data strategy<sup>11</sup> demonstrated the futility of building a universal common vocabulary. The development of a vocabulary for the APEX, GFM and Readiness communities should include the minimum set of vocabulary terms understood and needed by these communities. Any additional vocabulary terms should be added with an extension schema or linked as an association with the core schema. Figure 4 Extensible Schemas shows the concept of the Space Situational Awareness Track Framework (SSATF) core and extensions. A COI schema is modeled as an application schema. The vocabularies needed to represent the

information exchanges are encoded in an application schema. The application schema has the vocabulary terms particular to a COI that are not part of any core.

The modeling framework discussed in this paper is the one designed to implement the NCDS by the Net Enabled Command and Control (NECC), which is the SSATF. SSATF provides a pattern for organizing data artifacts around the concept of an object. The object is an information resource with properties defining *what* type of resource is and *who* the producer is. Amplification data can be added to define the context for using the information and the period of time for the timeliness of the data. The geographical location, if applicable, defines *where* the information occurs. The pedigree and provenance for the data source is added as metadata. By abstracting the information as a resource, additional assertions are made by extending the basic object with distinct community vocabularies.

A resource is the pattern for conceptualizing how to structure an information message, and the framework is the set of standards used to implement the pattern. The SSATF framework is based on a set of XML open standards. The basic UML representation of the SSATF object is shown below.

<sup>11</sup> DoD Directive 8320.1 Data Administration

The DoD IRDS provides a medium for defining metadata, cross-referencing, and consistency checking, and supports the standardization of data element names, definitions, and relationships. Metadata includes a wide variety of data element information such as data element access name, descriptive name, alternate names, data element definition, data type, data length, storage format, data validation rules, and the functional area or the IS that is the source of the data element

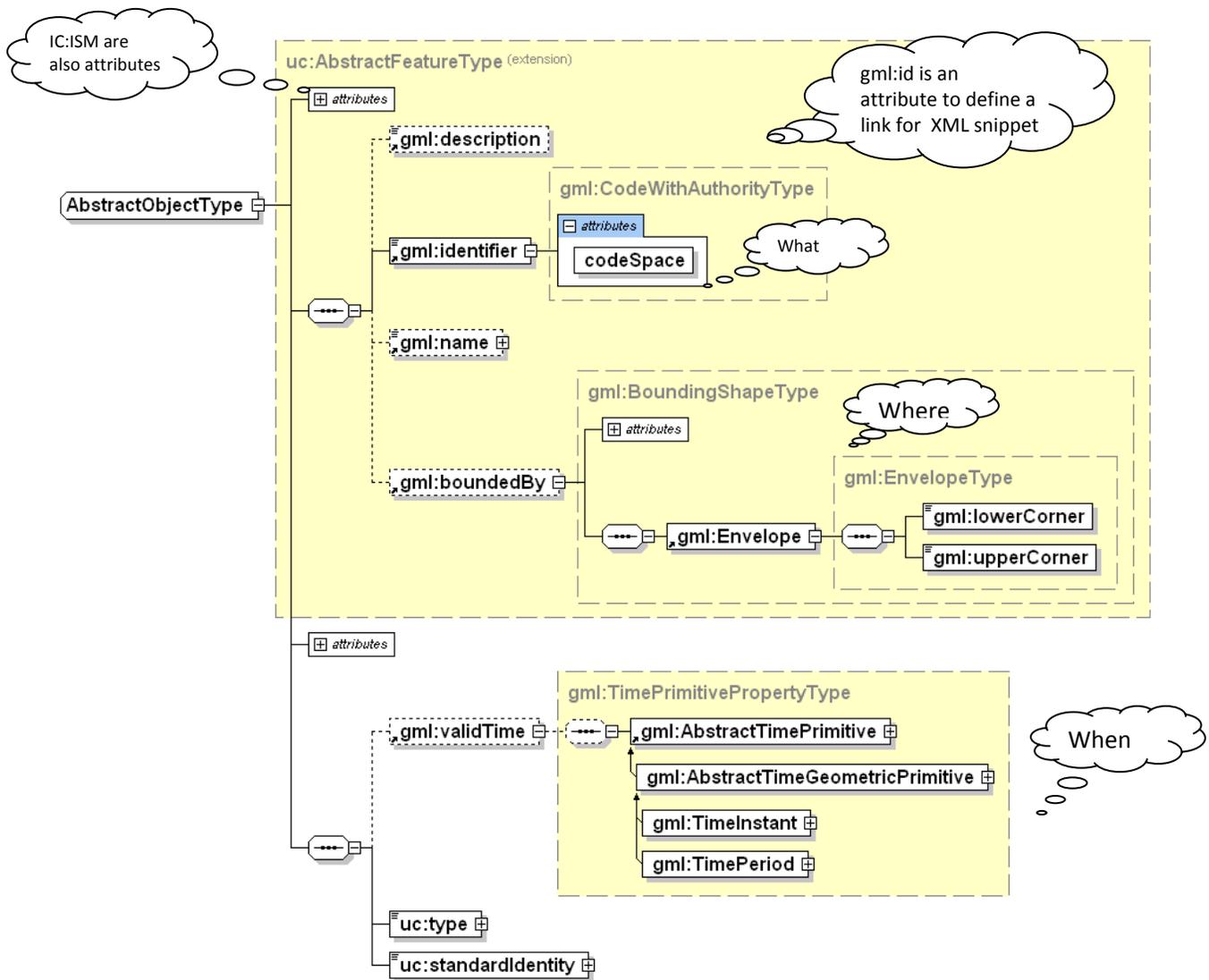


Figure 5 Basic UML Representation of SSATF object

Every resource (object) is identified by a unique identifier, has a unique type to describe what type of information (message) the resource is (track, plan, report, etc.), and an optional valid time to indicate the timeliness of the information. The message can also contain a description to indicate the content of the message, and a name to define an optional text string to name the resource contained in the message. The identifier is defined by using the *gml:identifier*, and the value of the identifier comes from the domain identified codeSpace attribute. The *gml:id* attribute is used to identify a specific XML fragment within a message.

The *gml:id* attribute provides a link to identify the XML fragment for a message to be referenced in other XML objects. Each object has its own classification markings making it possible to transmit objects with different security marking across security domains. Security guards can discard the parts not cleared to cross the domain based on the Intelligence Community Information Security Markings (IC-ISM). The access rules are implemented at the application layer and are not based on the ICISM tags. The access rules are codified separately using an attribute based standard such eXtensible Access

Control Markup Language (XACML). The *codeSpace* for the *gml:identifier* tag would identify the data authority generating the set of valid code values. The codespace *ssatf:type* would identify a taxonomy for the object in the message. The *ssatf:type* would allow the machine to know the set of rules it needs to process the message content based on the taxonomy or ontology.

Since the object type for a SSATF object is either an object or a collection, then each data object can be exchanged by itself or as a member of a collection. This would allow different organizations to produce information on the different information exchange requirements and link the information in a workflow process. The Unified Modeling Language (UML) model for the collection is shown below.

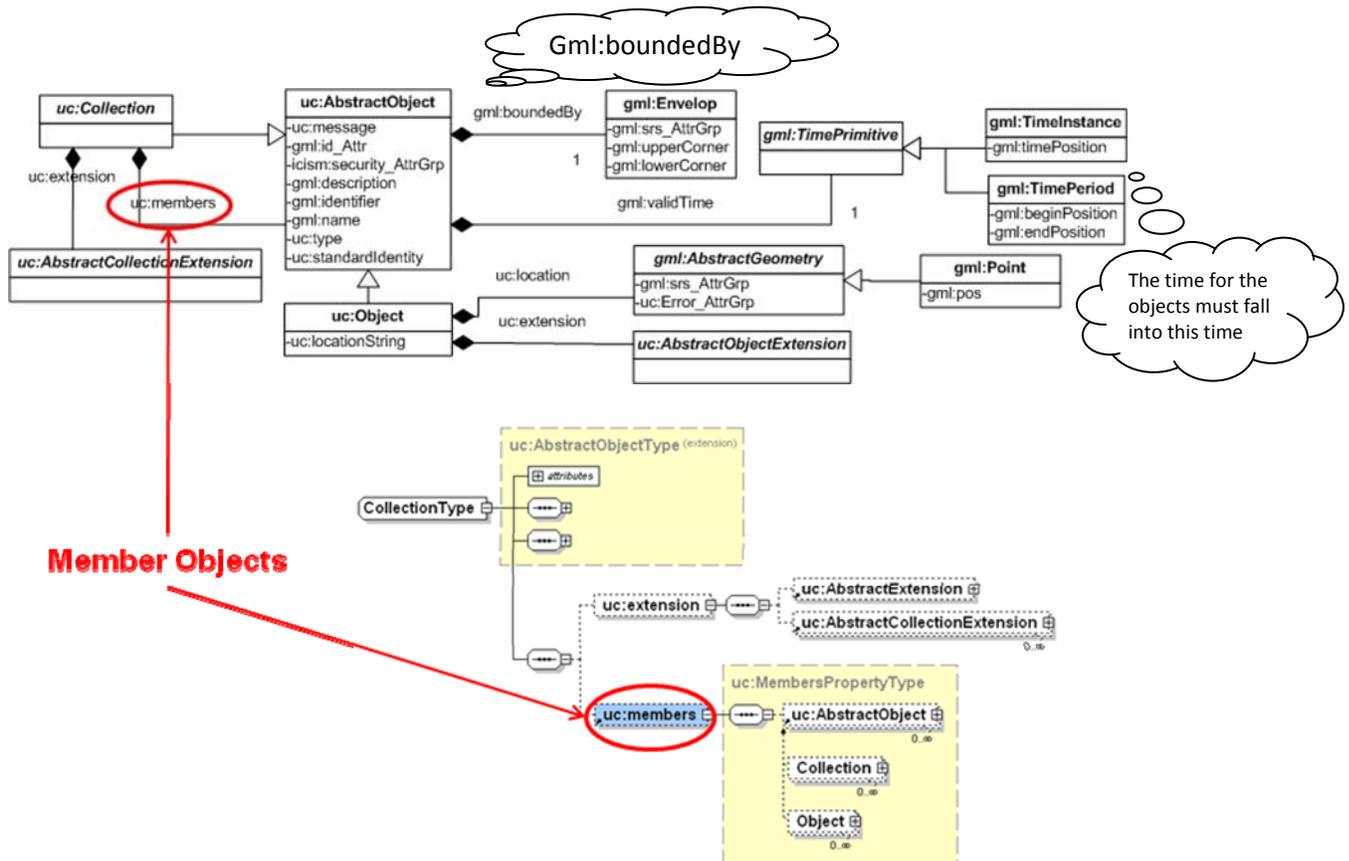


Figure 6 - UML model for collection

There are two restrictions that apply to all of the objects members in the collection. The valid time of the object must fall within the range specified in the collection, and the location must be within the area specified in the *boundedBy* element, which is defined as a *gml:Envelope*. Although, AP systems do not natively support geographic coordinates to represent the concept of location, it would be required to build a mediation service to produce geographic coordinates based on the Geocode file used today in AP systems until all systems can support reporting location using GML.

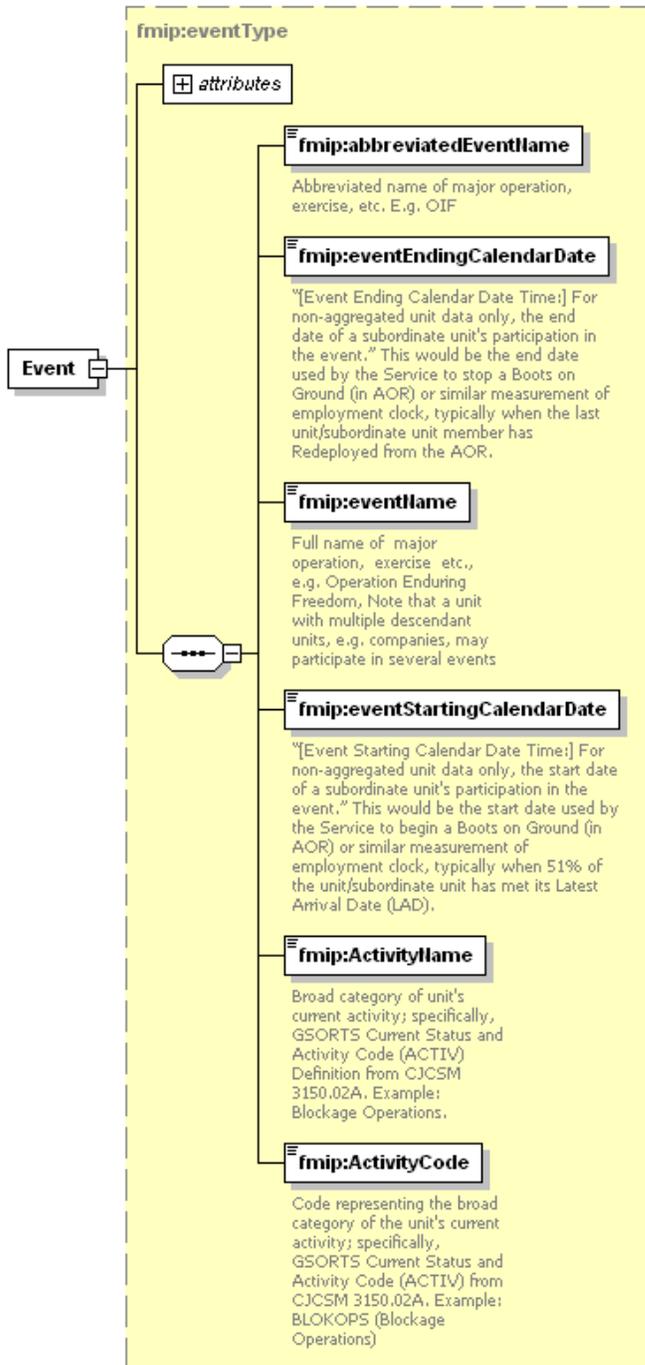
The flexibility of the SSATF framework is based on its extensibility pattern for the inclusion of additional vocabularies to expand the content of the basic information object. Three steps are needed to add an extension to the core SSATF schema.

1. Define an extension data type of `ssatf:ObjectExtensionType`
2. Define the element for the newly created extension type and include that element in the substitution group of either
  - `ssatf:Object Extension` to extend Static Object properties
  - `ssatf:CollectionExtension` to extend Collection properties
3. Make extension visible by making the defining schema a SSATF Application XSD
  - Import the SSATF Root XSD

The next two sections will describe how the SSATF was used to develop the FMIP vocabulary, and how the XML messages from disparate data sources can be associated into a single message to respond to a data query.

## FMIP XML Vocabulary

The modeling example provided below does not include the 47 information requirements covered in the FMIP Technical Exchanges. For simplicity, only the information exchange requirements needed to support the example business case model from Figure 3 are included.



The business case defined in Figure 3 was about the assignment of units and equipment after a RFF was received by the Force Provider. The vocabulary concepts needed for the data queries are:

- Event
- Units
- Equipment
- Unit readiness
- Capabilities
- Equipment Readiness

Each of these concepts will have to be modeled as separate objects according to the SSATF.

The event, units and equipment inherit from the basic abstract object and extended with the properties needed to define it. The extended object inherits the IC-ISM markings from the basic object.

Though their FMIP vocabularies included 47 Information Exchange requirements, some of these requirements can be grouped together because they are part of the same concept. For example, the equipment type, model and description were defined as separate IER, despite the fact they are all properties of equipment.

The unit employment data lists the activities in which a unit participates. The activity codes are defined in the CJCSM 3150.02A and are available on SORTS. The activity defines the overall set of actions on how the unit is being employed in a major event. Many times the name from the event comes from the title of the Operational Plan (Oplan) in execution, but there are many Oplans that will never be executed. Therefore, the Oplan title cannot be recognized as the data authority for this field. The COCOM © 2009 The MITRE Corporation. All rights reserved

usually assigns the name for the event. A unit and subordinates subunits can be employed in many different events.

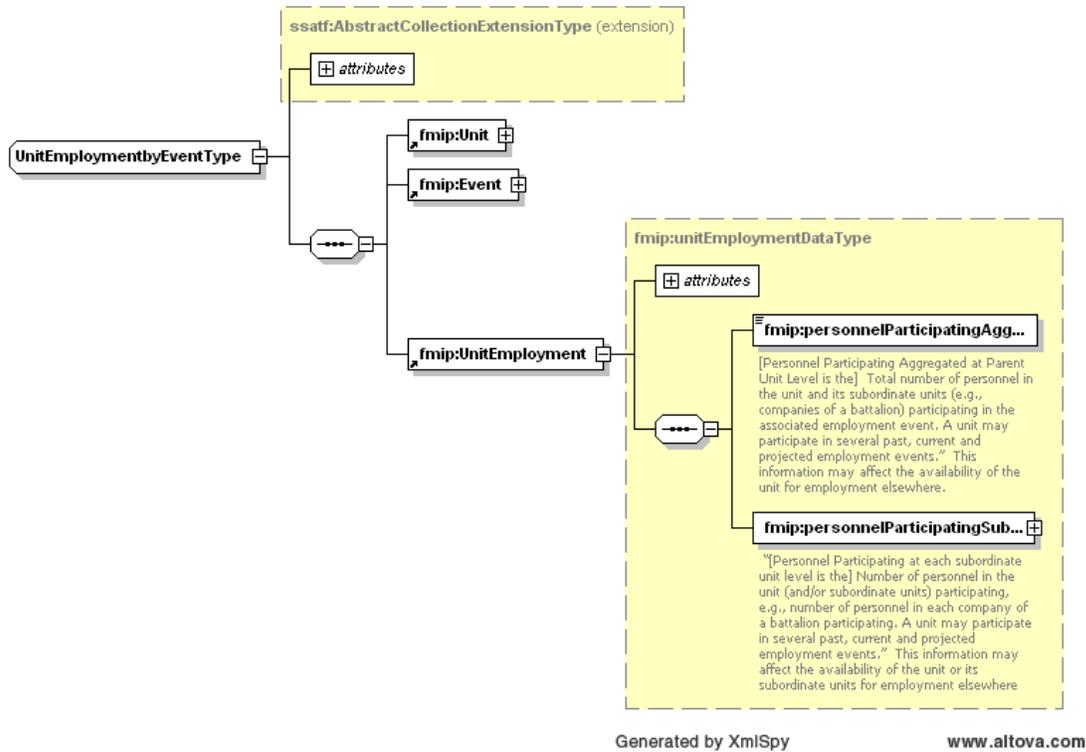


Figure 8 UnitEmployment Object

Figure 8 UnitEmployment Objects shows the concept of a unit employment as defined in the FMIP vocabulary. A unit can participate in many events, and some of the events might be exercises. If the exercise is an activity then the event name can be taken from Joint Training Information Management

System (JITMS). Otherwise there are not ADS available for other types of events. The number of personnel participating at the subordinate unit is needed to determine the unit's overall availability for future events.

The equipment data needed for force sourcing is only the essential equipment the unit needs for deployment. It does not include pre-positioned equipment. The list of what unit equipment is classified as essential is done by the Services.

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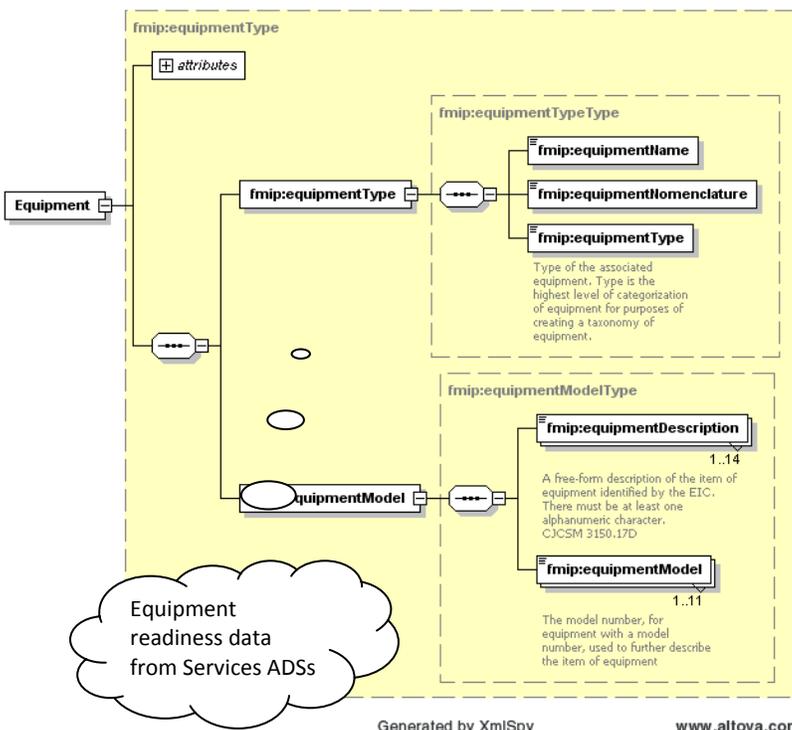


Figure 9 Equipment Object

transportation needed to be included as well.

One of the problems identified in the Tech Exchanges by the USMC is that Mission Essential Equipment that is reportable across the board (by readiness) is different than the class of equipment reported in the maintenance system such as MARES. There is not a one-to-one correspondence between the equipment reported in SORTS with the equipment reported within MARES .

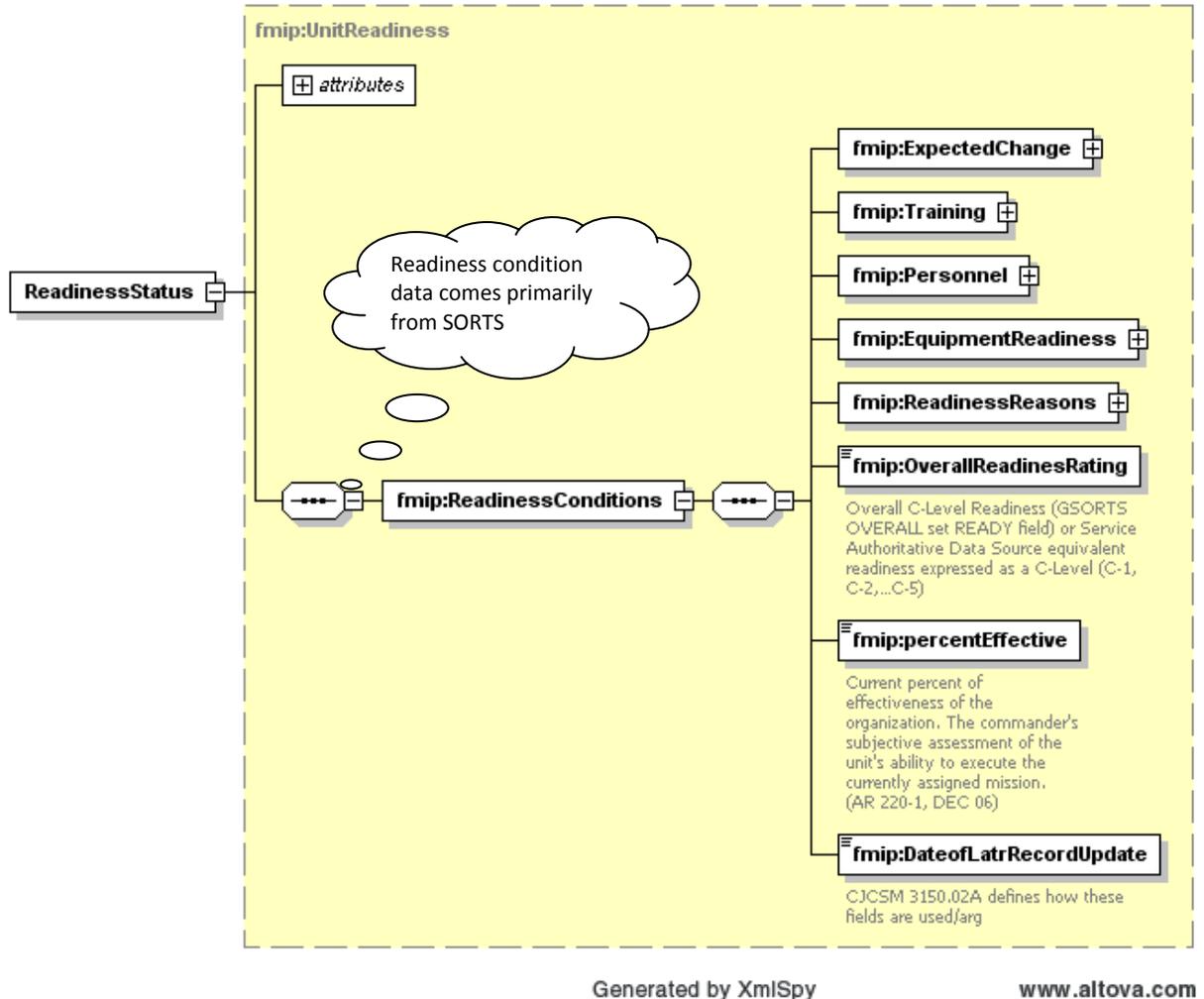


Figure 10 Readiness Status Report

The FMIP readiness related IERs came directly from the SORTS reporting fields, but were defined as independent IERs. The reporting TTPs for readiness level and assessment vary by Service. The ADS used by the Air Force is done at the UTC level and only 25% of AF units report readiness into SORTS. ART and DCAPES are done at the UTC level and express readiness in terms of spaces and equipment, whereas GSORTS is mission-based at the unit-level and depends on the commander's assessment.

As mentioned previously the objective of the FMIP technical exchanges was the identification of the ADS to supply the data needed to the GFM sourcing tool. However, using the XML vocabulary developed for

this effort will continue the data replication that exists today. Instead of sending large XML files with the same information for a point-to-point interface between the GFM tool and the ADS tools, the FMIP community should leverage the existing services to reduce data duplication and improve data quality.

## Using SSATF to associate messages from different ADS

This section will refine the FMIP XML vocabulary by replacing redundant information with references to other community vocabularies and services.

The authoritative source for the activity code is the CJCSM 3150.02A, and the data is available in SORTS. SORTS could easily implement a web service to expose the activity information using the FMIP activity snippet, without the event information. The GFM tool has a list of events since they have to provide the sourcing to support it. The GFM tool set could be used as the ADS for the event. The XML snippet for an event and a list of related activities could look like the sample in the Figure 11 XML Snippet for an Event below.

```
<fmip >
  <fmip:Event xlink:role="http://www.jfcom.mil/GFM" xlink:title="Event"
    xlink:href="http://www.gfm.com/REST/getEvent?EventName"
    xlink:arcrole="urn:GFM#Event:">Enduring Freedom
  </fmip:Event>
  <fmip:Activities xlink:role="http://www.disa.mil/SORTS" xlink:type="simple" xlink:title="Activity"
    xlink:href="http://www.disa.mil/SORTS/REST/getActivity?ACTIV"
    xlink:arcrole="http://www.jfcom.mil/GFM/Event#HasActivities">PERRECVRY
  </fmip:Activities>
  <fmip:Activities xlink:role="http://www.disa.mil/SORTS" xlink:type="simple" xlink:title="Activity"
    xlink:href="http://www.disa.mil/SORTS/REST/getActivity?ACTIV"
    xlink:arcrole="http://www.jfcom.mil/GFM/Event#HasActivities">AIRTRANSEX
  </fmip:Activities>
</fmip>
```

Figure 11 XML Snippet for an Event

Referencing the event and activities by using the authoritative data source rather than repeating the data values will increase performance and reduce redundancy. If the receiving system does not have the detail information on an event, then it could use the “*href*” attribute in the data element to obtain all of the details for the event, and the same could also be done to get the name of the activity.

The next step is to retrieve the units participating in an event. Unfortunately there is not a single system providing this information; however this information could be organized as collections with an object referencing the event and another one for the activity. There are additional two data elements in the Unit Employment IER, besides the event and activity, with ADS coming from the Services tools. These data elements are the *Personnel Participating Aggregated at Parent Unit Level* and *Personnel Participating at each subordinate UnitLevel*. To obtain the data for these data fields, the request will also have to include the activity code. An abbreviated version of the XML snippet is shown in Figure 12 XML Snippet for a Unit Employment Collection with the additional metadata removed to show only the areas of interest

```

?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2008 (http://www.altova.com)-->
<fmip:UnitEmploymentCollection gml:id="" icism:ownerProducer="" icism:classification=""
xmlns:fmip="http://metadata.dod.mil/mdr/ns/fmip" xmlns:ssatf="http://metadata.dod.mil/mdr/ns/necc/ssatf"
xmlns:ssatfe="http://metadata.dod.mil/mdr/ns/necc/ssatfe" xmlns:gml="http://www.opengis.net/gml/3.2"
xmlns:icism="urn:us:gov:ic:ism:v2">
  <gml:description>String</gml:description>
  <gml:identifier codeSpace="">String</gml:identifier>
  <gml:name>String</gml:name>
  <gml:validTime></gml:validTime>
  <ssatf:members>
    <fmip:UnitReference gml:id="" icism:ownerProducer="" icism:classification="">
      <gml:description>String</gml:description>
      <gml:identifier codeSpace="" =&ssatf;unitName"> Unit_1BDE</gml:identifier>
      <gml:name>1st INF BD</gml:name>
      <ssatf:standardIdentity>String</ssatf:standardIdentity>
      <ssatf:type codeSpace=""&ssatf;type"> ORG.ARMY.UNIT</ssatf:type>
      <gml:locationName>Camp Victory</gml:locationName>
    </fmip:UnitReference>
    <fmip:activity >
      <gml:description>Personnel Recovery</gml:description>
      <gml:identifier codeSpace=""&SORTS;activityName"> PERRECVRY </gml:identifier>
      <gml:name>Recovery Mission</gml:name>
      <gml:validTime>
      </gml:validTime>
      <ssatf:type codeSpace=""&ssatf;type">Activity.Code</ssatf:type>
      <ssatf:location>
      </ssatf:location>
    </fmip:activity>
  </fmip:UnitEmployment>
  <gml:description> 1st Unit of Employment </gml:description>
  <gml:identifier codeSpace="">String</gml:identifier>
  <gml:name>String</gml:name>
  <gml:boundedBy>
  </gml:boundedBy>
  <gml:validTime>
  </gml:validTime>
  <fmip:PersonnelParticipatingUnitLevel>4096</fmip:PersonnelParticipatingUnitLevel>
<fmip:PersonnelParticipatingSubunitLevel>4096</fmip:PersonnelParticipatingSubunitLevel>
</fmip:UnitEmployment>
  </ssatf:members>
</fmip:UnitEmploymentCollection>

```

The valid time for the collection must be based on the timeliness for each of the objects

The Unit and Task information is included by reference rather than

Figure 12 XML Snippet for a Unit Employment Collection

The readiness information for the equipment information is based on the commander's assessment, and there is no known linkage between the readiness and Service maintenance systems. If such a linkage exists then it would be possible to create an equipment readiness reports in a similar fashion as the unit employment report. This capability cannot be built until there is a linkage among the joint readiness tools and the Service's readiness and maintenance tools.

The current readiness report is already available within SORTS. However, the algorithms used to estimate the assessments are only encoded in the CJCSM 3150.02A and defined with a broad band of measurements. The new METLS rating system measures readiness information based on the status of a unit to complete the tasks and the measure algorithms are also based on a CJSCM 3401.02B currently on draft status. The definition of what a capability is and how it should be represented has not been identified yet<sup>12</sup>. The IER capability requirements definitions and data elements were deferred by JFCOM.

The SSATF provides a mechanism for linking XML messages from disparate data sources, but requires the definition of an orchestration service to handle the data query requests and to assemble the response messages. In the Internet there are readily available presentation services that can merge data from different data sources in what is referred to as a mashup<sup>13</sup>. Unfortunately, many of the web services available from legacy applications cannot be incorporate into a mashup NECC envisions providing a user with the capability to discover data from authoritative data sources that can be merged in a mashup style to build new information resources quickly. Unfortunately, rather than reengineering what data services should be built to share information, many of the legacy applications simply implement their current interfaces in a XML format and expose them with a Web Services Description Language.

## Summary

The problems discussed in this paper reflect the challenges faced by organizations when integrating data from many systems to support their business processes. Unfortunately, some data initiatives focused on defining data requirements without identifying first the context for using the data. Past data integration initiatives had the intent of providing data elements and metadata to be used by all systems. In an organization the size of DoD this effort proved to be too cumbersome and complex. The goal for the FMIP data visibility effort was to identify data elements required for force providing, force management, force readiness and adaptive planning. The FMIP Tech Exchanges focused on identifying the ADS and tools to get the data. This process was used to define the XML schemas for the IERs, and proposed a methodology for associating XML messages produced by many systems.

## Further Work and Recommendations

Additional work and analysis is necessary to define the linkage among the IERs and the tools to enable machine-to-machine exchanges. In order to support the types of queries needed to provide the data to these communities, a reasoning or search engine would require a prior knowledge of what systems to use based on the context of the query. For example, the data requirements for the initial sourcing decision require less fidelity than the final sourcing decision. The commander's assessment for readiness conditions on the equipment might be enough for the initial selection of a unit. However, before a final

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<sup>12</sup> Force Management Integration Project Data Summit Phase 1, Joint Staff J8, March 2008

<sup>13</sup> Wikipedia [http://en.wikipedia.org/wiki/Mashup\\_\(web\\_application\\_hybrid\)](http://en.wikipedia.org/wiki/Mashup_(web_application_hybrid))

mashup is a [web application](#) that combines data from more than one source into a single integrated tool. The term Mashup implies easy, fast integration, frequently done by access to open APIs and data sources to produce results data owners had no idea could be produced. An example is the use of cartographic data from

decision on what units are available the force analyst requires detailed information on the readiness status of the equipment. Further, the force analyst needs to know if the equipment readiness conditions are dependent on maintenance repairs or backordered parts.

Recommend the next phases for FMIP data visibility include 1) an analysis of IERs already satisfied by current web services or interfaces, 2) a statement of additional services required for the data that exist, and 3) clearly defined data elements for the undefined set of IERs. Finally, the Force Management community should devote less effort in trying to get access to the data to replicate in a local enclave, and place more emphasis on implementing a net-centric solution based on semantic technologies.

## References

CJCSM 3150.02A , “GLOBAL STATUS OF RESOURCES AND TRAINING SYSTEM (GSORTS)”  
DoD Directive 8320.1, “Data Administration”, 1991.  
DoD , “Net-Centric Data Strategy”, May 2003  
DoD Directive 8320.2, “Data Sharing in a Net-Centric Department of Defense “, December 2 2004,  
DoD Guidance 8320.2-G “Guidance for Implementing Net Centric Data Sharing”, December 2, 2004.  
JFCOM/J9 Adaptive Planning, “Adaptive Planning Concept of Operations” Version 1, 20 August 2008  
JSAP J8A 00280-07, “Data Summit Support”, October 26, 2007  
Morales, Rosamaria, “Force Projection Adoption of Proposed C2 Core”, Mitre Technical Report E212-L-6525, August 2008  
Morales, Rosamaria, “Force Readiness Adoption of C2 Core”, Mitre Technical Report E212-L-6674, September 2008  
Sprung George, J8, “Data Summit Phase 1 Results”, March 31, 2008

## Acronyms

ADS – Authoritative Data Source  
ART – Air Expeditionary Force Reporting Tool  
AP – Adaptive Planning  
APEX – Adaptive Planning and Execution  
AMSRR –Aviation Management Supply and Readiness Reporting  
CJCSM – Chairman of the Joint Chiefs of Staff Manual  
COI – Community of Interest  
DCAPES –Deployment and Deliberate. Crisis Action Planning and. Execution Segments  
DISA – DoD Information Systems Agency  
DMDC (Defense Manpower Data Center)  
DoD –Department of Defense  
DRRS-OSD – Readiness Reporting System  
DRRS-A –Defense Readiness Reporting System - Army  
ejMaps – Electronic Joint Manpower and Personnel System  
GFM – Global Force Management  
GML – Geographic Markup Language  
GSORTS – Global Status of Readiness and Training System  
GCSS-AF (Global Combat Support System – Air Force) Data Services  
FPAT  
HQMC PPO MSG – mobilization messaging system

IER – Information Exchange Requirement  
ILOC – Interim Requirements  
ITAPDB (Integrated Total Army Personnel Database)  
J8/MASO – Joint Staff/J8 Models and Analysis Support Office  
JESS – Joint Event Scheduling System  
JMD –Joint Manning Document  
JITMS – Joint Intelligence Training Management System  
JOPEs – Joint Operation Planning & Execution System  
JSAP – Joint Staff Action Processing  
MARES - Marine Corps Automated Readiness Evaluation System  
MCTFS –Marine Corps Total Force System  
MDIS – Mobilization Deployment Integration System  
MDR – USMC Master Data Repository  
MILPDS – Military Personnel Data System/Personnel Accounting System  
MIMMS - Marine Corps Integrated Maintenance Management System  
MPES – Manpower Programming and Execution System  
MOVREP – Movement Report  
NCDS – Net Centric Data Strategy  
NECC – Net Enabled Command and Control  
RCC - Regional combatant commander  
RFC – Request for capability  
RFF – Request for forces  
RFI – Request for information  
RSOI – Reception, Staging, Onward Movement Integration  
SASSY - Support Activities Supply System  
SECDEF – Secretary of Defense  
SLAIMS – Standard Line Item Number (LIN) Automated Management Information System  
SORTS - Status of Resources & Training System  
SSATF – Space Situational Awareness  
TTP –Tactics, Techniques and Procedures  
NMCMPs - Navy Marine Corps Mobilization Processing System  
METLS - Mission Essential Task List  
TFSMS - Total Force Structure Management System  
TRMS – Type Commander Readiness Management System  
UCORE – Universal Core  
UJTL – Universal Joint Task List  
WEBSKED – Web-Enabled Scheduling System  
UMP – Unit Manpower Personnel  
UMPR – Unit Manpower Personnel Record  
ECAST  
LOGDET – Logistical Detail  
ASPEN – provides mobilization information  
DMS – Defense Message System  
WMP 3 – War & Mobilization Planning 3  
OPNAV – Office of the Chief of Naval Operations instructions  
FFC – Fleet Forces Command messages