

**GSOC –**

German Space Operations Center



Deutsches Zentrum  
für Luft- und Raumfahrt e.V.  
in der Helmholtz-Gemeinschaft

**JSC – OTF**

Johnson Space Center

Operations Technology Facility



Operations Technology Facility  
Johnson Space Center

# PROTOTYPE INTEROPERABILITY DOCUMENT BETWEEN NASA-JSC AND DLR-GSOC DESCRIBING THE CCSDS SM&C MISSION OPERATIONS PROTOTYPE

VERSION 1.4

DATE 17.09.2010

Prepared::

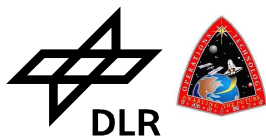
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## Document Change Control

Issue	Rev.	Date	Pages	Changes	Status
1	0	25.08.2009	all	New document	Issued
1	1	01.10.2009	Chapter 5.2.1	Update MAL XML Schema	issued
1	2	17.03.2010	Chapter 6	Added service configuration data	issued
1	3	21.04.2010	Various	Updates from Phase One Review and removed XML-SOAP encoding over HTTP	Issued
1	4	17.09.2010	Chapter 6.3	Corrections to the Alert Service configuration	Issued



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CONTENTS .....Page

<b>1</b>	<b>PURPOSE</b>	<b>6</b>
<b>2</b>	<b>AGENCIES AGREEMENT</b>	<b>6</b>
2.1	STATEMENT OF MUTUAL BENEFIT AND INTERESTS	6
2.2	JSC-OTF SHALL	6
2.3	DLR-GSOC SHALL	6
2.4	MUTUALLY UNDERSTOOD AND AGREED	7
2.5	NETWORK ARCHITECTURE	7
2.6	SECURITY ISSUES	7
2.7	PRINCIPAL CONTACTS	8
2.7.1	GSOC-DLR / ESA Contacts	8
2.7.2	JSC-OTF Contacts	8
<b>3</b>	<b>TECHNICAL DESCRIPTION OF PROTOTYPE</b>	<b>9</b>
3.1	DESIGN	9
3.1.1	Mission Operations Concept	9
3.1.2	Standard used	10
3.1.3	JSC-OTF Prototype design	11
3.1.4	DLR-GSOC Prototype Design	14
3.1.5	Combined Protocol Description	14
3.2	LAYERS TO BE IMPLEMENTED	15
3.2.1	Application Layer	15
3.2.2	Service Layer	15
3.2.3	Common Object Model	16
3.2.4	Message Abstraction Layer	18
3.2.5	Encoding Layer	19
3.2.6	Transport layer	19
3.3	SERVICES TO BE IMPLEMENTED	21
3.3.1	Directory Service	21
3.3.2	Parameter Service	24
3.3.3	Login Service	25
3.3.4	Alert Service (optional)	26
3.4	TEST ENVIRONMENT	28
3.4.1	Communication	28
3.4.2	Security policy	28
3.4.3	Test environment in JSC-OTF	28
3.4.4	Test environment in DLR-GSOC	29
3.4.5	Use Cases	29
3.4.6	Bridging System Domains	32
<b>4</b>	<b>PLANNING</b>	<b>34</b>
4.1	STAGES	34
4.1.1	Stage 1	34
4.1.2	Stage 2	34
4.2	SCHEDULE	35
4.3	DOCUMENT DELIVERY	35
<b>5</b>	<b>ENCODING</b>	<b>36</b>
5.1	BINARY ENCODING	36
5.2	XML ENCODING	41
5.2.1	Message Abstraction Layer Structures	41
5.2.2	Common Structures	61
5.2.3	Directory Service Structures	62
5.2.4	Directory Service Operation Structures	66
5.2.5	Directory Service WSDL	66



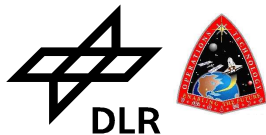
<b>6</b>	<b>SERVICE CONFIGURATION .....</b>	<b>67</b>
6.1	ACTION SERVICE .....	67
6.1.1	XTCE Entity Definitions .....	67
6.1.2	Action Definition .....	89
6.2	PARAMETER SERVICE .....	91
6.2.1	XTCE Entity Definitions .....	91
6.2.2	Parameter Definition .....	95
6.3	ALERT SERVICE .....	99
6.3.1	JSC-OTF Alert Service Provider Configuration Data .....	101
6.3.2	JSC OTF Alert Definition .....	103
6.3.3	DLR-GSOC Alert Service Configuration Data .....	103
6.3.4	GSOC-DLR Alert Definition .....	104

**FIGURES .....**Page

Figure 2-1	Network Communications .....	7
Figure 3-1	Overview of the Mission Operations Service Framework .....	9
Figure 3-2	Mission Operations Service Layers .....	10
Figure 3-3	Action, Parameter and Alert Service Interoperability .....	12
Figure 3-4	Directory Service Interoperability .....	13
Figure 3-5	JSC-OTF Prototype .....	13
Figure 3-6	DLR-GSOC Prototype .....	14
Figure 3-7	DLR-GSOC Application Layer .....	15
Figure 3-8	DLR-GSOC Transport Layer .....	20
Figure 3-9	Directory Service Sequence .....	29
Figure 3-10	Action Service Sequence .....	30
Figure 3-11	Parameter Service Sequence .....	31
Figure 3-12	Alert Service Sequence – Subscribe .....	31
Figure 3-13	Alert Service Sequence – Raise .....	32

**TABLES .....**Page

Table 3-1	JSC-OTF Common Model Operations .....	17
Table 3-2	DLR-GSOC Common Model Operations .....	18
Table 3-3	JSC-OTF Directory Service Operations .....	21
Table 3-4	DLR-GSOC Directory Service Operations .....	22
Table 3-5	JSC-OTF Action Service Operations .....	22
Table 3-6	JSC-OTF Supported Verification Stages .....	23
Table 3-7	DLR-GSOC Action Service Operations .....	24
Table 3-8	JSC-OTF Parameter Service Operations .....	24
Table 3-9	DLR-GSOC Parameter Service Operations .....	25
Table 3-10	JSC-OTF Login Service Operations .....	26

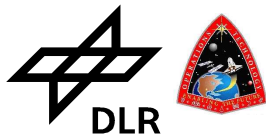


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Table 3-11 DLR-GSOC Login Service Operations .....	26
Table 3-12 JSC-OTF Alert Service Operations .....	27
Table 3-13 DLR-GSOC Alert Service Operations.....	28
Table 4-1 Project Schedule .....	35
Table 5-1 Abstract Data Type Short Forms .....	36
Table 5-2 Basic Data Type Properties .....	37
Table 5-3 Sample Message Header .....	39
Table 5-4 Standard Error with Extra Information .....	40
Table 5-5 Binary Standard Error with Null Value .....	41

**LISTINGS.....Page**

Listing 5-1 Binary Message Header.....	40
Listing 5-2 Binary Standard Error with Extra Information.....	40
Listing 5-3 Binary Standard Error with Null Value .....	41
Listing 5-4 Schema for Message Abstraction Layer Structures.....	60
Listing 5-5 Schema for Common Service Structures .....	62
Listing 5-6 Schema for Directory Service Structures .....	66
Listing 5-7 Schema for Directory Service WSDL Creation .....	<b>Fehler! Textmarke nicht definiert.</b>
Listing 5-8 Directory Service WSDL .....	<b>Fehler! Textmarke nicht definiert.</b>
Listing 6-1 Alert Service Configuration Schema .....	101
Listing 6-2 JSC-OTF Alert Service Provider Configuration Data .....	102



This PROTOTYPE INTEROPERABILITY DOCUMENT is hereby made and entered into by and between the Johnson Space Center (JSC) Operations Technology Facility (JSC - OTF) and the Deutsches Zentrum für Luft- und Raumfahrt (DLR – GSOC).

## 1 PURPOSE

The purpose of the PROTOTYPE INTEROPERABILITY DOCUMENT is to document the design and interfaces for the service providers and consumers of a Mission Operations prototype between JSC-OTF and DLR-GSOC.

The primary goal is to test the interoperability sections of the CCSDS Spacecraft Monitor & Control (SM&C) Mission Operations (MO) specifications between both control centers. An additional goal is to provide feedback to the Spacecraft Monitor and Control (SM&C) working group through the Review Item Disposition (RID) process.

This Prototype is considered a proof of concept and should increase the knowledge base of the CCSDS SM&C Mission Operations standards. No operational capabilities will be provided.

The CCSDS Mission Operations (MO) initiative was previously called Spacecraft Monitor and Control (SM&C). The specifications have been renamed to better reflect the scope and overall objectives. The working group retains the name Spacecraft Monitor and Control working group and is under the Mission Operations and Information Services Area (MOIMS) of CCSDS. This document will refer to the specifications as SM&C Mission Operations, Mission Operations or just MO.

## 2 AGENCIES AGREEMENT

### 2.1 STATEMENT OF MUTUAL BENEFIT AND INTERESTS

DLR-GSOC and JSC-OTF desire to work together to investigate the use of the CCSDS SM&C Mission Operations protocols between two independent and disparate control centers. This collaboration will help validate the use of Mission Operations communications standards.

### 2.2 JSC-OTF SHALL

JSC-OTF shall construct a spacecraft simulation test bed within the OTF that will allow GSOC users in designated GSOC development labs to command the simulated spacecraft and receive the associated telemetry, as well as other useful data streams, in accordance with the SM&C Mission Operations standards being developed.

JSC-OTF shall provide example test data (in encoded binary format) for the Action, Parameters and Alert service providers. The data will be used by DLR-GSOC to perform local testing.

### 2.3 DLR-GSOC SHALL

DLR-GSOC shall jointly exercise the OTF Spacecraft Simulator using SM&C Mission Operations protocols to validate the usefulness and completeness of the Mission Operations standards for spacecraft monitoring and control.

DLR-GSOC shall provide one example request test data (in encoded binary format) for each of the following service consumers: Action, Parameters and Alert. The data will be used by JSC-OTF to perform local testing

## 2.4 MUTUALLY UNDERSTOOD AND AGREED

DLR-GSOC and JSC-OTF will develop independent implementations of the SM&C Mission Operations specifications to exchange actions, parameters, and alerts. This agreement will allow both parties to validate the specifications and provide feedback to the MOIMS SM&C working group.

DLR-GSOC and JSC-OTF agree to exchange the Data and Reports related to the SM&C Mission Operations Prototype in a transparent way. No exchange of software is planned.

## 2.5 NETWORK ARCHITECTURE

The configuration of the communications link between the GSOC and OTF prototype labs will utilize the ESA Gateway located in the MCC-Houston. Figure 2-1 describes the network communications architecture.

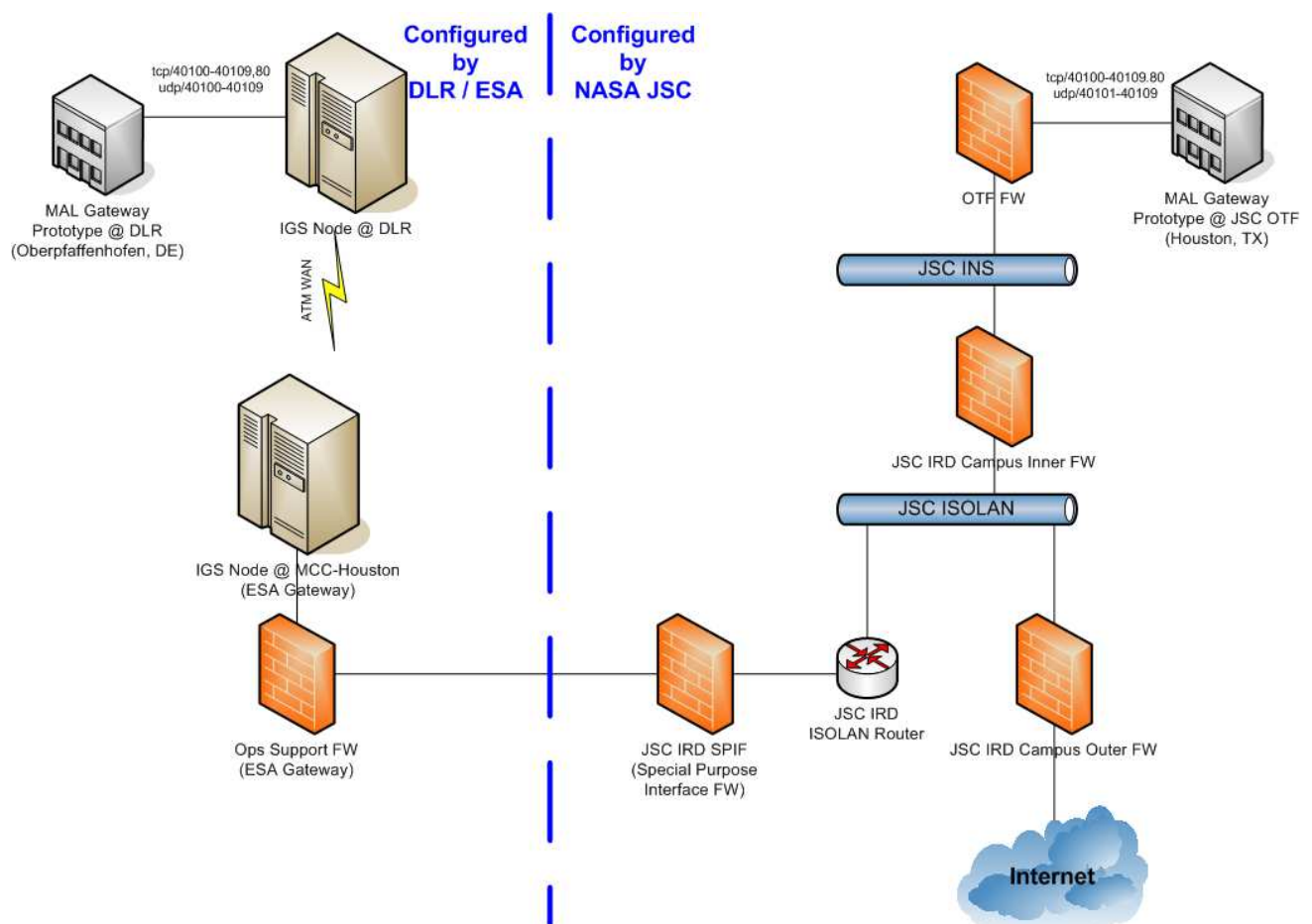


Figure 2-1 Network Communications

## 2.6 SECURITY ISSUES

Transport of messages across the link is performed unencrypted to meet the firewall requirements of both agencies. Firewall configuration will be used to prove identity of the agency gateways.

Authentication and authorisation is done locally on both sides using Login Services. Interaction between JSC-OTF login service and GSOC-DLR login service is not planned for this prototype.



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Components of the prototype that are installed on the COL/IGS Network will enforce the COL security rules (such as virus checking, authentication, a.s.o.)

## 2.7 PRINCIPAL CONTACTS

### 2.7.1 GSOC-DLR / ESA CONTACTS

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### 3 TECHNICAL DESCRIPTION OF PROTOTYPE

#### 3.1 DESIGN

##### 3.1.1 MISSION OPERATIONS CONCEPT

The Mission Operations Service Framework is intended to increase the level of interoperability between agencies. The CCSDS Spacecraft Monitoring & Control (SM&C) working group has developed a concept for a Mission Operations (MO) Service Framework, which follows the principles of Service Oriented Architectures. It defines an extensible set of end-to-end services that support interactions between distributable mission operations functions, e.g., software applications specific to the mission operations domain:

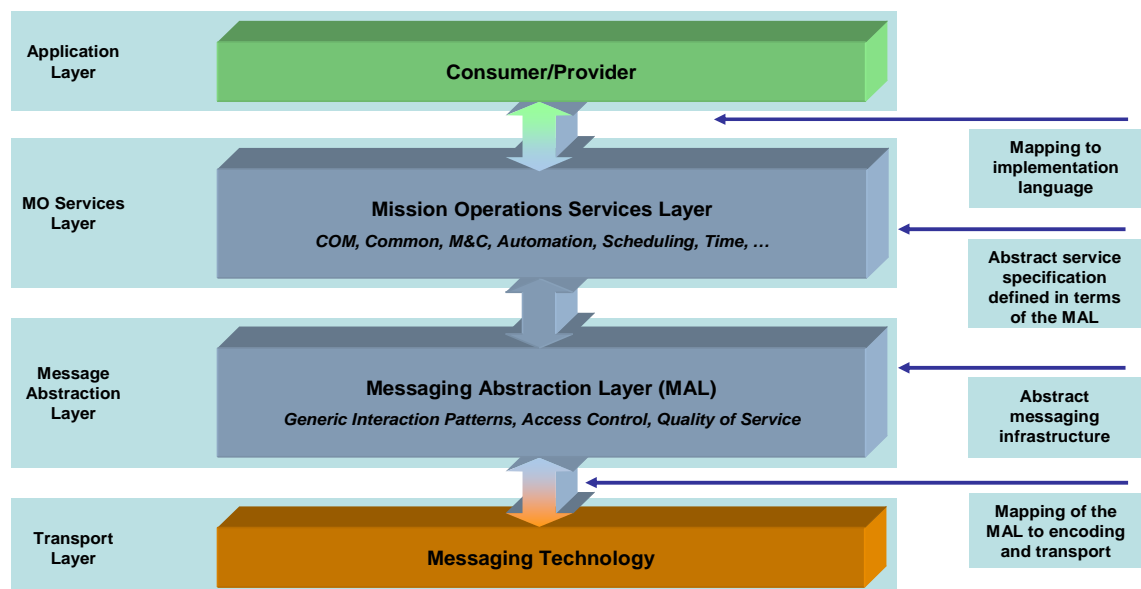


Figure 3-1 Overview of the Mission Operations Service Framework

The Mission Operations Services Layer provides the end-to-end services that are exposed to mission operations applications. Internally it is composed of three aspects:

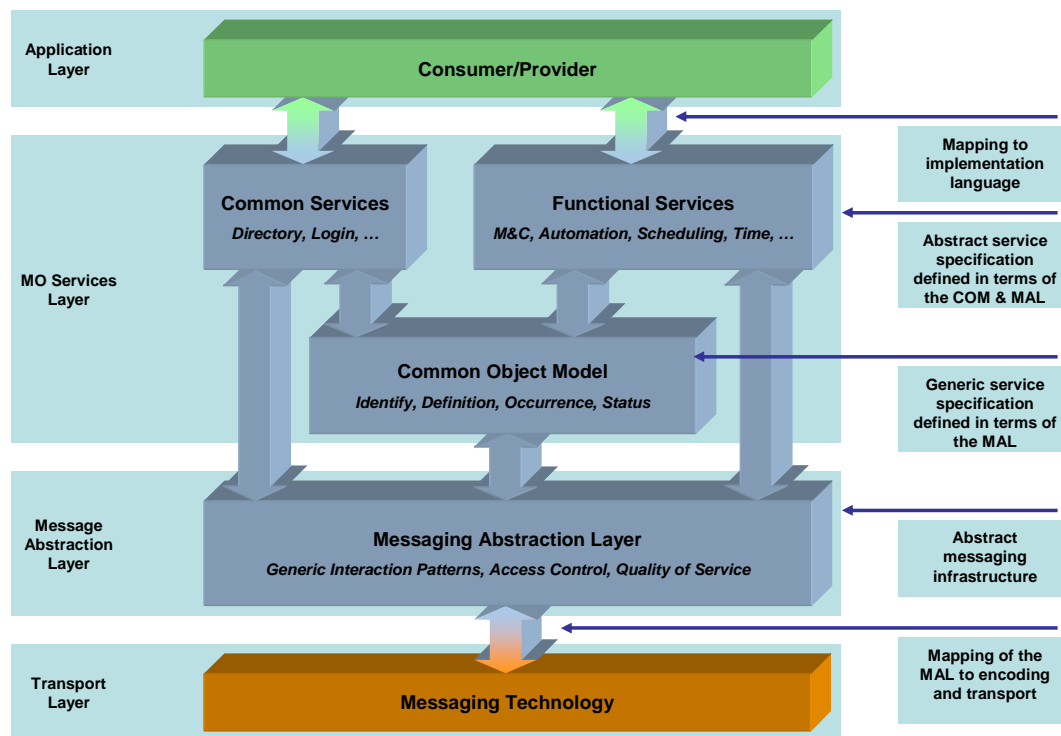
- Functional Services
- Common Services
- Common Object Model

The Message Abstraction Layer provides a standard messaging layer between the Consumer and Provider sides of the service framework. This, together with standardised bindings between the MO Service Framework layers, ensures that different implementations of the service framework can interoperate across the service interfaces, providing the underlying communications protocol stack is equivalent on both sides of the interface. The layer provides the following fundamental aspects:

- A specification of the fundamental data types, enumerations and structures;
- A definition of the rules for combining data types and structures;
- Generic Messaging Interaction Patterns that define the allowed sequence of message exchange;

- Fundamental concepts such as security and Quality of Service (QoS).

In practice, the service layers are slightly more complex as illustrated below. A similar format is used to illustrate the relationships between the service layers in this document. The formal and thorough explanation of the Mission Operations Concepts is documented in CCSDS 520.0-G-3 Mission Operations Concepts Informational Report April 2009.



**Figure 3-2 Mission Operations Service Layers**

### 3.1.2 STANDARD USED

#### 3.1.2.1 MISSION OPERATIONS SPECIFICATIONS

The interoperability prototype will be implemented according to the Mission Operations / SM&C Red Books, without security specifications. The latest versions, at the time of agreement, are listed below. As updates are made, we will mutually agree to step up to the new versions.

Mission Operations Service Abstraction Framework CCSDS 521.0.R-2, September 2009

[Updated to Agency Review MAL 17/03/2010]

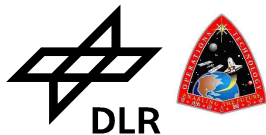
Mission Operations Common Object Model CCSDS 52x.0.R-x.x Draft A, April 2009

Spacecraft Monitor and Control Common Services CCSDS 521.1-R-2 April 2008

Spacecraft Monitor and Control Core Services CCSDS 522.-R-2 April 2008

#### 3.1.2.2 JSC-OTF DIRECTORY SERVICE

The JSC-OTF Directory service provider and consumer will use a binary encoding as described in Section 5.1. The transport layer will be implemented with a bridge to connect a DDS and JMS middleware solution.



## 1. Transport

- Data Distribution System (DDS) Version 1.2 as defined by the Object Manager Group (OMG): <http://www.omg.org/spec/DDS/1.2/>

Java Message Service (JMS) Version 1.1 as defined by Oracle-Sun: <http://java.sun.com/products/jms> (PDF download available)

[Removed SOAP/XML encoding over HTTP 23/04/2010]

### 3.1.2.3 DLR-GSOC DIRECTORY SERVICE

The DLR-GSOC Directory Service provider and consumer will use a binary encoding, as described in Section 5.1, over a JMS transport.

#### 1. Transport

- Java Message Service (JMS) Version 1.1 as defined by Oracle-Sun: <http://java.sun.com/products/jms> (PDF download available)

[Removed SOAP/XML encoding over HTTP 23/04/2010]

### 3.1.2.4 JSC-OTF SERVICE PROVIDERS

The JSC-OTF implemented service providers, with the exception of the Directory Service, will use a binary encoding as described in Section 5.1. The transport layer will be implemented with a bridge to connect a DDS and JMS middleware solution.

#### 2. Transport

- Data Distribution System (DDS) Version 1.2 as defined by the Object Manager Group (OMG): <http://www.omg.org/spec/DDS/1.2/>
- Java Message Service (JMS) Version 1.1 as defined by Oracle-Sun: <http://java.sun.com/products/jms> (PDF download available)

### 3.1.2.5 DLR-GSOC SERVICE CONSUMERS

The DLR-GSOC service consumers, with the exception of the Directory Service, will use a binary encoding, as described in Section 5.1, over a JMS transport.

#### 2. Transport

- Java Message Service (JMS) Version 1.1 as defined by Oracle-Sun: <http://java.sun.com/products/jms> (PDF download available)

## 3.1.3 JSC-OTF PROTOTYPE DESIGN

In this prototype, JSC-OTF will implement the service providers for the Action, Parameter, Login and optionally, the Alert Services. JSC-OTF may also implement an Alert Service consumer. DLR-GSOC is responsible for the service consumers; DLR-GSOC may also implement an Alert Service provider. For two agencies to interoperate using the Mission Operations standards they must agree on 1) the versions of the specifications to implement 2) the encoding and 3) the transport layer. JSC-OTF and DLR-GSOC have chosen different transport layers. A bridge is necessary to connect the middleware products. JSC-OTF will implement a binary encoding over a DDS transport. DLR-GSOC is implementing a binary encoding over a JMS transport. Figure 3-3 illustrates the communication flow between JSC-OTF and DLR-GSOC. The bridge will be maintained at JSC to provide the illusion the two homogenous prototypes communicating using binary encoding over JMS. The Common Object Model is outlined using dashes to highlight a minimum amount of functionality will be implemented. The Login Service will be implemented for internal access control to the JSC-OTF system; the Login Service will not publish its availability to the DLR-GSOC Directory Service.

The Mission Operations specifications are language agnostic. DLR-GSOC will implement the service consumers using C++. JSC-OTF will implement the service providers using C++.

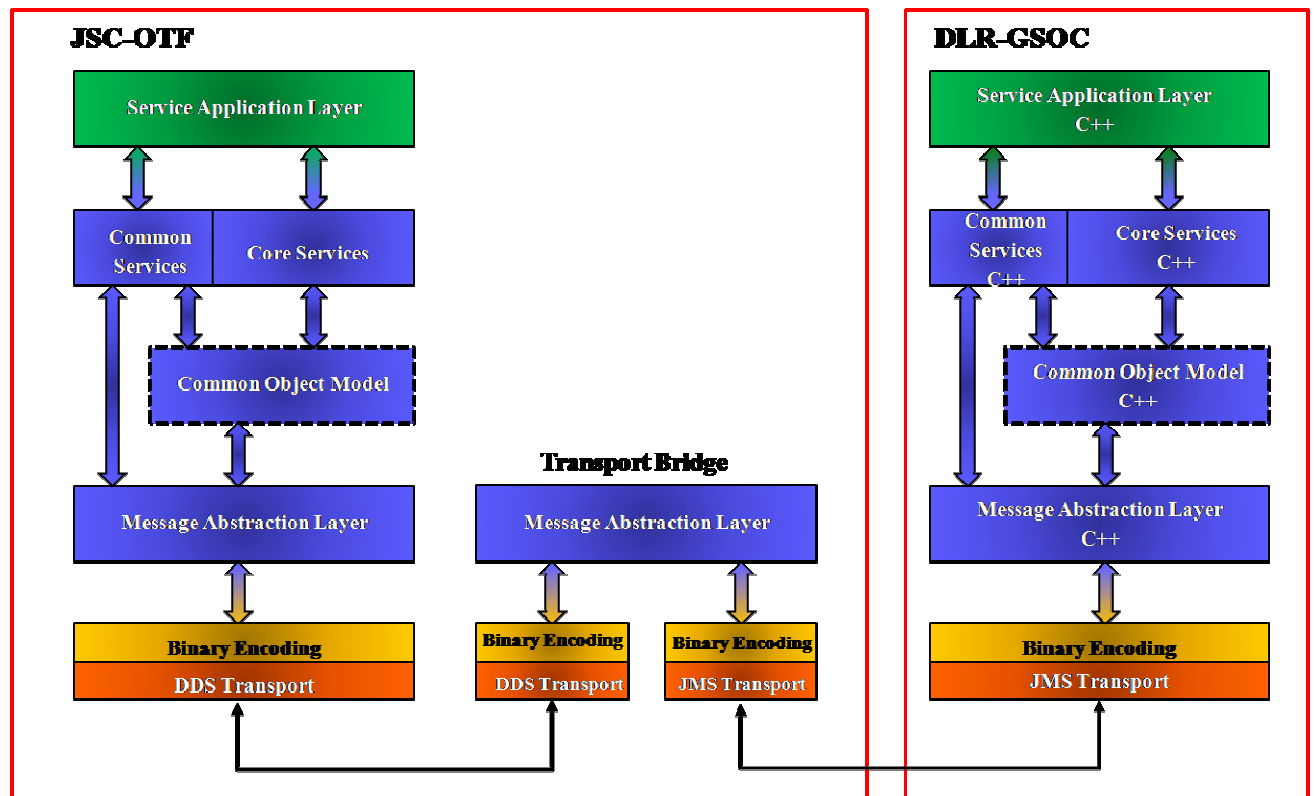


Figure 3-3 Action, Parameter and Alert Service Interoperability

For the Directory Service, JSC-OTF and DLR-GSOC will utilize a binary encoding. A bridge will be necessary to connect a DDS and JMS transport layer. This service includes operations that allow for deployment as a federated service. JSC-OTF will publish service availability to its Directory Service implementation. DLR-GSOC will request lookup operations from its Directory Service implementation. Figure 3-9 in Section 3.4.5 provides the necessary steps to keep the two implementations synchronized. The Figure 3-4 illustrates the communications flow for the Directory Service.

[Removed SOAP/XML encoding over HTTP 23/04/2010]

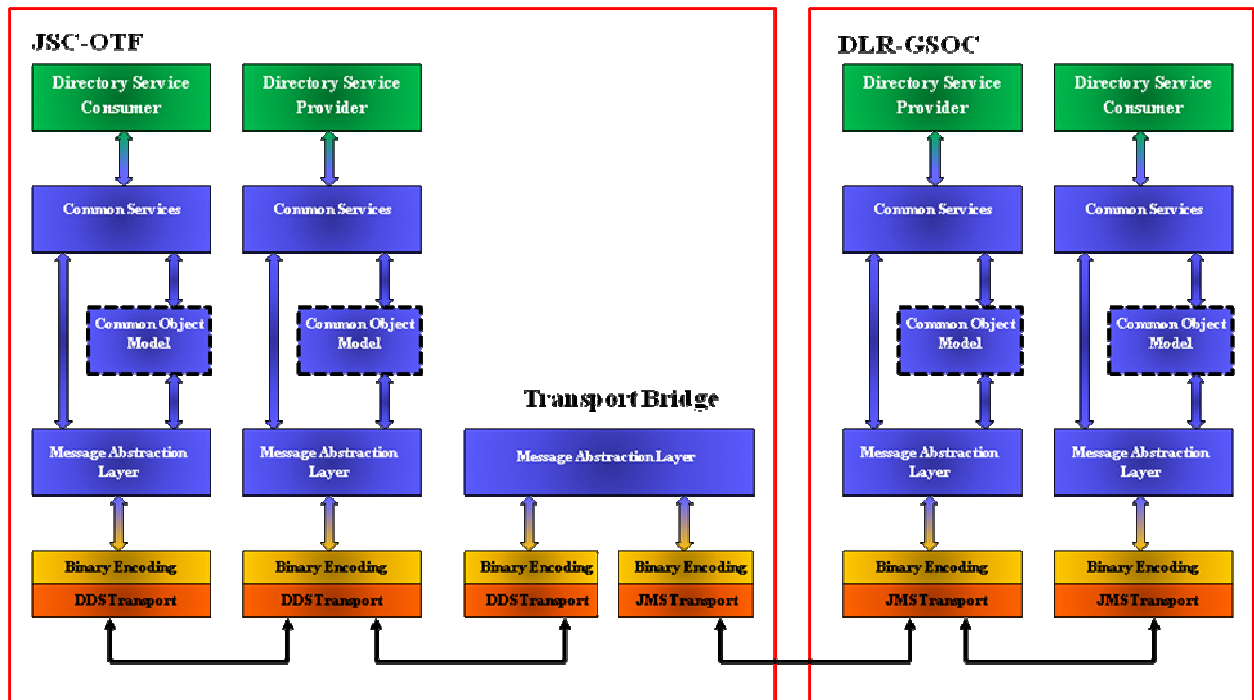


Figure 3-4 Directory Service Interoperability

JSC-OTF will implement the provider for the Action, Parameter and, optionally, Alerts services. These services will front existing OTF systems to provide the necessary capabilities. A spacecraft simulator will receive actions and provide telemetry feedback. The available telemetry parameters will be chosen so the values will be affected by actions that are invoked. The Alerts Service will allow exchange of advisory messages among service providers and consumers. Figure 3-5 provides a high level overview of the prototype from the perspective of the service provider. The Login Service controls internal access to the JSC-OTF prototype; hence, the lighter shade and different shape outline.

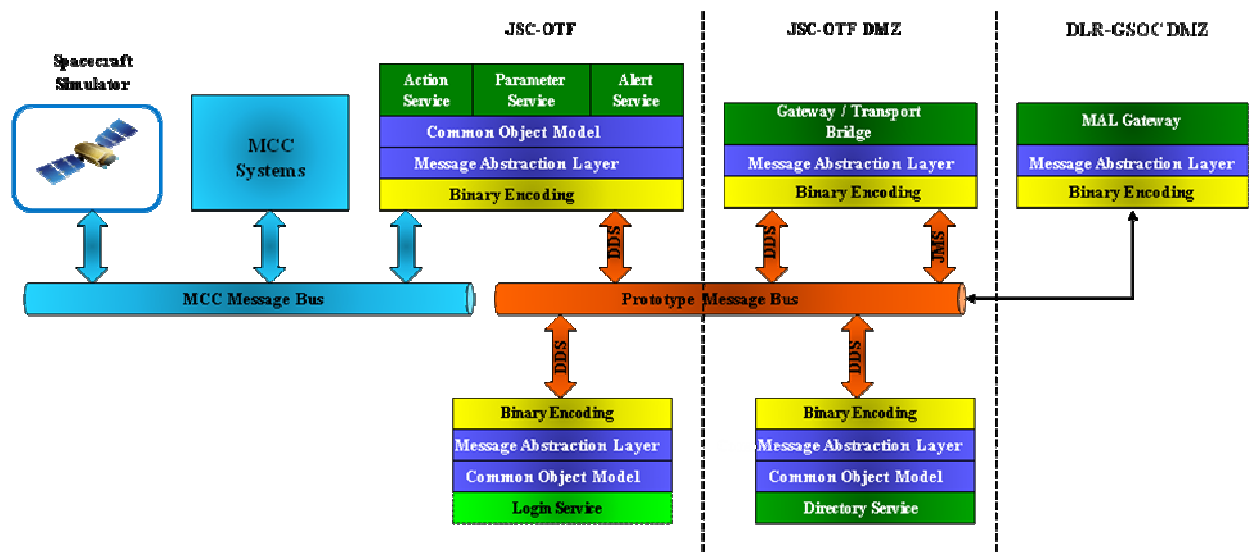


Figure 3-5 JSC-OTF Prototype

### 3.1.4 DLR-GSOC PROTOTYPE DESIGN

Here is a preliminary design of the Mission Operations Prototype running at DLR-GSOC:

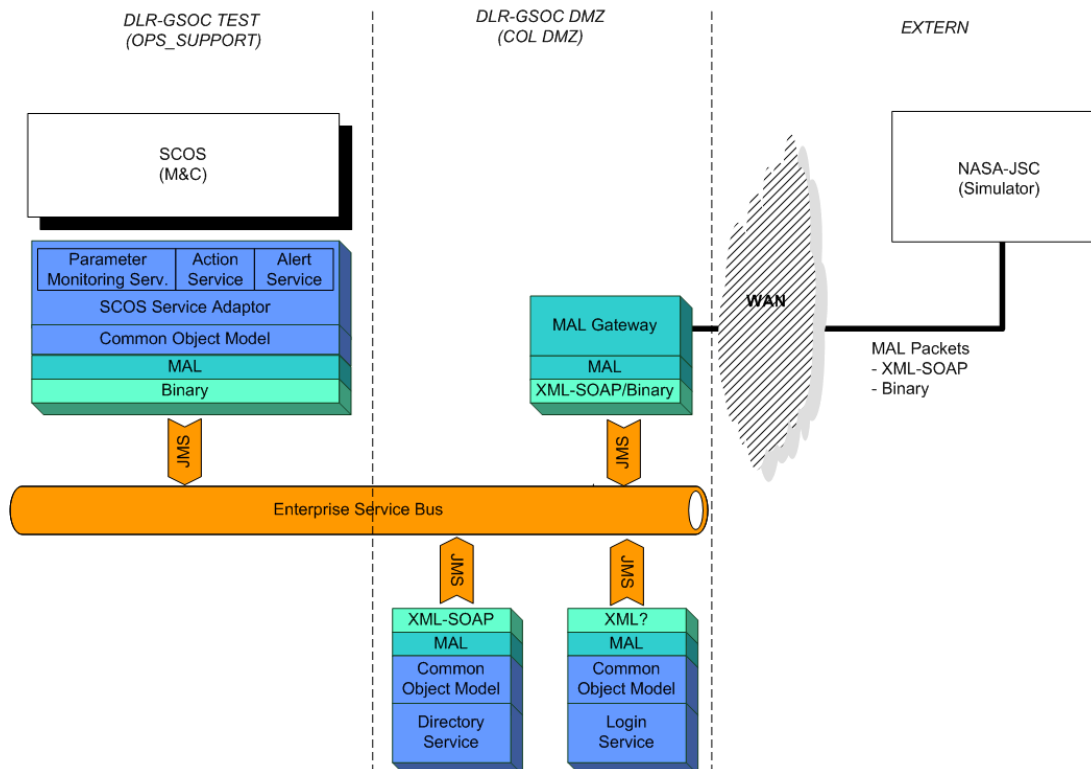


Figure 3-6 DLR-GSOC Prototype

The Prototype will be distributed over 2 different segments of DLR LAN because of security directives.

The internal communication should be implemented with an Enterprise Service Bus (based on JMS message exchanges)

The communication with JSC-OTF will be performed through a "MAL Gateway" that is able to forward the MAL Packets between the external communication line and the internal ESB.

Firewalls are located at each border between 2 LAN segments (the dotted lines in the figure)

### 3.1.5 COMBINED PROTOCOL DESCRIPTION

The Mission Operations specifications do not currently address the encoding of the MAL, Common or Core data structures. For the Action, Parameter Alert and Directory Services, JSC-OTF and DLR-GSOC will exchange the data in a binary format. The binary encoding format is presented in Section 5.1. It is based upon the encoding used in the JSC-OTF Parameter Service prototype effort. The Directory Service will use and XML encoding for the MAL and Common data structures. The schemas for the XML encoding are included in Section 5.2.

Blue book definition of serveral encoding mechanisms is on the road map for the Mission Operations specifications. However, the service configuration data is left as an implementation detail to be agreed upon by the interoperating agencies. The configuration data is included in Section 5.2.4.

## 3.2 LAYERS TO BE IMPLEMENTED

### 3.2.1 APPLICATION LAYER

#### 3.2.1.1 JSC-OTF

JSC-OTF will use a spacecraft simulator as illustrated in Figure 3-5. The Mission Operations service providers will leverage existing OTF systems to provide the required capabilities.

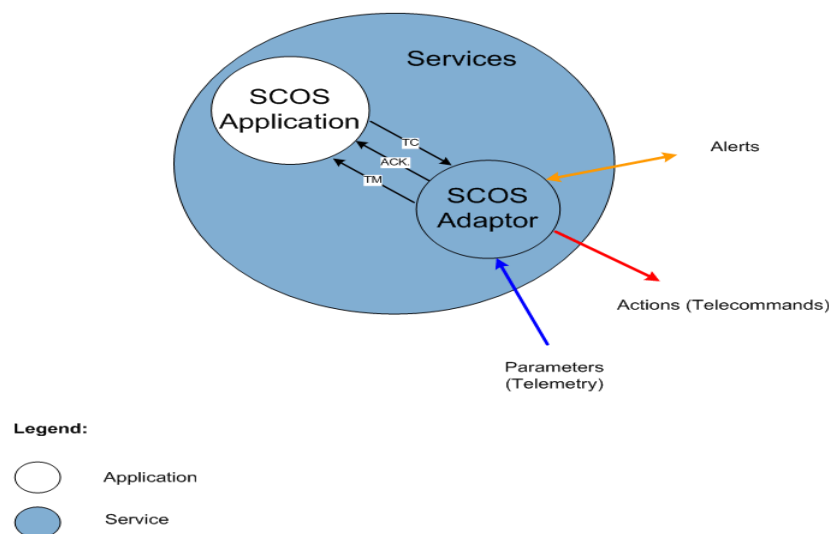
#### 3.2.1.2 DLR-GSOC

DLR-GSOC will use the SCOS M&C Application from ESA. This application is commonly used by most of the satellite projects currently flown by GSOC.

This will be done by implementing a “SCOS Service Adaptor” to communicate using services.

DLR will make this implementation in C++

The Graphical User Interfaces to communicate with SCOS will be SATMON, already used in most of the GSOC satellite missions.



**Figure 3-7 DLR-GSOC Application Layer**

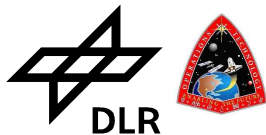
### 3.2.2 SERVICE LAYER

The service layer will be implemented using the Common Object Model based on the MAL. The services to be implemented are described in chapter 3.3

All the services will be registered in a database and called through the “Directory service”.

The following Services existing in the Mission Operations specifications will not be implemented in this prototype:

- Common Services
  - Configuration Services



- Interaction Service
- Retrieval Service
- Replay Service
- Core Services
  - Aggregation Service\*
  - Argument Service
  - Conversion Service
  - Check Service
  - Statistics Service

\*The Aggregation Service may be implemented as more details become available.

### 3.2.2.1 JSC-OTF

JSC-OTF will implement the service providers for Directory, Action, Parameters, Alerts and Login. Alerts are optional. A Login Service will be implemented for internal access control; however, this service will not provide authentication for the DLR-GSOC service consumers at this time. All the services, with exception of the Login Service, will publish availability to the JSC-OTF Directory Service.

### 3.2.2.2 DLR-GSOC

DLR will make an implementation in C++

The Services implemented for this prototype will be divided in two categories:

- Core Services:

The core services are the "Parameter Monitoring Service", the "Action Service" and the "Alert Service". They are all directly communicating with SCOS and will be realised in the "SCOS Service Adaptor".

- Common Services:

The Common Services are the "Directory Service" and the "Login Service". They are not related with SCOS and will be realised each as a separate component. These services will be designed to be later reused by other Services.

## 3.2.3 COMMON OBJECT MODEL

### 3.2.3.1 JSC-OTF

The Common Object Model (COM) will be partially implemented in the prototype. No archival of data or history will be initially supported; therefore, REPLAY sessions are not available. The COM operations are listed in Table 3-1. A column for each inter-center service in the prototype is included. A check mark in the service column indicates the operation will be supported. The Directory Service maintains information about capability sets that are available for services as opposed to individual operations. The request and list of occurrences require historical data to be fully implemented. As archival is not being performed, the "O" indicates the operation is available but will always return an empty list. Although the operation to monitor definitions is available, the operations to add, modify and delete a definition are not implemented. No notifications for definition changes will be issued.



Operation Name	Operation Number	Capability Set	Directory Service	Action Service	Parameter Service	Alert Service
requestDefinition	0	0		✓	✓	✓
listDefinition	1			✓	✓	✓
monitorDefinition	2			✓	✓	✓
requestOccurrence	4	1				0
listOccurrence	5					0
monitorOccurrence	6					✓
requestStatus	7	2			0	
listStatus	8				0	
monitorStatus	9				✓	
addDefinition	10	3				
modifyDefinition	11					
deleteDefinition	12					

Table 3-1 JSC-OTF Common Model Operations

### 3.2.3.2 DLR-GSOC

DLR will make a partial implementation of the Common Object Model in C++ for the prototype. No archival of data or history will be initially supported; therefore, REPLAY sessions are not available.

The Common Object Model Layer will be based on the MAL and will consist of Class/Object definitions for structures that will be used by the Service definitions.

This model will consist of definitions of the following elements as described in the Mission Operations specifications:

- Identity
- Definition
- Occurrence
- Status

Here is a list of the operations supported:

Operation Name	Operation Number	Capability Set	Directory Service	Action Service	Parameter Service	Alert Service
requestDefinition	0	0		✓	✓	✓
listDefinition	1			✓	✓	✓
monitorDefinition	2			✓	✓	✓
requestOccurrence	4	1				
listOccurrence	5					
monitorOccurrence	6					✓
requestStatus	7					

Operation Name	Operation Number	Capability Set	Directory Service	Action Service	Parameter Service	Alert Service
listStatus	8	2				
monitorStatus	9				✓	
addDefinition	10	3				
modifyDefinition	11					
deleteDefinition	12					

**Table 3-2 DLR-GSOC Common Model Operations**

### 3.2.4 MESSAGE ABSTRACTION LAYER

#### 3.2.4.1 JSC-OTF

JSC-OTF will implement the Message Abstract Layer in C++. No history or archival capabilities will be implemented.

JSC-OTF will support a MAL QoS level of “Assured”, that means:

- Ensure delivery of messages to its destination
- Messages are not duplicated
- The order of messages is preserved between a single provider and consumer
- No support for Loose Time Coupling
- No time guarantees
- No messages will be queued if a destination is not available

#### 3.2.4.2 DLR-GSOC

DLR will make an implementation of the Message Abstraction Layer in C++. No history or archival capabilities will be implemented.

The MAL Attribute formats are defined in the MAL specifications but for the details (big/little endian, values of TRUE and FALSE, a.s.o) DLR-GSOC will take the MAL Attribute format already implemented by JSC-OTF.

DLR-GSOC will support a MAL QoS level of “Assured”, that means:

- Ensure delivery of messages to its destination
- Messages are not duplicated
- The order of messages is preserved between a single provider and consumer
- No support for Loose Time Coupling
- No time guarantees
- No messages will be queued if a destination is not available

The MAL will implement authentication and authorisation in the form of an identifier (generated by the “Directory Service” and “Login Service”). There will be no encryption implemented in the “Directory Service” or “Login Service”.

---

### **3.2.5 ENCODING LAYER**

#### **3.2.5.1 JSC-OTF**

##### **3.2.5.1.1 DIRECTORY SERVICE**

The Directory Service will use binary encoding. The encoding rules are defined in Section 5.1.  
[Removed SOAP/XML encoding over HTTP 23/04/2010]

##### **3.2.5.1.2 ACTION, PARAMETER AND ALERT SERVICES**

The service providers will use binary encoding. The encoding rules are defined in Section 5.1.

#### **3.2.5.2 DLR-GSOC**

DLR-GSOC DLR will make an implementation in C++.

The encoding layer should be coded over an abstract definition, to allow using different coding without changing the MAL API.

##### **3.2.5.2.1 DIRECTORY SERVICE**

The Directory Service will use binary encoding. The encoding rules are defined in Section 5.1.  
[Removed SOAP/XML encoding over HTTP 23/04/2010]

##### **3.2.5.2.2 ACTION, PARAMETER AND ALERT SERVICES**

The service consumers will use the same binary encoding as the service providers. The encoding rules are defined in Section 5.1.

### **3.2.6 TRANSPORT LAYER**

#### **3.2.6.1 JSC-OTF**

##### **3.2.6.1.1 DIRECTORY SERVICE**

The Directory Service will communicate via a Data Distribution Service (DDS) transport layer. A bridge will be implemented to allow interaction between DDS and JMS.

[Removed SOAP/XML encoding over HTTP 23/04/2010]

##### **3.2.6.1.2 ACTION, PARAMETER, AND ALERT SERVICES**

JSC-OTF service providers will communicate via a Data Distribution Service (DDS) transport layer. A bridge will be implemented to allow interaction between DDS and JMS.

### 3.2.6.2 DLR-GSOC

#### 3.2.6.2.1 DIRECTORY SERVICE

The Directory Service will communicate via a JMS transport layer.

#### 3.2.6.2.2 ACTION, PARAMETER, AND ALERT SERVICES

DLR-GSOC service consumers will communicate via JMS transport layer.

The internal communication in GSOC will be done through JMS messaging. The OTF is responsible for bridging between the JMS and DDS transports.

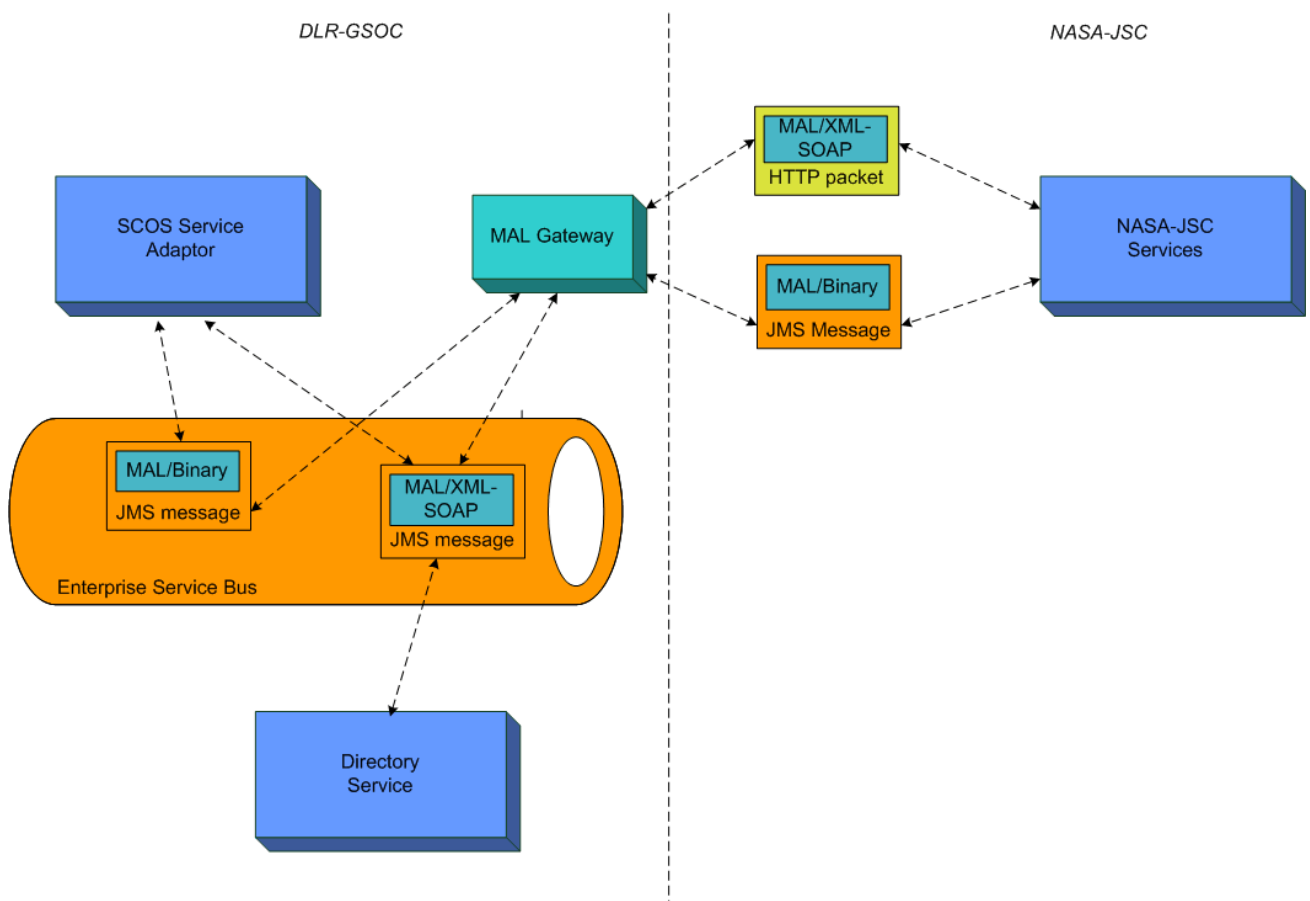


Figure 3-8 DLR-GSOC Transport Layer

### 3.3 SERVICES TO BE IMPLEMENTED

#### 3.3.1 DIRECTORY SERVICE

##### 3.3.1.1 JSC-OTF

JSC-OTF will implement a Directory Service provider. The current implementation will be modified to meet to the current red book specifications for Common Services as specified in Section 3.1.2. The service operations are listed in Table 3-3. All common service operations for this service will be implemented.

Service Identifier	Area Number	Service Number	Availability
Directory	0	1	
Operation Name	Operation Number	Capability Set	
<b>Common Model Operations</b>			
None			
<b>Service Operations</b>			
createNode	100	100	✓
removeNode	101		✓
resolveNodeURI	102		✓
addLink	103	101	✓
removeLink	104		✓
publishService	105	102	✓
lookupService	106		✓
withdrawService	107		✓

**Table 3-3 JSC-OTF Directory Service Operations**

The JSC-OTF Service definitions (Action, Parameter, and Alert) will be added to the DLR-GSOC Directory database using the external node capabilities.

##### 3.3.1.2 DLR-GSOC

The JSC-OTF Service definitions (Action, Parameter, and Alert) will be added to the DLR-GSOC Directory database

The Directory Service will be developed as a standalone component using a SQL database for serialisation of the service information

Encoding of the "Directory Service" will be Binary; the schemas are defined in Section 5.1.



Here is a list of the operation supported by DLR-GSOC "Directory Service":

Service Identifier		Area Number		Service Number	
Directory		0		1	
Interaction Pattern	Operation Name	Operation Number	Support in Replay	Capability Set	
<b>Common Model Operations:</b>					
<b>Service specific Operations:</b>					
SUBMIT	createNode	100	No	100	
SUBMIT	removeNode	101			
REQUEST	resolveNodeURI	102			
SUBMIT	addLink	103	No	101	
SUBMIT	removeLink	104			
SUBMIT	publishService	105	No	102	
SUBMIT	lookupService	106			
SUBMIT	withdrawService	107			

Table 3-4 DLR-GSOC Directory Service Operations

### 3.3.1.3 ACTION SERVICE

### 3.3.1.4 JSC-OTF

JSC-OTF will implement the Action Service provider. The service will be implemented as described in the current red book specifications for Core Services as specified in Section 3.1.2. The service operations are listed in Table 3-5. All core service operations will be implemented by the service provider.

Service Identifier	Area Number	Service Number	Availability
Action	1	1	
Operation Name	Operation Number	Capability Set	
Common Object Model Operations			
requestDefinition	0	0	✓
listDefinition	1		✓
monitorDefinition	2		✓
Service Operations			
invokeAction	100	100	✓
preCheckAction	101		✓

Table 3-5 JSC-OTF Action Service Operations

The monitorDefinition operation is supported as part of the capability set 0; however, the creation, update and delete of definitions will not be implemented. This operation will not provide notifications.

The service provider will support the Verification Stage as identified in Table 3.6. Stages not supported will be marked with Verification State ASSUMED as subsequent stages are completed.

Verification Stage			
Enumeration Value	Short Form	Comment	Supported
RELEASE	1	Release from the source	✓
RECEIPT	2	Reception by the destination	✗
ACCEPTANCE	3	Acceptance by the destination	✗
EXECUTION	4	Execution started by destination	✗
PROGRESS	5	Execution is progressing in the destination	✗
COMPLETION	6	Execution completed by the destination	✓

**Table 3-6 JSC-OTF Supported Verification Stages**

The Action Service configuration data will be included in Section 6.1 when available.

### 3.3.1.5 DLR-GSOC

DLR-GSOC will act as a consumer of the "Action Service", invoking Telecommand for the emulated spacecraft

The "Action Service" will be developed as a module of the "SCOS Service Adaptor".

The DLR-GSOC "Action Service" will use the "Directory Service" and the "Login Service" to communicate with the NASA-JSC "Action Service".

The format of a Command will be defined by JSC-OTF and the "SCOS Service Adaptor" will transform a generated SCOS Telecommand (TC) in a Mission Operations Action.

The "Action Service" should send an acknowledge using the VerificationStage entity.

Here is a list of the operations supported by the DLR-GSOC "Action Service" consumer:

Service Identifier		Area Number		Service Number	
Action		1		1	
Interaction Pattern	Operation Name	Operation Number	Support in Replay	Capability Set	
Common Model Operations:					
REQUEST	requestDefinition	0	No	0	
REQUEST	listDefinition	1			
PUBSUB	monitorDefinition	2			
Service specific Operations:					
PROGRESS	inkokeAction	100	No	100	
REQUEST	preCheckAction	101			



**Table 3-7 DLR-GSOC Action Service Operations**

### 3.3.2 PARAMETER SERVICE

#### 3.3.2.1 JSC-OTF

JSC-OTF will implement the Parameter Service provider. The service will be implemented as described in the current red book specifications for Core Services as specified in Section 3.1.2. The service operations are listed in Table 3-8. Capability Set 100 is not implemented. The impact of these operations on the middleware is unknown.

The operations requestStatus and listStatus for the Common Object Model are designated with an “O”. The interoperability prototype will not initially support history or archival. These operations will return an empty list.

Service Identifier	Area Number	Service Number	Availability
Parameter	1	2	
Operation Name	Operation Number	Capability Set	
Common Object Model			
requestDefinition	0	0	✓
listDefinition	1		✓
monitorDefinition	2		✓
requestStatus	6	2	○
listStatus	7		○
monitorStatus	8		✓
Service Operations			
setFiltered	100	100	✗
getFiltered	101		✗
setTimeouts	102		✗
getTimeouts	103		✗

**Table 3-8 JSC-OTF Parameter Service Operations**

The monitorDefinition operation is supported as part of the capability set 0; however, the creation, update and delete of definitions will not be implemented. This operation will not provide notifications.

The layout of the parameter definitions described in the specifications is sufficient for data exchange. The list of available parameters, provided by JSC-OTF as configuration data, will be included in Section 6.2 when available.



### 3.3.2.2 DLR-GSOC

DLR-GSOC will act as a consumer of the Parameter service, receiving Telemetry from emulated spacecraft

The "Parameter Service" will be developed as a module of the "SCOS Service Adaptor".

The DLR-GSOC "Parameter Service" will use the "Directory Service" to communicate with the JSC-OTF "Parameter Service".

The format/calibration of a Parameter is defined in a parameter database from JSC-OTF. The parameters are sent using the MAL layer and have already been decommutated and calibrated by the Service Provider. SCOS Adapter should not have to do any decommutation or calibration, but still needs a list of the parameters/formats in calibrated state (see chapter 6.2 for a details of the configuration data). A SCOS database has to be generated by DLR-GSOC, using this information.

The following status will not be implemented by the Parameter Service consumer: parameter checking status, statistics status.

Following functionalities will be supported by the "Parameter Service consumer"

- Subscribe for parameter
- Receive update
- Unsubscribe

Here is a list of the operations supported by the DLR-GSOC "Parameter Service" consumer:

Service Identifier		Area Number		Service Number	
Parameter		1		2	
Interaction Pattern		Operation Name	Operation Number	Support in Replay	Capability Set
Common Model Operations:					
REQUEST	requestDefinition	0	No	0	
REQUEST	listDefinition	1			
PUBSUB	monitorDefinition	2			
PUBSUB	monitorStatus	8	No	2	
Service specific Operations:					

Table 3-9 DLR-GSOC Parameter Service Operations

### 3.3.3 LOGIN SERVICE

#### 3.3.3.1 JSC-OTF

JSC-OTF will implement a Login Service. The service will be implemented as described in the current red book specifications for Common Services as specified in Section 3.1.2. This service will only provide



internal access control to the JSC-OTF prototype and will not publish its availability to the DLR-GSOC Directory Service.

Service Identifier	Area Number	Service Number	Availability
Login	0	2	
Operation Name	Operation Number	Capability Set	
<b>Common Model Operations</b>			
None			
<b>Service Operations</b>			
login	100	100	✓
logout	101		✓
reportRoles	102		✗
handover	103	101	✗

Table 3-10 JSC-OTF Login Service Operations

### 3.3.3.2 DLR-GSOC

The Login Service will be developed as a standalone component.

The Login Service will assure authentication of a service request. An identifier will be used to bind this information with the authorisation information from the "Directory Service" to the data packet.

No encryption will be used for the prototype.

Here is a list of the operation supported by the DLR-GSOC "Login Service" provider:

Service Identifier	Area Number	Service Number		
Login	0	2		
Interaction Pattern	Operation Name	Operation Number	Support in Replay	Capability Set
<b>Common Model Operations:</b>				
<b>Service specific Operations:</b>				
REQUEST	login	100	No	100
SUBMIT	logout	101		

Table 3-11 DLR-GSOC Login Service Operations

### 3.3.4 ALERT SERVICE (OPTIONAL)

This service is optional, although desired. Time permitting, JSC-OTF and DLR-GSOC will implement the service provider and consumer as part of the interoperability prototype.



### 3.3.4.1 JSC-OTF

JSC-OTF may implement the Alert Service provider and a consumer. The service will be implemented as described in the current red book specifications for Core Services as specified in Section 3.1.2. The available operations are listed in Table 3-12. Capability Set 101 will not be implemented at this time since these operations would require authentication.

The operations requestOccurrence and listOccurrence for the Common Object Model are designated with an "O". The interoperability prototype will not support history or archival. These operations will return an empty list.

Service Identifier	Area Number	Service Number	Availability
Alert	1	6	
Operation Name	Operation Number	Capability Set	
Common Model Operations			
requestDefinition	0	0	✓
listDefinition	1		✓
monitorDefinition	2		✓
requestOccurrence	3	1	○
listOccurrence	4		○
monitorOccurrence	5		✓
Service Operations			
raiseAlert	100	100	✓
enableGeneration	101	101	✖
disableGeneration	102		✖

**Table 3-12 JSC-OTF Alert Service Operations**

The implementation of the service provider will require JSC-OTF to provide the list of available alerts as part of the service configuration data. The list is included in Section 6.3.

### 3.3.4.2 DLR-GSOC

The "Alert Service" is optional and will be implemented if time and resources are available.

DLR-GSOC "Alert Service" will act as a consumer and as a provider of the Parameter service, sending Alert to JSC-OTF as well as receiving Alerts from JSC-OTF.

The "Alert Service" will be developed as a module of the "SCOS Service Adaptor".

The DLR-GSOC "Alert Service" will use the "Directory Service" to communicate with the JSC-OTF "Alert Service".

Here is a list of the operations supported by the DLR-GSOC "Alert Service" consumer / provider

Service Identifier	Area Number	Service Number		
Alert	1	6		
Interaction Pattern	Operation Name	Operation Number	Support in Replay	Capability Set

<b>Common Model Operations:</b>				
REQUEST	requestDefinition	0	No	<b>0</b>
REQUEST	listDefinition	1		
PUBSUB	monitorDefinition	2		
PUBSUB	monitorOccurence	5	<b>No</b>	<b>1</b>
<b>Service specific Operations:</b>				
SUBMIT	raiseAlert	100	No	100

**Table 3-13 DLR-GSOC Alert Service Operations**

### 3.4 TEST ENVIRONMENT

#### 3.4.1 COMMUNICATION

Communication will be realised through the existing Columbus IGS network (see chapter 2.5). The corresponding firewall configuration will be organised by each agency on its side.

#### 3.4.2 SECURITY POLICY

For the use of the Columbus communication link, the security policy of Columbus-IGS will apply.

##### 3.4.2.1 JSC-OTF

The standard NASA IT & Security policies will apply as documented in the JSC-OTF IT security plan (SPDA5100)

##### 3.4.2.2 DLR-GSOC

The general GSOC/Col-CC security policy will apply (t.b.d. doc. reference)

#### 3.4.3 TEST ENVIRONMENT IN JSC-OTF

Prototype will be located in a segment of the JSC-OTF development lab. A bridge and application servers are planned:

1. *OTF Mission Operations Bridge* to host the following:
  - Mission Operations Transport Bridge will use ports from 40100 to 40109
  - [Removed HTTP port 80 for Directory Services 23/04/2010]
  - GSOC Loopback Test bed.
2. *OTF Application Servers* to host the following:
  - OTF Spacecraft Simulator.
  - OTF Systems
  - Mission Operations Service Providers

### 3.4.4 TEST ENVIRONMENT IN DLR-GSOC

The prototype will be located in the COL DMZ and in a special VLAN of the OPS\_SUPPORT area at GSOC Control Center:

- “MAL Gateway” Server in COL DMZ:  
This Server will hold the „MAL Gateway“, the “Directory Service” application/database, the “Login Service” application and a “JMS Access Point” for the communication.
- “SMC” Server in OPS\_SUPPORT:  
This Server will hold the “SCOS Service Adaptor”(responsible for the “Parameter Monitoring Service”, the “Action Service” and the “Alert Service”), the SCOS application/database and a “JMS Access Point” for the communication.

The ports described in section 3.4.3 are also applicable here

### 3.4.5 USE CASES

High level sequence diagrams providing an overview of each of the services (except Login) are presented in this section. Figure 3-9 illustrates the JSC-OTF interpretation of the Directory Services specification from April 2008. The service provides operations that indicate that a federated deployment is possible; however, the descriptions do not explicitly state how the operations should be used.

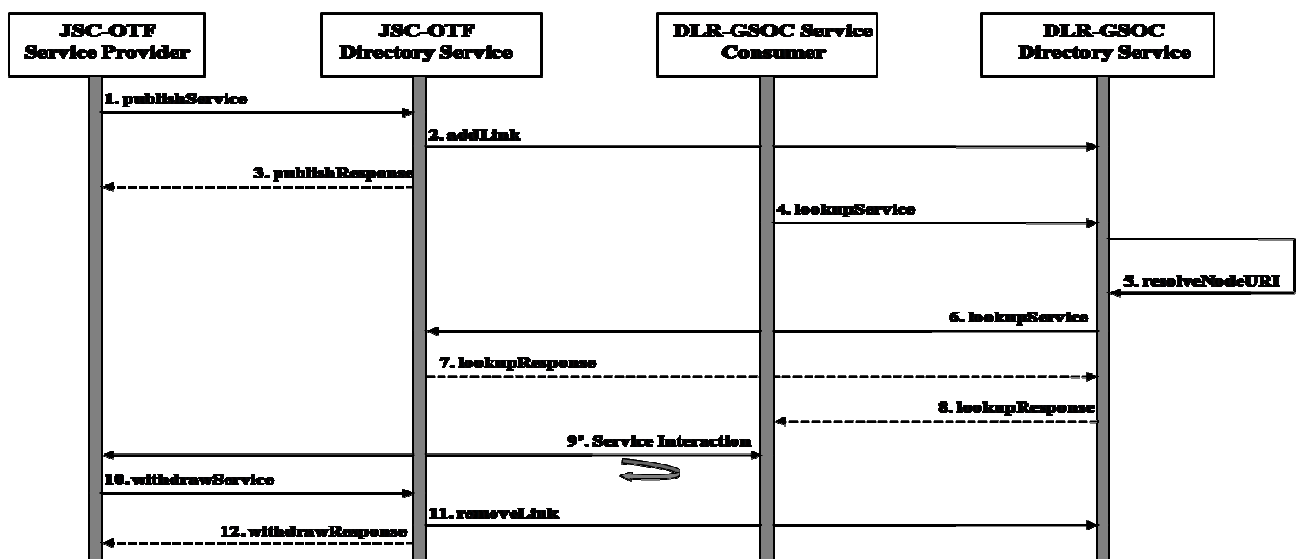


Figure 3-9 Directory Service Sequence

Figure 3-10 illustrates the sequence of operations to invoke an action via the Action Service.

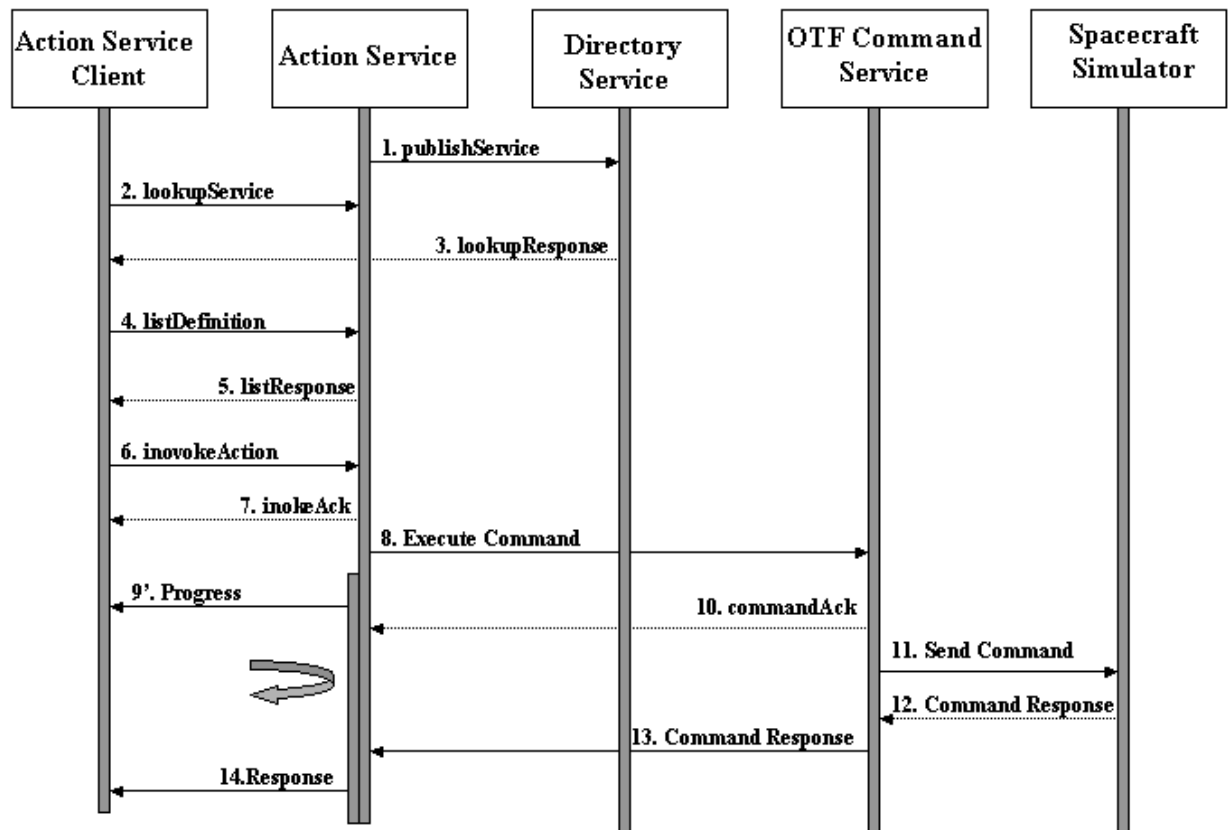


Figure 3-10 Action Service Sequence

The telemetry stream is constantly flowing between the spacecraft simulator and the OTF Telemetry Service. The necessary steps shown in Figure 3-11 assume the connection between the simulator and telemetry service has already been established.

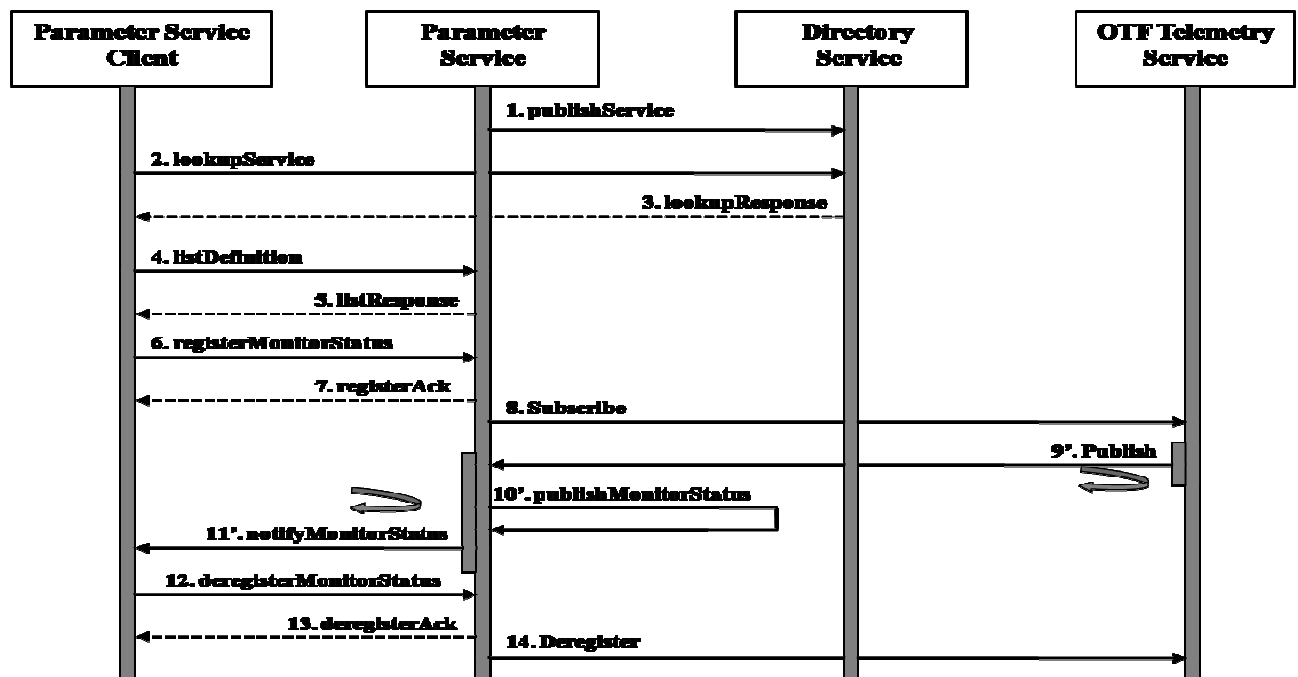


Figure 3-11 Parameter Service Sequence

The steps to subscribe for Alerts are shown in Figure 3-12. Alerts may be raised by a service provider or consumer in the prototype. The sequence to raise alerts is illustrated in Figure 3-13.

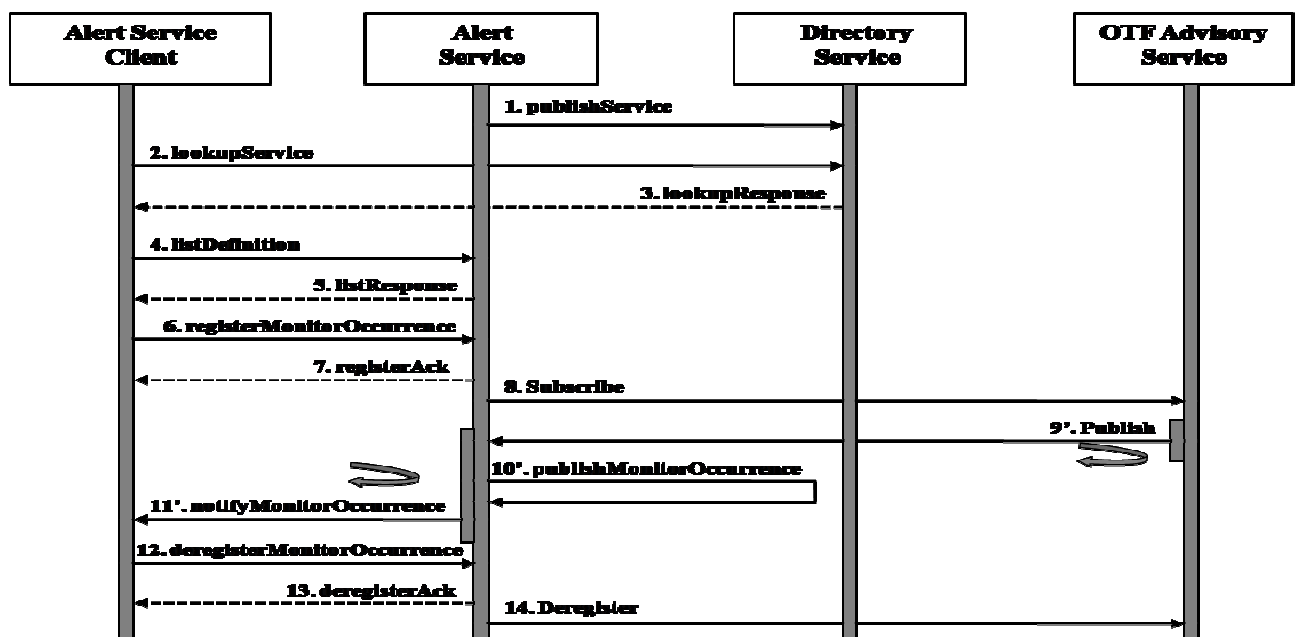


Figure 3-12 Alert Service Sequence – Subscribe

t.b.d. DLR-GSOC has to provide an Alert Service Sequence use case to subscribe to SCOS service

The Alert - Raise sequence assumes the registration for Alerts has been completed. The raise and notify of an alert is shown.

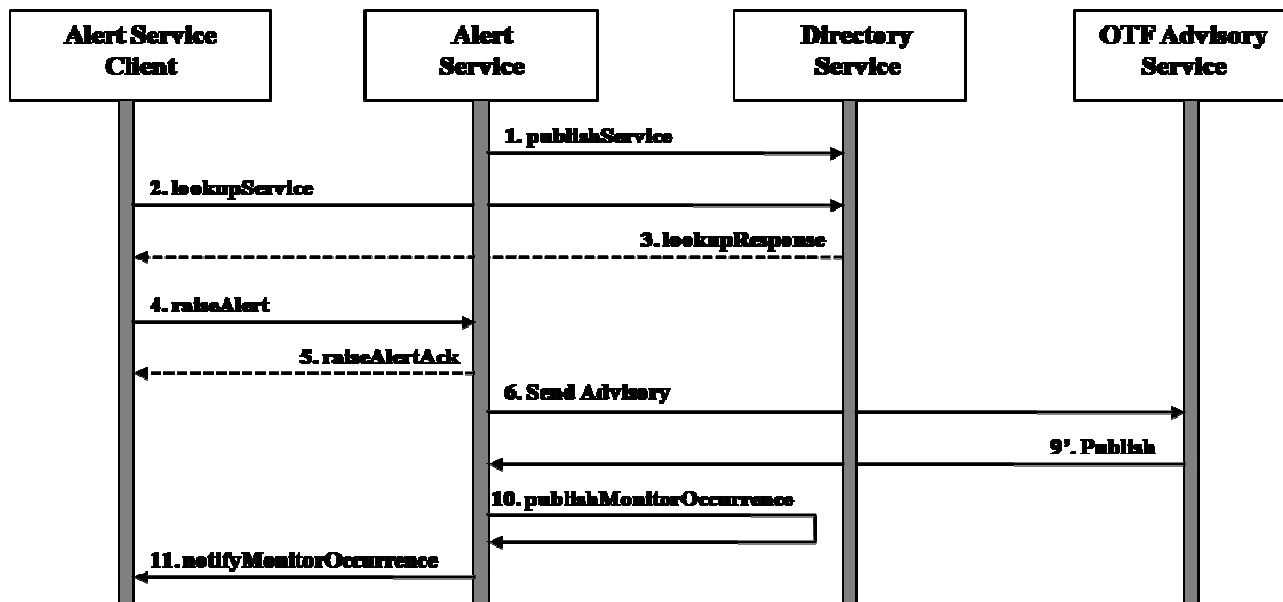


Figure 3-13 Alert Service Sequence – Raise

t.b.d. DLR-GSOC has to provide an Alert Service Sequence use case to raise a SCOS service alert.

### 3.4.6 BRIDGING SYSTEM DOMAINS

The prototype will use an “in-care of” address strategy to permit messages to be exchanged between the gateway machines. The complete routine information will be contained in the URTo and URIfrom values in the MAL Message Header. The value oftf-service-uri@otf-gateway-uri indicates the message should be sent to the oftf-gateway-uri. The oftf gateway is responsible for forwarding the message on to the OTF service provider.

The service providers will publish the entire routing sequence in the service URI contained in the Directory Service. An OTF service provider will publish its URI value as the following: ddsbin:otf-service-provider@jmsbin:otf-gaway@jmsbin:dlr-gateway. A DLR service provider will publish its URI value as the following: jmsbin:dlr-service-provider@jmsbin:dlr-gateway@ddsbin:otf-gateway. The OTF gateway uses the JMS-Binary (jmsbin) protocol for external communications and the DDS-Binary (ddsbin) protocol for internal communications. The OTF Gateway is responsible for modifying the protocol as the messages are forwarded.

The gateway bridges follows two rules whenever a message is received:

- Removes its URI value from the end of the URTo
- Append its URI value to the end of the URIfrom.



Table 3-14 illustrates the URI values for a message sent from a DLR Service Consumer to an OTF Service Provider. The initial URItto value of the OTF Service Provider was provided on the publish to the Directory Service.

	DLR Client	DLR Gateway	OTF Gateway	OTF Service
<b>Request</b> ➡				
<b>URItto</b>	ddsbin:otf-service@ jmsbin:otf-gateway@ jmsbin:dlr-gateway	ddsbin:otf-service@ <b>jmsbin</b> :otf-gateway	ddsbin:otf-service	ddsbin:otf-service
<b>URIfrom</b>	jmsbin:dlr-client	jmsbin:dlr-client@ jmsbin:dlr-gateway	jmsbin:dlr-client@ jmsbin:dlr-gateway@ <b>ddsbin</b> :otf-gateway	jmsbin:dlr-client@ jmsbin:dlr-gateway@ <b>ddsbin</b> :otf-gateway
⬅ <b>Reply</b>				
<b>URItto</b>	jmsbin:dlr-client	jmsbin:dlr-client	jmsbin:dlr-client@ jmsbin:dlr-gateway	jmsbin:dlr-client@ jmsbin:dlr-gateway@ <b>ddsbin</b> :otf-gateway
<b>URIfrom</b>	ddsbin:otf-service@ jmsbin:otf-gateway@ jmsbin:dlr-gateway	ddsbin:otf-service@ jmsbin:otf-gateway@ jmsbin:dlr-gateway	ddsbin:otf-service@ <b>jmsbin</b> :otf-gateway	ddsbin:action-service

**Table 3-14 URI Values from DLR Consumer to OTF Provider**

Table 3-15 illustrates the URI values for a message sent from an OTF Service Consumer to a DLR Service Provider. The initial URItto value of the DLR Service Provider was provided on the publish to the Directory Service.

	OTF Client	OTF Gateway	DLR Gateway	DLR Service
<b>Request</b> ➡				
<b>URItto</b>	jmsbin:dlr-service@ jmsbin:dlr-gateway@ <b>ddsbin</b> :otf-gateway	jmsbin:dlr-service@ jmsbin:dlr-gateway	jmsbin:dlr-service	jmsbin:dlr-service
<b>URIfrom</b>	ddsbin:otf-client	ddsbin:otf-client@ <b>jmsbin</b> :otf-gateway	ddsbin:otf-client@ jmsbin:otf-gateway@ jmsbin:dlr-gateway	ddsbin:otf-client@ jmsbin:otf-gateway@ jmsbin:dlr-gateway
⬅ <b>Reply</b>				
<b>URItto</b>	ddsbin:otf-client@	ddsbin:otf-client	ddsbin:otf-client@ jmsbin:otf-gateway	ddsbin:otf-client@ jmsbin:otf-gateway@ jmsbin:dlr-gateway
<b>URIfrom</b>	jmsbin:dlr-service@ jmsbin:dlr-gateway@ <b>ddsbin</b> :otf-gateway	jmsbin:dlr-service@ jmsbin:dlr-gateway@ <b>ddsbin</b> :otf-gateway	jmsbin:dlr-service@ jmsbin:dlr-gateway@	jmsbin:dlr-service

**Table 3-15 URI Values from OTF Consumer to DLR Provider**

## 4 PLANNING

### 4.1 STAGES

The "Mission Operations Prototype" is divided in 2 stages. The idea is first to develop the lower layer components and make a communication test at the end of the first stage. With this test succeeded, the development of the Service components will be started, that will lead to a Service test at the end of stage 2.

On this way it is possible to have a better management of the time and resources affected to the project.

#### 4.1.1 STAGE 1

The stage 1 consists of developing the MAL and a basic communication allowing both agencies to interact on MAL layer by January 2010. Here is a list of the different tasks contained in Stage 1:

- Define a Project Schedule for the whole SM&C Prototype
- Gather all information about format, protocols and technical specifications and document findings in a PID (Prototype Interoperability Document).
- Coordinate network connection between JSC-OTF and DLR-GSOC
- Connectivity test to send bits over port 40100 through 40109 using TCP/IP
- Develop (for DLR-GSOC and JSC-OTF) a MAL on both sides
- Develop (for DLR-GSOC) or update (for JSC-OTF) a draft "Directory Service" to make a first authorisation. Initialization vectors to start Mission Operations messaging can be sent via email
- Develop some MAL managing tool allowing to display the MAL traffic (incoming & outgoing) to help by trouble shooting.
- JSC-OTF to implement the DDS-JMS protocol bridge
- Communication test on MAL level (t.b.d. which interaction patterns should be tested)

#### 4.1.2 STAGE 2

The stage 2 is started after success of the end tests of stage 1.

The stage 2 consists of developing the 'real' Services and their interaction between both agencies. After the services are developed, they should be used to allow an end-to-end communication between both agencies.

The JSC/OTF system provides telemetry from and accepts commands to an emulated spacecraft. In the other direction, the DLR-GSOC SCOS Monitoring & Control System displays the telemetry and generates the commands.

Here is a list of the different tasks contained in Stage 2:

- Develop (for DLR-GSOC and JSC-OTF) "Common Object Model" based on MAL
- Develop (for DLR-GSOC and JSC-OTF) "Parameter Service", "Action Service": JSC-OTF is provider of these services and DLR-GSOC consumer.
- Implement JSC-OTF "Parameter and Command database" in SCOS using the configuration data (see chapter 6.1 and 6.2)
- Provide full "Directory Service" : both agencies are provider and consumer of the "Directory Service". The "Directory Service" will have entries loaded to locate the "Directory Service" of the other agency.

- Provide full "Login Service" : the "Login Services" will be located via their own local "Directory Service" and used internally by each agency.
- Develop (for DLR-GSOC and JSC-OTF) the "Alert Service" (optional). Both agencies will be provider and consumer of that service.
- DLR-GSOC to implement the HTTP-JMS protocol bridge
- Test on Service level with "Directory Service" and "Parameter Service"
- Test on Service level with "Directory Service" and "Action Service"
- Test on Service level with "Directory Service" and "Alert Service" (optional)
- Definition of Test Procedures for the end test
- End test on application level with "JSC-OTF Simulator" and "DLR-GSOC SCOS M&C", using "Directory Service", "Parameter Service", "Action Service" and eventually "Alert Service"
- Write a "Prototype Report"

## 4.2 SCHEDULE

Milestone	Planned Date
Start of project	CCSDS conference in Colorado Springs April 2009
Definition Prototype Interoperability Document (PID)	June/August 2009
Meeting in Munich for finalised PID	August 2009
Begin Stage 1	June 2009
Connectivity Test	December 2009
Communication test on MAL Level	February 2010
Review Stage 1 in Houston	March 2010
Begin Stage 2	March 2010
Tests on service level	June 2010 Target
Communication test on application level	June 2010 Target
Review Stage 2 in Munich	
End of project	September 2010

**Table 4-1 Project Schedule**

## 4.3 DOCUMENT DELIVERY

- Agreement between NASA-JSC-OTF and DLR-GSOC
- Prototype Interoperability Document (PID)
- Prototype Report
- RIDS for Mission Operation specifications

## 5 ENCODING

### 5.1 BINARY ENCODING

This section presents a strategy for encoding the Mission Operations structures in binary. The encoding rules are provided using a BNF grammar followed by examples of encoded Message Header and Standard Error data structures. The sample values provided are for illustration purposes only.

The Service Abstraction Framework requires an encoding to be able to represent the NULL value. This encoding strategy includes a Boolean indicator for each element to indicate if the attribute is NULL. Abstract data types needs a Short Form to indicate the data type of the NULL attribute when no value is provided. Short Forms are not specified in the standards so a value is assigned for encoding purposes:

Abstract Data Type	Short Form
Element	0
Attribute	1
Composite	2

**Table 5-1 Abstract Data Type Short Forms**

All bytes will be transported in network order. Bytes are assumed to be octets, or 8-bits. The basic data types are defined first:

```
S8 ::= a signed byte (8 -bits, an octet)
S16 ::= a signed 16-bit integer
S32 ::= a signed 32-bit integer
S64 ::= a signed 64-bit integer
S128 ::= a signed 128-bit integer
FLOAT ::= a 4-byte IEEE-754 single precision floating point value
DOUBLE ::= a 8-byte IEEE-754 double precision floating point value
UTF-16 ::= Variable length character string encoded in UTF-16
```

The specifications also describe basic data types that are structures:

```
<octet-list> ::= S8 [ {S8}... ]
<time-structure> ::= <seconds> <milliseconds> ; Elapsed time since Epoch of
<seconds> ::= S64 ; January 01, 1970
<milliseconds> ::= S16
<finetime-structure> ::= <seconds> <picoseconds> ; Elapsed time since Epoch of
<picoseconds> ::= S128 ; January 01, 1970
```

The attributes, composites, enumerations and lists are defined in the Mission Operations specifications. The BNF grammar is intended to provide enough information to perform the binary encoding of all the data types. All composites and attributes can be reduced to the basic data types contained in Table 5-2.



Attribute	Short Form	Fixed Length	Variable Length	Basic Data Type	Notes
Blob	L		✓	octet-list	
Boolean	B	✓		S8	0x00 = FALSE, x01=TRUE
Duration	D	✓		S32	Value / 1000 = seconds Value % 1000 = milliseconds
Float	F	✓		FLOAT	NaN=Quiet (non-signaling) NaN value
Double	Z	✓		DOUBLE	NaN=Quiet (non-signaling) NaN value
Identifier	I		✓	UTF-16	
Octet	A	✓		S8	
Short	H	✓		S16	
Integer	N	✓		S32	
Long	Y	✓		S64	
String	S		✓	UTF-16	
Time	T	✓		time-structure	Epoch=01/01/1970 00:00:00
Finetime	C	✓		finetime-structure	Epoch=01/01/1970 00:00:00
URI	U		✓	UTF-16	

Table 5-2 Basic Data Type Properties

The element encoding rules will now be described.

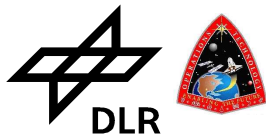
```
<short-form> ::= 4*<alpha-numeric>
<alpha-numeric> ::= <alpha><digit>
<alpha> ::= a-z / A-Z
<digit> ::= 0-9
```

```
<encoded-value> ::= S8 | S16 | S32 | S128 | FLOAT | DOUBLE | UTF-16 |
    <time-structure> | <finetime-structure> | <octet-list> | enumeration-value>
<enumeration-value> ::= S32
<null-indicator> ::= S8
<element-count> ::= S32
```

!! The element is the parent of all attributes and composites.

```
<element> ::= <attribute> | <composite>
```

!! All of Attributes are specified in the Service Abstraction Framework draft.  
!! The enumerations are defined throughout the proposed blue books. The intent  
!! is to provide enough information to encode/decode all attributes and  
!! enumerations



!! Attributes may either be fixed length, variable length or enumerations.  
!! Enumerations are actually fixed length but treated separately as they  
!! are in the proposed blue books.

```
<attribute> ::= <fixed-length-attribute> | <variable-length-attribute> |  
               <enumeration>
```

!! If the null-indicator is true, no encoded value is provided.

```
<fixed-length-attribute> ::= <short-form> <null-indicator> [<encoded-value>]
```

!! Variable length attributes contain repeatable basic types.

!! If the null indicator is true, no element count or encoded values are  
!! provided.

```
<variable-length-attribute> ::= <short-form> <null-indicator>  
                               [<element-count> (<encoded-value> | [{encoded-value}...])]
```

!! The short form values for enumerations are encoded/decoded.

!! If the null-indicator is true, no encoded value is provided.

```
<enumeration> ::= <short-form> <null-indicator> [<enumeration-value>]
```

!! Composites are structures that contain other structures or attributes.

!! Lists are also composites which contains repeatable elements of the same  
!! type. Composites and lists are defined throughout the proposed blue books.  
!! The intent is to provide enough information to encode/decode all  
!! composites and lists

!! The composite may contain an element or list of elements. The composite

!! can be thought of as a set of heterogeneous elements. If the null indicator  
!! is true no encoded structures are provided.

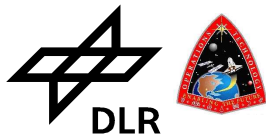
```
<composite> ::= <short-form> <null-indicator>  
               [(<element> | [{<element>}...]) | [<list>]
```

!! A list is a composite that contains repeatable elements of the same type.

!! A element count is necessary to indicate the size. If the null-indicator  
!! is true, no element count or encoded values are provided.

```
<list> ::= <short-form> <null-indicator>  
          [<element-count> (<element> | [{element}...])]
```

Table 5-3 describes the attributes and values of a sample Message Header. The binary encoding of the composite follows in Listing 5-1.



Structure	Short Form					
MessageHeader	x					
Field	Type	Null	Short Form	Size in Bytes	Element Count	Value
URIfrom	URI		U		25	name:ipd.otf.jsc.nasa.gov
authenticationId	Blob		L		9	superuser
URIto	URI		U		20	name:ipd.dlr.gsoc.de
timestamp	Time		T	10		2009-06-19 08:59:59.424
QoSLevel	QoSLevel		O	4		ASSURED
priority	Integer		N	4		99
Domain	DomainIdentifier		W		4	
domain[1]	Identifier		I		3	dlr
domain[2]	Identifier		I		3	otf
domain[3]	Identifier		I		9	prototype
domain[4]	Identifier		I		3	smc
networkZone	Identifier		I		11	esa.gateway
Session	SessionType		g	4		SIMULATION
interactionType	InteractionType		G	4		PROGRESS
interactionStage	Octet		A	1		2
transactionId	Identifier		I		6	000001
area	Identifier		I		4	core
service	Identifier		I		13	ActionService
operation	Identifier		I		12	invokeAction
version	Octet		A	1		1
isError	Boolean		B	1		True

Table 5-3 Sample Message Header

Listing 5-1 illustrates the sample message header after encoding. The encoded fields alternate between bold and regular font. The color scheme for all listings follows:

<b>Composite</b>
<b>Lists</b>
<b>Attributes</b>
<b>-Alternating between blue/black</b>

This message represents an error that was returned instead of the acknowledgement for a invokeAction request for the ActionService. The interaction type is PROGRESS, the stage is 2 (Ack) and the isError indicator is true.

```

00000000 78 00 00 00 00 55 00 00 00 00 00 00 19 00 6e |x....U.....n
00000010 00 61 00 6d 00 65 00 3a 00 69 00 70 00 64 00 2e |.a.m.e.:.i.p.d..
00000020 00 6f 00 74 00 66 00 2e 00 6a 00 73 00 63 00 2e |.o.t.f...j.s.c..
00000030 00 6e 00 61 00 73 00 61 00 2e 00 67 00 6f 00 76 |.n.a.s.a...g.o.v
00000040 4c 00 00 00 00 00 00 00 09 73 75 70 65 72 75 73 |L.....superus
00000050 65 72 55 00 00 00 00 00 00 00 14 00 6e 00 61 00 |erU.....n.a.

```



```
00000060 6d 00 65 00 3a 00 69 00 70 00 64 00 2e 00 64 00 |m.e.:.i.p.d...d.|
00000070 6c 00 72 00 2e 00 67 00 73 00 6f 00 63 00 2e 00 |l.r...g.s.o.c...|
00000080 64 00 65 54 00 00 00 00 00 00 00 00 4a 3b 53 8f |d.eT.....J;S.|
00000090 01 a8 4f 00 00 00 00 00 00 00 02 4e 00 00 00 00 |..O.....N....|
000000a0 00 00 00 63 57 00 00 00 00 00 00 00 00 04 49 00 00 |...cW.....I..|
000000b0 00 00 00 00 00 03 00 64 00 6c 00 72 49 00 00 00 00 |.....d.l.rI...|
000000c0 00 00 00 00 03 00 6f 00 74 00 66 49 00 00 00 00 00 |.....o.t.fI...|
000000d0 00 00 00 09 00 70 00 72 00 6f 00 74 00 6f 00 74 00 |....p.r.o.t.o.t|
000000e0 00 79 00 70 00 65 49 00 00 00 00 00 00 00 03 00 00 |.y.p.eI.....|
000000f0 73 00 6d 00 63 49 00 00 00 00 00 00 00 0b 00 65 00 |s.m.cI.....e|
00000100 00 73 00 61 00 2e 00 67 00 61 00 74 00 65 00 77 00 00 |.s.a...g.a.t.e.w|
00000110 00 61 00 79 67 00 00 00 00 00 00 00 02 47 00 00 00 |.a.yg.....G..|
00000120 00 00 00 00 00 05 41 00 00 00 00 02 49 00 00 00 00 |.....A.....I..|
00000130 00 00 00 00 06 00 30 00 30 00 30 00 30 00 30 00 00 |.....0.0.0.0.0.|
00000140 31 49 00 00 00 00 00 00 00 04 00 63 00 6f 00 72 00 |lI.....c.o.r|
00000150 00 65 49 00 00 00 00 00 00 00 0d 00 41 00 63 00 00 |.eI.....A.c.|
00000160 74 00 69 00 6f 00 6e 00 53 00 65 00 72 00 76 00 00 00 |t.i.o.n.S.e.r.v.|
00000170 69 00 63 00 65 49 00 00 00 00 00 00 00 0c 00 69 00 |i.c.eI.....i|
00000180 00 6e 00 76 00 6f 00 6b 00 65 00 41 00 63 00 74 00 00 |.n.v.o.k.e.A.c.t|
00000190 00 69 00 6f 00 6e 41 00 00 00 00 01 42 00 00 00 00 00 |.i.o.nA.....B...|
000001a0 00 01 |..|
000001a2
```

Listing 5-1 Binary Message Header

A sample Standard Error follows. The errorNumber indicates a BAD\_ENCODING. The extralInformation is an abstract element that is replaced with a DoubleList. The list composite was chosen to provide an example of a floating point encoding. The value is not representative of an operational scenario.

Structure	Short Form					
StandardError	X					
Field	Type	Null	Short Form	Size in Bytes	Element Count	Value
errorNumber	Integer		N	4		65548
extralInformation	DoubleList		z		4	
extralInformation[1]	Double		Z	8		POSITIVE_INFINITY
extralInformation[2]	Double		Z	8		NEGATIVE_INFINITY
extralInformation[3]	Double		Z	8		NaN
extralInformation[4]	Double		Z	8		1.1

Table 5-4 Standard Error with Extra Information

```
00000000 58 00 00 00 00 4e 00 00 00 00 00 01 00 0c 7a 00 |X...N.....z.|
00000010 00 00 00 00 00 00 04 5a 00 00 00 00 7f f0 00 00 00 |.....Z.....|
00000020 00 00 00 00 5a 00 00 00 00 ff f0 00 00 00 00 00 00 |...Z.....|
00000030 00 5a 00 00 00 00 7f f8 00 00 00 00 00 00 5a 00 |.Z.....Z.|
00000040 00 00 00 3f f1 99 99 99 99 99 9a |...?.....|
0000004b
```

Listing 5-2 Binary Standard Error with Extra Information

A second Standard Error is shown to illustrate the representation of a NULL value. The extralInformation is NULL. The null indicator is set to true. The abstract data types are not assigned short forms in the specifications so values were assigned in Table 5-1. The values are needed to allow the applications to confirm the null attribute is of the expected type for its location in the binary structure.



Structure	Short Form					
StandardError	X					
Field	Type	Null	Short Form	Size in Bytes	Element Count	Value
errorNumber	Integer		N	4		65548
extraInformation	Element	✓	0			

Table 5-5 Binary Standard Error with Null Value

As shown in Listing 5-3, when a attributes is NULL, no further encoded fields are necessary. In this example, the NULL element is the last field. The encoding would pickup with the short form of the next element.

```
00000000 58 00 00 00 00 4e 00 00 00 00 00 01 00 0c 30 00 |X...N.....0.|
00000010 00 00 01 |...|
00000013
```

Listing 5-3 Binary Standard Error with Null Value

## 5.2 XML ENCODING

[Note: The XML encoding was removed from the prototype on 23/04/2010. The Directory Service will use the Binary Encoding described in Section 5.1.

The schema definitions for the Directory Service are included in this section. The WSDL for the operations in listed in Section 5.2.5 was generated from the schema in Section 5.2.4. The WSDL is tentative and subject to change with agreement of JSC-OTF and DLR-GSOC.

### 5.2.1 MESSAGE ABSTRACTION LAYER STRUCTURES

t.b.d substitution Group issue

```
<?xml version="1.0" encoding="utf-16"?>
<xsd:schema xmlns:mal="http://www.gsoc.dlr.de/smc/mal"
  elementFormDefault="qualified"
  targetNamespace="http://www.gsoc.dlr.de/smc/mal"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema">
  <!-- General types -->
  <xsd:complexType name="Composite">
    <xsd:complexContent mixed="false">
      <xsd:extension base="mal:Element" />
    </xsd:complexContent>
  </xsd:complexType>
  <xsd:complexType name="Attribute">
    <xsd:complexContent mixed="false">
      <xsd:extension base="mal:Element" />
    </xsd:complexContent>
  </xsd:complexType>
  <xsd:complexType name="Element" />
  <!-- Abstract types -->
  <xsd:complexType name="List" abstract="true">
    <xsd:complexContent mixed="false">
      <xsd:extension base="mal:Composite" />
    </xsd:complexContent>
  </xsd:complexType>
</xsd:schema>
```

---

```

    </xsd:complexContent>
  </xsd:complexType>
  <xsd:complexType name="Enumeration" abstract="true">
    <xsd:complexContent mixed="false">
      <xsd:extension base="mal:Element" />
    </xsd:complexContent>
  </xsd:complexType>
  <!-- Basis data types -->
  <xsd:complexType name="Long">
    <xsd:complexContent mixed="false">
      <xsd:extension base="mal:Attribute">
        <xsd:sequence>
          <xsd:element name="longValue" type="xsd:long" />
        </xsd:sequence>
        <xsd:attribute default="Y" name="shortForm" type="xsd:string" />
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>
  <xsd:complexType name="Short">
    <xsd:complexContent mixed="false">
      <xsd:extension base="mal:Attribute">
        <xsd:sequence>
          <xsd:element name="shortValue" type="xsd:short" />
        </xsd:sequence>
        <xsd:attribute default="H" name="shortForm" type="xsd:string" />
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>
  <xsd:complexType name="Time">
    <xsd:complexContent mixed="false">
      <xsd:extension base="mal:Attribute">
        <xsd:sequence>
          <xsd:element name="time" type="xsd:long" />
        </xsd:sequence>
        <xsd:attribute default="T" name="shortForm" type="xsd:string" />
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>
  <xsd:complexType name="NamedValue">
    <xsd:complexContent mixed="false">
      <xsd:extension base="mal:Composite">
        <xsd:sequence>
          <xsd:element name="name" type="mal:Identifier" />
          <xsd:element name="value" type="mal:Attribute" />
        </xsd:sequence>
        <xsd:attribute default="J" name="shortForm" type="xsd:string" />
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>
  <xsd:complexType name="Float">
    <xsd:complexContent mixed="false">
      <xsd:extension base="mal:Attribute">
        <xsd:sequence>
          <xsd:element name="floatValue" type="xsd:float" />
        </xsd:sequence>
        <xsd:attribute default="F" name="shortForm" type="xsd:string" />
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>
  <xsd:complexType name="Octet">
    <xsd:complexContent mixed="false">
      <xsd:extension base="mal:Attribute">
        <xsd:sequence>

```



```
<xsd:element name="octetValue" type="xsd:byte" />
</xsd:sequence>
<xsd:attribute default="A" name="shortForm" type="xsd:string" />
</xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="Boolean">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Attribute">
      <xsd:sequence>
        <xsd:element name="booleanValue" type="xsd:boolean" />
      </xsd:sequence>
      <xsd:attribute default="B" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="Integer">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Attribute">
      <xsd:sequence>
        <xsd:element name="intValue" type="xsd:int" />
      </xsd:sequence>
      <xsd:attribute default="N" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="Blob">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Attribute">
      <xsd:sequence>
        <xsd:element name="byteValue" type="xsd:hexBinary" />
      </xsd:sequence>
      <xsd:attribute default="L" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="Duration">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Attribute">
      <xsd:sequence>
        <xsd:element name="durationValue" type="xsd:int" />
      </xsd:sequence>
      <xsd:attribute default="D" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="IdBooleanPair">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Composite">
      <xsd:sequence>
        <xsd:element name="id" type="mal:Identifier" />
        <xsd:element name="value" type="mal:Boolean" />
      </xsd:sequence>
      <xsd:attribute default="V" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="Double">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Attribute">
      <xsd:sequence>
        <xsd:element name="doubleValue" type="xsd:double" />
      </xsd:sequence>
```

---

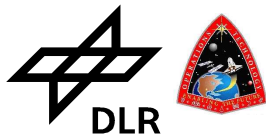
```

        <xsd:attribute default="Z" name="shortForm" type="xsd:string" />
    </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="FineTime">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:Attribute">
            <xsd:sequence>
                <xsd:element name="time" type="xsd:long" />
            </xsd:sequence>
            <xsd:attribute default="C" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="Identifier">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:Attribute">
            <xsd:sequence>
                <xsd:element name="stringValue" type="xsd:string" />
            </xsd:sequence>
            <xsd:attribute default="I" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="URI">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:Attribute">
            <xsd:sequence>
                <xsd:element name="stringValue" type="xsd:string" />
            </xsd:sequence>
            <xsd:attribute default="U" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="String">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:Attribute">
            <xsd:sequence>
                <xsd:element name="stringValue" type="xsd:string" />
            </xsd:sequence>
            <xsd:attribute default="S" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<!-- List types -->
<xsd:complexType name="QoSLevelList">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:List">
            <xsd:sequence maxOccurs="unbounded">
                <xsd:element name="item" type="mal:QoSLevel" />
            </xsd:sequence>
            <xsd:attribute default="o" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="UpdateList">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:List">
            <xsd:sequence maxOccurs="unbounded">
                <xsd:element name="item" type="mal:Update" />
            </xsd:sequence>
            <xsd:attribute default="m" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>

```



```
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="IdentifierList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:Identifier" />
      </xsd:sequence>
      <xsd:attribute default="i" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="IntegerList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:Integer" />
      </xsd:sequence>
      <xsd:attribute default="n" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="IdBooleanList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:IdBooleanPair" />
      </xsd:sequence>
      <xsd:attribute default="v" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="PairList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:Pair" />
      </xsd:sequence>
      <xsd:attribute default="p" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="StringList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:String" />
      </xsd:sequence>
      <xsd:attribute default="s" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="EntityRequestList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:EntityRequest" />
      </xsd:sequence>
      <xsd:attribute default="q" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="SubscriptionUpdateList">
```



```
<xsd:complexContent mixed="false">
  <xsd:extension base="mal:List">
    <xsd:sequence maxOccurs="unbounded">
      <xsd:element name="item" type="mal:SubscriptionUpdate" />
    </xsd:sequence>
    <xsd:attribute default="w" name="shortForm" type="xsd:string" />
  </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="DomainIdentifier">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:Identifier" />
      </xsd:sequence>
      <xsd:attribute default="W" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="NamedValueList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:NamedValue" />
      </xsd:sequence>
      <xsd:attribute default="j" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="EntityKeyList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:IdentifierList" />
      </xsd:sequence>
      <xsd:attribute default="k" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="BlobList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:Blob" />
      </xsd:sequence>
      <xsd:attribute default="l" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="BooleanList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:Boolean" />
      </xsd:sequence>
      <xsd:attribute default="b" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="DurationList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
```

---

```

        <xsd:element name="item" type="mal:Duration" />
    </xsd:sequence>
    <xsd:attribute default="d" name="shortForm" type="xsd:string" />
</xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="FloatList">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:List">
            <xsd:sequence maxOccurs="unbounded">
                <xsd:element name="item" type="mal:Float" />
            </xsd:sequence>
            <xsd:attribute default="f" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="DoubleList">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:List">
            <xsd:sequence maxOccurs="unbounded">
                <xsd:element name="item" type="mal:Double" />
            </xsd:sequence>
            <xsd:attribute default="z" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="OctetList">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:List">
            <xsd:sequence maxOccurs="unbounded">
                <xsd:element name="item" type="mal:Octet" />
            </xsd:sequence>
            <xsd:attribute default="a" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="ShortList">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:List">
            <xsd:sequence maxOccurs="unbounded">
                <xsd:element name="item" type="mal:Short" />
            </xsd:sequence>
            <xsd:attribute default="h" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="LongList">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:List">
            <xsd:sequence maxOccurs="unbounded">
                <xsd:element name="item" type="mal:Long" />
            </xsd:sequence>
            <xsd:attribute default="y" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="TimeList">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:List">
            <xsd:sequence maxOccurs="unbounded">
                <xsd:element name="item" type="mal:Time" />
            </xsd:sequence>
            <xsd:attribute default="t" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>

```

---

```

        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="FineTimeList">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:List">
            <xsd:sequence maxOccurs="unbounded">
                <xsd:element name="item" type="mal:FineTime" />
            </xsd:sequence>
            <xsd:attribute default="c" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="URIList">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:List">
            <xsd:sequence maxOccurs="unbounded">
                <xsd:element name="item" type="mal:URI" />
            </xsd:sequence>
            <xsd:attribute default="u" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<!-- Enumeration types -->
<xsd:complexType name="UpdateType">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:Enumeration">
            <xsd:sequence>
                <xsd:element name="enum" type="mal:UpdateTypeEnum" />
            </xsd:sequence>
            <xsd:attribute default="M" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<xsd:simpleType name="UpdateTypeEnum">
    <xsd:restriction base="xsd:string">
        <xsd:enumeration value="CREATION" />
        <xsd:enumeration value="UPDATE" />
        <xsd:enumeration value="MODIFICATION" />
        <xsd:enumeration value="DELETION" />
    </xsd:restriction>
</xsd:simpleType>
<xsd:complexType name="SessionType">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:Enumeration">
            <xsd:sequence>
                <xsd:element name="enum" type="mal:SessionTypeEnum" />
            </xsd:sequence>
            <xsd:attribute default="g" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<xsd:simpleType name="SessionTypeEnum">
    <xsd:restriction base="xsd:string">
        <xsd:enumeration value="LIVE" />
        <xsd:enumeration value="SIMULATION" />
        <xsd:enumeration value="REPLAY" />
    </xsd:restriction>
</xsd:simpleType>
<xsd:complexType name="InteractionType">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:Enumeration">
            <xsd:sequence>

```





```
<xsd:element name="enum" type="mal:InteractionTypeEnumeration" />
</xsd:sequence>
<xsd:attribute default="G" name="shortForm" type="xsd:string" />
</xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:simpleType name="InteractionTypeEnumeration">
  <xsd:restriction base="xsd:string">
    <xsd:enumeration value="SEND" />
    <xsd:enumeration value="SUBMIT" />
    <xsd:enumeration value="REQUEST" />
    <xsd:enumeration value="INVOKE" />
    <xsd:enumeration value="PROGRESS" />
    <xsd:enumeration value="PUBSUB" />
  </xsd:restriction>
</xsd:simpleType>
<xsd:complexType name="QoSLevel">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Enumeration">
      <xsd:sequence>
        <xsd:element name="enum" type="mal:QoSLevelEnumeration" />
      </xsd:sequence>
      <xsd:attribute default="0" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:simpleType name="QoSLevelEnumeration">
  <xsd:restriction base="xsd:string">
    <xsd:enumeration value="BEST_EFFORT" />
    <xsd:enumeration value="ASSURED" />
    <xsd:enumeration value="QUEUED" />
    <xsd:enumeration value="TIMELY" />
  </xsd:restriction>
</xsd:simpleType>
<!-- Extended types -->
<xsd:complexType name="SubscriptionUpdate">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Composite">
      <xsd:sequence>
        <xsd:element name="subscriptionId" type="mal:Identifier" />
        <xsd:element name="updateList" type="mal:UpdateList" />
      </xsd:sequence>
      <xsd:attribute default="r" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="MessageHeader">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Composite">
      <xsd:sequence>
        <xsd:element name="uriFrom" type="mal:URI" />
        <xsd:element name="uriTo" type="mal:URI" />
        <xsd:element name="authenticationId" type="mal:Blob" />
        <xsd:element name="timeStamp" type="mal:Time" />
        <xsd:element name="qoSLevel" type="mal:QoSLevel" />
        <xsd:element name="priority" type="mal:Integer" />
        <xsd:element name="domain" type="mal:DomainIdentifier" />
        <xsd:element name="networkZone" type="mal:Identifier" />
        <xsd:element name="session" type="mal:SessionType" />
        <xsd:element name="interactionType" type="mal:InteractionType" />
        <xsd:element name="interactionStage" type="mal:Octet" />
        <xsd:element name="transactionId" type="mal:Integer" />
        <xsd:element name="area" type="mal:Identifier" />
      </xsd:sequence>
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
```



```
<xsd:element name="service" type="mal:Identifier" />
<xsd:element name="operation" type="mal:Identifier" />
<xsd:element name="version" type="mal:Octet" />
<xsd:element name="isError" type="mal:Boolean" />
</xsd:sequence>
<xsd:attribute default="x" name="shortForm" type="xsd:string" />
</xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="Update">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Composite">
      <xsd:sequence>
        <xsd:element name="timeStamp" type="mal:Time" />
        <xsd:element name="sourceURI" type="mal:URI" />
        <xsd:element name="updateType" type="mal:UpdateType" />
        <xsd:element name="key" type="mal:IdentifierList" />
      </xsd:sequence>
      <xsd:attribute default="" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="Subscription">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Composite">
      <xsd:sequence>
        <xsd:element name="subscriptionId" type="mal:Identifier" />
        <xsd:element name="entities" type="mal:EntityRequestList" />
      </xsd:sequence>
      <xsd:attribute default="R" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="Pair">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Composite">
      <xsd:sequence>
        <xsd:element name="first" type="mal:Attribute" />
        <xsd:element name="second" type="mal:Attribute" />
      </xsd:sequence>
      <xsd:attribute default="P" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="EntityRequest">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Composite">
      <xsd:sequence>
        <xsd:element name="entityKeys" type="mal:EntityKeyList" />
        <xsd:element name="onlyOnChange" type="mal:Boolean" />
      </xsd:sequence>
      <xsd:attribute default="Q" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="StandardError">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Composite">
      <xsd:sequence>
        <xsd:element name="errorNumber" type="mal:Integer" />
        <xsd:element name="extraInformation" type="mal:Element" />
      </xsd:sequence>
      <xsd:attribute default="X" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
```

```

    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
</xsd:schema>

```

Listing 5-4 describes the MAL data structures that would be required for the Directory Service implementation.

```

<?xml version="1.0" encoding="utf-16"?>
<xsd:schema xmlns:mal="http://www.gsoc.dlr.de/smc/mal"
  elementFormDefault="qualified"
  targetNamespace="http://www.gsoc.dlr.de/smc/mal"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema">
  <!-- General types -->
  <xsd:complexType name="Composite">
    <xsd:complexContent mixed="false">
      <xsd:extension base="mal:Element" />
    </xsd:complexContent>
  </xsd:complexType>
  <xsd:complexType name="Attribute">
    <xsd:complexContent mixed="false">
      <xsd:extension base="mal:Element" />
    </xsd:complexContent>
  </xsd:complexType>
  <xsd:complexType name="Element" />
  <!-- Abstract types -->
  <xsd:complexType name="List" abstract="true">
    <xsd:complexContent mixed="false">
      <xsd:extension base="mal:Composite" />
    </xsd:complexContent>
  </xsd:complexType>
  <xsd:complexType name="Enumeration" abstract="true">
    <xsd:complexContent mixed="false">
      <xsd:extension base="mal:Element" />
    </xsd:complexContent>
  </xsd:complexType>
  <!-- Basis data types -->
  <xsd:complexType name="Long">
    <xsd:complexContent mixed="false">
      <xsd:extension base="mal:Attribute">
        <xsd:sequence>
          <xsd:element name="longValue" type="xsd:long" />
        </xsd:sequence>
        <xsd:attribute default="Y" name="shortForm" type="xsd:string" />
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>
  <xsd:complexType name="Short">
    <xsd:complexContent mixed="false">
      <xsd:extension base="mal:Attribute">
        <xsd:sequence>
          <xsd:element name="shortValue" type="xsd:short" />
        </xsd:sequence>
        <xsd:attribute default="H" name="shortForm" type="xsd:string" />
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>
  <xsd:complexType name="Time">
    <xsd:complexContent mixed="false">
      <xsd:extension base="mal:Attribute">
        <xsd:sequence>
          <xsd:element name="time" type="xsd:long" />
        </xsd:sequence>
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>

```

---

```

        </xsd:sequence>
        <xsd:attribute default="T" name="shortForm" type="xsd:string" />
    </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="NamedValue">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:Composite">
            <xsd:sequence>
                <xsd:element name="name" type="mal:Identifier" />
                <xsd:element name="value" type="mal:Attribute" />
            </xsd:sequence>
            <xsd:attribute default="J" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="Float">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:Attribute">
            <xsd:sequence>
                <xsd:element name="floatValue" type="xsd:float" />
            </xsd:sequence>
            <xsd:attribute default="F" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="Octet">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:Attribute">
            <xsd:sequence>
                <xsd:element name="octetValue" type="xsd:byte" />
            </xsd:sequence>
            <xsd:attribute default="A" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="Boolean">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:Attribute">
            <xsd:sequence>
                <xsd:element name="booleanValue" type="xsd:boolean" />
            </xsd:sequence>
            <xsd:attribute default="B" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="Integer">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:Attribute">
            <xsd:sequence>
                <xsd:element name="intValue" type="xsd:int" />
            </xsd:sequence>
            <xsd:attribute default="N" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="Blob">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:Attribute">
            <xsd:sequence>
                <xsd:element name="byteValue" type="xsd:hexBinary" />
            </xsd:sequence>
            <xsd:attribute default="L" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>

```

---

```

    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="Duration">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Attribute">
      <xsd:sequence>
        <xsd:element name="durationValue" type="xsd:int" />
      </xsd:sequence>
      <xsd:attribute default="D" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="IdBooleanPair">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Composite">
      <xsd:sequence>
        <xsd:element name="id" type="mal:Identifier" />
        <xsd:element name="value" type="mal:Boolean" />
      </xsd:sequence>
      <xsd:attribute default="V" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="Double">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Attribute">
      <xsd:sequence>
        <xsd:element name="doubleValue" type="xsd:double" />
      </xsd:sequence>
      <xsd:attribute default="Z" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="FineTime">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Attribute">
      <xsd:sequence>
        <xsd:element name="time" type="xsd:long" />
      </xsd:sequence>
      <xsd:attribute default="C" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="Identifier">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Attribute">
      <xsd:sequence>
        <xsd:element name="stringValue" type="xsd:string" />
      </xsd:sequence>
      <xsd:attribute default="I" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="URI">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Attribute">
      <xsd:sequence>
        <xsd:element name="stringValue" type="xsd:string" />
      </xsd:sequence>
      <xsd:attribute default="U" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>

```



```
</xsd:complexType>
<xsd:complexType name="String">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Attribute">
      <xsd:sequence>
        <xsd:element name="stringValue" type="xsd:string" />
      </xsd:sequence>
      <xsd:attribute default="S" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<!-- List types -->
<xsd:complexType name="QoSLevelList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:QoSLevel" />
      </xsd:sequence>
      <xsd:attribute default="o" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="UpdateList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:Update" />
      </xsd:sequence>
      <xsd:attribute default="m" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="IdentifierList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:Identifier" />
      </xsd:sequence>
      <xsd:attribute default="i" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="IntegerList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:Integer" />
      </xsd:sequence>
      <xsd:attribute default="n" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="IdBooleanList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:IdBooleanPair" />
      </xsd:sequence>
      <xsd:attribute default="v" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="PairList">
```

---

```

<xsd:complexContent mixed="false">
  <xsd:extension base="mal:List">
    <xsd:sequence maxOccurs="unbounded">
      <xsd:element name="item" type="mal:Pair" />
    </xsd:sequence>
    <xsd:attribute default="p" name="shortForm" type="xsd:string" />
  </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="StringList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:String" />
      </xsd:sequence>
      <xsd:attribute default="s" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="EntityRequestList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:EntityRequest" />
      </xsd:sequence>
      <xsd:attribute default="q" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="SubscriptionUpdateList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:SubscriptionUpdate" />
      </xsd:sequence>
      <xsd:attribute default="w" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="DomainIdentifier">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:Identifier" />
      </xsd:sequence>
      <xsd:attribute default="W" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="NamedValueList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:NamedValue" />
      </xsd:sequence>
      <xsd:attribute default="j" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="EntityKeyList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">

```

---

```

        <xsd:element name="item" type="mal:IdentifierList" />
    </xsd:sequence>
    <xsd:attribute default="k" name="shortForm" type="xsd:string" />
</xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="BlobList">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:List">
            <xsd:sequence maxOccurs="unbounded">
                <xsd:element name="item" type="mal:Blob" />
            </xsd:sequence>
            <xsd:attribute default="l" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="BooleanList">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:List">
            <xsd:sequence maxOccurs="unbounded">
                <xsd:element name="item" type="mal:Boolean" />
            </xsd:sequence>
            <xsd:attribute default="b" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="DurationList">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:List">
            <xsd:sequence maxOccurs="unbounded">
                <xsd:element name="item" type="mal:Duration" />
            </xsd:sequence>
            <xsd:attribute default="d" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="FloatList">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:List">
            <xsd:sequence maxOccurs="unbounded">
                <xsd:element name="item" type="mal:Float" />
            </xsd:sequence>
            <xsd:attribute default="f" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="DoubleList">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:List">
            <xsd:sequence maxOccurs="unbounded">
                <xsd:element name="item" type="mal:Double" />
            </xsd:sequence>
            <xsd:attribute default="z" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="OctetList">
    <xsd:complexContent mixed="false">
        <xsd:extension base="mal:List">
            <xsd:sequence maxOccurs="unbounded">
                <xsd:element name="item" type="mal:Octet" />
            </xsd:sequence>
            <xsd:attribute default="a" name="shortForm" type="xsd:string" />
        </xsd:extension>
    </xsd:complexContent>

```

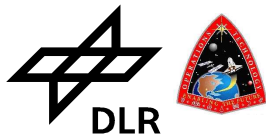


---

```

    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="ShortList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:Short" />
      </xsd:sequence>
      <xsd:attribute default="h" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="LongList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:Long" />
      </xsd:sequence>
      <xsd:attribute default="y" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="TimeList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:Time" />
      </xsd:sequence>
      <xsd:attribute default="t" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="FineTimeList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:FineTime" />
      </xsd:sequence>
      <xsd:attribute default="c" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="URIList">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:List">
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element name="item" type="mal:URI" />
      </xsd:sequence>
      <xsd:attribute default="u" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<!-- Enumeration types -->
<xsd:complexType name="UpdateType">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Enumeration">
      <xsd:sequence>
        <xsd:element name="enum" type="mal:UpdateTypeEnumeration" />
      </xsd:sequence>
      <xsd:attribute default="M" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>

```



```
</xsd:complexType>
<xsd:simpleType name="UpdateTypeEnum">
  <xsd:restriction base="xsd:string">
    <xsd:enumeration value="CREATION" />
    <xsd:enumeration value="UPDATE" />
    <xsd:enumeration value="MODIFICATION" />
    <xsd:enumeration value="DELETION" />
  </xsd:restriction>
</xsd:simpleType>
<xsd:complexType name="SessionType">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Enumeration">
      <xsd:sequence>
        <xsd:element name="enum" type="mal:SessionTypeEnum" />
      </xsd:sequence>
      <xsd:attribute default="g" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:simpleType name="SessionTypeEnum">
  <xsd:restriction base="xsd:string">
    <xsd:enumeration value="LIVE" />
    <xsd:enumeration value="SIMULATION" />
    <xsd:enumeration value="REPLAY" />
  </xsd:restriction>
</xsd:simpleType>
<xsd:complexType name="InteractionType">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Enumeration">
      <xsd:sequence>
        <xsd:element name="enum" type="mal:InteractionTypeEnum" />
      </xsd:sequence>
      <xsd:attribute default="G" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:simpleType name="InteractionTypeEnum">
  <xsd:restriction base="xsd:string">
    <xsd:enumeration value="SEND" />
    <xsd:enumeration value="SUBMIT" />
    <xsd:enumeration value="REQUEST" />
    <xsd:enumeration value="INVOKE" />
    <xsd:enumeration value="PROGRESS" />
    <xsd:enumeration value="PUBSUB" />
  </xsd:restriction>
</xsd:simpleType>
<xsd:complexType name="QoSLevel">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Enumeration">
      <xsd:sequence>
        <xsd:element name="enum" type="mal:QoSLevelEnum" />
      </xsd:sequence>
      <xsd:attribute default="O" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:simpleType name="QoSLevelEnum">
  <xsd:restriction base="xsd:string">
    <xsd:enumeration value="BEST_EFFORT" />
    <xsd:enumeration value="ASSURED" />
    <xsd:enumeration value="QUEUED" />
    <xsd:enumeration value="TIMELY" />
  </xsd:restriction>
</xsd:simpleType>
```



```
</xsd:simpleType>
<!-- Extended types -->
<xsd:complexType name="SubscriptionUpdate">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Composite">
      <xsd:sequence>
        <xsd:element name="subscriptionId" type="mal:Identifier" />
        <xsd:element name="updateList" type="mal:UpdateList" />
      </xsd:sequence>
      <xsd:attribute default="r" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="MessageHeader">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Composite">
      <xsd:sequence>
        <xsd:element name="uriFrom" type="mal:URI" />
        <xsd:element name="uriTo" type="mal:URI" />
        <xsd:element name="authenticationId" type="mal:Blob" />
        <xsd:element name="timeStamp" type="mal:Time" />
        <xsd:element name="qoSLevel" type="mal:QoSLevel" />
        <xsd:element name="priority" type="mal:Integer" />
        <xsd:element name="domain" type="mal:DomainIdentifier" />
        <xsd:element name="networkZone" type="mal:Identifier" />
        <xsd:element name="session" type="mal:SessionType" />
        <xsd:element name="interactionType" type="mal:InteractionType" />
        <xsd:element name="interactionStage" type="mal:Octet" />
        <xsd:element name="transactionId" type="mal:Integer" />
        <xsd:element name="area" type="mal:Identifier" />
        <xsd:element name="service" type="mal:Identifier" />
        <xsd:element name="operation" type="mal:Identifier" />
        <xsd:element name="version" type="mal:Octet" />
        <xsd:element name="isError" type="mal:Boolean" />
      </xsd:sequence>
      <xsd:attribute default="x" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="Update">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Composite">
      <xsd:sequence>
        <xsd:element name="timeStamp" type="mal:Time" />
        <xsd:element name="sourceURI" type="mal:URI" />
        <xsd:element name="updateType" type="mal:UpdateType" />
        <xsd:element name="key" type="mal:IdentifierList" />
      </xsd:sequence>
      <xsd:attribute default="" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="Subscription">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Composite">
      <xsd:sequence>
        <xsd:element name="subscriptionId" type="mal:Identifier" />
        <xsd:element name="entities" type="mal:EntityRequestList" />
      </xsd:sequence>
      <xsd:attribute default="R" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
```

---

```

<xsd:complexType name="Pair">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Composite">
      <xsd:sequence>
        <xsd:element name="first" type="mal:Attribute" />
        <xsd:element name="second" type="mal:Attribute" />
      </xsd:sequence>
      <xsd:attribute default="P" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="EntityRequest">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Composite">
      <xsd:sequence>
        <xsd:element name="entityKeys" type="mal:EntityKeyList" />
        <xsd:element name="onlyOnChange" type="mal:Boolean" />
      </xsd:sequence>
      <xsd:attribute default="Q" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="StandardError">
  <xsd:complexContent mixed="false">
    <xsd:extension base="mal:Composite">
      <xsd:sequence>
        <xsd:element name="errorNumber" type="mal:Integer" />
        <xsd:element name="extraInformation" type="mal:Element" />
      </xsd:sequence>
      <xsd:attribute default="X" name="shortForm" type="xsd:string" />
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
</xsd:schema>

```

**Listing 5-4 Schema for Message Abstraction Layer Structures**

## 5.2.2 COMMON STRUCTURES

Listing 5-5 describes the structures for Common Services.

```
<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns:MAL="http://otf.jsc.nasa.gov/smc/mal"
  xmlns:Common="http://otf.jsc.nasa.gov/smc/common"
  targetNamespace="http://otf.jsc.nasa.gov/smc/common"
  elementFormDefault="qualified">

  <xsd:import namespace="http://otf.jsc.nasa.gov/smc/mal"
    schemaLocation="http://localhost:8080/directory-
ws/schema/MessageAbstractionLayer.xsd"/>

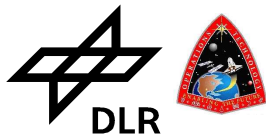
  <xsd:annotation>
    <xsd:documentation>
      This schema provides data types necessary for the supporting an
      implementation of the Directory Service as defined in the Common
      Services Red Book for for CCSDS Spacecraft Monitor and Control (CCSDS
      521.1-R-2 April 2008). The structures for the Common Object Model
      support are not included.
    </xsd:documentation>
  </xsd:annotation>

  <xsd:complexType name="OccurrenceKeyType">
    <xsd:annotation>
      <xsd:documentation>
      </xsd:documentation>
    </xsd:annotation>
    <xsd:sequence>
      <xsd:element name="entityId" type="MAL:Identifier" nillable="true"/>
      <xsd:element name="definitionId" type="MAL:Identifier" nillable="true"/>
      <xsd:element name="occurrenceId" type="MAL:Identifier" nillable="true"/>
    </xsd:sequence>
  </xsd:complexType>

  <xsd:complexType name="OccurrenceKeyListType">
    <xsd:annotation>
      <xsd:documentation>
        This type represents a list of OccurrenceKey structures.
      </xsd:documentation>
    </xsd:annotation>
    <xsd:sequence minOccurs="0" maxOccurs="unbounded">
      <xsd:element name="occurrenceKey" type="Common:OccurrenceKeyType"/>
    </xsd:sequence>
  </xsd:complexType>

  <xsd:complexType name="OccurrenceType">
    <xsd:annotation>
      <xsd:documentation>
      </xsd:documentation>
    </xsd:annotation>
    <xsd:sequence>
      <xsd:element name="key" type="Common:OccurrenceKeyType"/>
      <xsd:element name="timestamp" type="MAL:Time"/>
    </xsd:sequence>
  </xsd:complexType>

  <xsd:complexType name="OccurrenceListType">
    <xsd:annotation>
      <xsd:documentation>
        This type represents a list of Occurrence structures.
      </xsd:documentation>
    </xsd:annotation>
    <xsd:sequence minOccurs="0" maxOccurs="unbounded">
```



```
<xsd:element name="occurrence" type="Common:OccurrenceType"/>
</xsd:sequence>
</xsd:complexType>

<xsd:complexType name="StatusKeyType">
  <xsd:annotation>
    <xsd:documentation>
    </xsd:documentation>
  </xsd:annotation>
  <xsd:sequence>
    <xsd:element name="entityId" type="MAL:Identifier" nillable="true"/>
    <xsd:element name="definitionId" type="MAL:Identifier" nillable="true"/>
    <xsd:element name="occurrenceId" type="MAL:Identifier" nillable="true"/>
    <xsd:element name="statusId" type="MAL:Identifier" nillable="true"/>
  </xsd:sequence>
</xsd:complexType>

<xsd:complexType name="StatusKeyListType">
  <xsd:annotation>
    <xsd:documentation>
      This type represents a list of StatusKey structures.
    </xsd:documentation>
  </xsd:annotation>
  <xsd:sequence minOccurs="0" maxOccurs="unbounded">
    <xsd:element name="statusKey" type="Common:StatusKeyType"/>
  </xsd:sequence>
</xsd:complexType>

<xsd:complexType name="StatusType">
  <xsd:annotation>
    <xsd:documentation>
    </xsd:documentation>
  </xsd:annotation>
  <xsd:sequence>
    <xsd:element name="key" type="Common:StatusKeyType"/>
    <xsd:element name="timestamp" type="MAL:Time"/>
  </xsd:sequence>
</xsd:complexType>

<xsd:complexType name="StatusListType">
  <xsd:annotation>
    <xsd:documentation>
      This type represents a list of Status structures.
    </xsd:documentation>
  </xsd:annotation>
  <xsd:sequence minOccurs="0" maxOccurs="unbounded">
    <xsd:element name="status" type="Common:StatusType"/>
  </xsd:sequence>
</xsd:complexType>
</xsd:schema>
```

**Listing 5-5 Schema for Common Service Structures**

### 5.2.3 DIRECTORY SERVICE STRUCTURES

Listing 5-6 describes the structures needed for the Directory Service.

```
<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns:MAL="http://otf.jsc.nasa.gov/smc/mal"
  xmlns:Common="http://otf.jsc.nasa.gov/smc/common"
  xmlns:Directory="http://otf.jsc.nasa.gov/smc/common/directory"
  targetNamespace="http://otf.jsc.nasa.gov/smc/common/directory">
```



```
elementFormDefault="qualified">

<xsd:import namespace="http://otf.jsc.nasa.gov/smc/mal"
            schemaLocation="http://localhost:8080/directory-
ws/schema/MessageAbstractionLayer.xsd"/>
<xsd:import namespace="http://otf.jsc.nasa.gov/smc/common"
            schemaLocation="http://localhost:8080/directory-
ws/schema/CommonStructures.xsd"/>

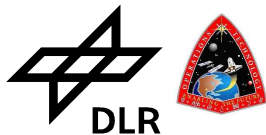
<xsd:annotation>
  <xsd:documentation>
    This schema provides data types necessary to implement the Directory
    Service as defined in the Common Services Red Book for for CCSDS
    Spacecraft Monitor and Control (CCSDS 521.1-R-2 April 2008). The
    structures for Common Object Model support are not included.
  </xsd:documentation>
</xsd:annotation>

<xsd:complexType name="DomainOccurrenceType">
  <xsd:annotation>
    <xsd:documentation>
      This structure holds all the information required by the Directory
      Service to uniquely identify a Node in the Directory Service tree
    </xsd:documentation>
  </xsd:annotation>
  <xsd:complexContent>
    <xsd:extension base="Common:OccurrenceType">
      <xsd:sequence>
        <xsd:element name="sessionType" type="MAL:SessionType"/>
        <xsd:element name="sourceSessionName" type="MAL:Identifier"/>
        <xsd:element name="isExternal" type="MAL:Boolean"/>
        <xsd:element name="subDomains" type="MAL:IdBooleanListType"/>
        <xsd:element name="alternateNetworks" type="MAL:IdBooleanListType"/>
        <xsd:element name="alternateSessions" type="MAL:IdBooleanListType"/>
        <xsd:element name="services" type="MAL:IdentifierList"/>
      </xsd:sequence>
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>

<xsd:complexType name="DomainOccurrenceListType">
  <xsd:annotation>
    <xsd:documentation>
      This type represent a list of DomainOccurrence structures
    </xsd:documentation>
  </xsd:annotation>
  <xsd:sequence minOccurs="1" maxOccurs="unbounded">
    <xsd:element name="domainOccurrence"
type="Directory:DomainOccurrenceType"/>
  </xsd:sequence>
</xsd:complexType>

<xsd:complexType name="NodeStatusType">
  <xsd:annotation>
    <xsd:documentation>
      This structure holds all information required by the Directory
      service for the services held at a Node
    </xsd:documentation>
  </xsd:annotation>
  <xsd:complexContent>
    <xsd:extension base="Common:StatusType">
      <xsd:sequence>
        <xsd:element name="services"
type="Directory:ServiceDetailsListType"/>
      </xsd:sequence>
    </xsd:extension>
  </xsd:complexContent>

```



```
</xsd:complexType>

<xsd:complexType name="NodeStatusListType">
  <xsd:annotation>
    <xsd:documentation>
      This type represent a list of NodeStatus structures.
    </xsd:documentation>
  </xsd:annotation>
  <xsd:sequence minOccurs="0" maxOccurs="unbounded">
    <xsd:element name="nodeStatus" type="Directory:NodeStatusType"/>
  </xsd:sequence>
</xsd:complexType>

<xsd:complexType name="ServiceDetailsType">
  <xsd:annotation>
    <xsd:documentation>
      This structure holds all information required by the Directory
      service for a single service
    </xsd:documentation>
  </xsd:annotation>
  <xsd:sequence>
    <xsd:element name="area" type="MAL:Identifier"/>
    <xsd:element name="service" type="MAL:Identifier"/>
    <xsd:element name="version" type="MAL:Short"/>
    <xsd:element name="providers"
type="Directory:ServiceProviderInformationListType"/>
  </xsd:sequence>
</xsd:complexType>

<xsd:complexType name="ServiceDetailsListType">
  <xsd:annotation>
    <xsd:documentation>
      This type represents a list of ServiceDetails structures.
    </xsd:documentation>
  </xsd:annotation>
  <xsd:sequence minOccurs="1" maxOccurs="unbounded">
    <xsd:element name="serviceDetails" type="Directory:ServiceDetailsType"/>
  </xsd:sequence>
</xsd:complexType>

<xsd:complexType name="ServiceProviderInformationType">
  <xsd:annotation>
    <xsd:documentation>
      This structure holds all the information required by the Directory
      Service about a provider of a service and its capabilities. The
      structure contains a list of ServiceAddress structures; a service may
      support more than one transport technology and therefore can be
      reached using more than one address
    </xsd:documentation>
  </xsd:annotation>
  <xsd:sequence>
    <xsd:element name="serviceProviderName" type="MAL:Identifier"/>
    <xsd:element name="supportedCapabilities" type="MAL:IntegerList"/>
    <xsd:element name="serviceProperties" type="MAL:NamedValueListType"/>
    <xsd:element name="serviceAddresses"
type="Directory:ServiceAddressListType"/>
  </xsd:sequence>
</xsd:complexType>

<xsd:complexType name="ServiceProviderInformationListType">
  <xsd:annotation>
    <xsd:documentation>
      This type represents a list of ServiceProviderInformation structures.
    </xsd:documentation>
  </xsd:annotation>
  <xsd:sequence minOccurs="1" maxOccurs="unbounded">
```





```
<xsd:element name="serviceProviderInformation"
type="Directory:ServiceProviderInformationType"/>
</xsd:sequence>
</xsd:complexType>

<xsd:complexType name="ServiceAddressType">
  <xsd:annotation>
    <xsd:documentation>
      This structure holds all information required by the Directory
      service about a service URI and attributes relating to QoS. If the
      dataName field contains a value and the dataURI field is NULL, then
      the dataURI value of the named provider shall be used. The name
      provider shall exist as another ProviderInformation entry in the
      ServiceStatusNodeStaus
    </xsd:documentation>
  </xsd:annotation>
  <xsd:sequence>
    <xsd:element name="supportedLevels" type="MAL:QoSLevelList"/>
    <xsd:element name="qosProperties" type="MAL:NamedValueListType"/>
    <xsd:element name="priorityLevels" type="MAL:IntegerList"/>
    <xsd:element name="serviceURI" type="MAL:URI" nillable="true"/>
    <xsd:element name="dataURI" type="MAL:URI" nillable="true"/>
    <xsd:element name="dataName" type="MAL:Identifier" nillable="true"/>
  </xsd:sequence>
</xsd:complexType>

<xsd:complexType name="ServiceAddressListType">
  <xsd:annotation>
    <xsd:documentation>
      This type represents a list of ServiceAddress structures.
    </xsd:documentation>
  </xsd:annotation>
  <xsd:sequence minOccurs="1" maxOccurs="unbounded">
    <xsd:element name="serviceAddress"
type="Directory:ServiceAddressType"/>
  </xsd:sequence>
</xsd:complexType>

<xsd:complexType name="DomainLinkType">
  <xsd:annotation>
    <xsd:documentation>
      This structure holds the link information for linking on directory
      service to another. It holds a DomainOccurrence structure that is
      the Node on the Directory service tree that is actually held in
      the external directory service, it also holds a ServiceInformation
      Provider structure taht provides all the informatino required to
      contact the external directory service
    </xsd:documentation>
  </xsd:annotation>
  <xsd:sequence>
    <xsd:element name="domainInfo" type="Directory:DomainOccurrenceType"/>
    <xsd:element name="directoryInfo"
type="Directory:ServiceProviderInformationType"/>
  </xsd:sequence>
</xsd:complexType>

<xsd:complexType name="DomainLinkListType">
  <xsd:annotation>
    <xsd:documentation>
      This type represents a list of DomainLink structures.
    </xsd:documentation>
  </xsd:annotation>
  <xsd:sequence minOccurs="1" maxOccurs="unbounded">
    <xsd:element name="domainLink" type="Directory:DomainLinkType"/>
  </xsd:sequence>
</xsd:complexType>
```

---

```
<xsd:complexType name="ServiceFilterType">
  <xsd:annotation>
    <xsd:documentation>
      This structure holds all information required by the Directory
      service for the service lookup operation
    </xsd:documentation>
  </xsd:annotation>
  <xsd:sequence>
    <xsd:element name="domainOccurrence" type="Common:OccurrenceKeyType"/>
    <xsd:element name="area" type="MAL:Identifier" nillable="true"/>
    <xsd:element name="service" type="MAL:Identifier" nillable="true"/>
    <xsd:element name="version" type="MAL:Short" nillable="true"/>
    <xsd:element name="requiredCapabilities" type="MAL:IntegerList"
nillable="true"/>
    <xsd:element name="serviceProviderName" type="MAL:String"
nillable="true"/>
  </xsd:sequence>
</xsd:complexType>
</xsd:schema>
```

**Listing 5-6 Schema for Directory Service Structures**

#### **5.2.4 DIRECTORY SERVICE OPERATION STRUCTURES**

Removed at Phase One Review 03/18/2010. The information is contained in the Mission Operations specifications.

#### **5.2.5 DIRECTORY SERVICE WSDL**

Removed at Phase One Review 03/18/2010. The information is contained in the Mission Operations specifications.

## 6 SERVICE CONFIGURATION

### 6.1 ACTION SERVICE

#### 6.1.1 XTCE ENTITY DEFINITIONS

The Action Service configuration data is provided in XTCE format. The data is contained in Listing 6-1.

```
<?xml version="1.0" encoding="UTF-8"?>
<xtce:SpaceSystem
  name="otf.dlr.smc.prototype"
  xsi:schemaLocation="http://www.omg.org/space/xtce
http://www.omg.org/spec/XTCE/20061101/06-11-06.xsd"
  xmlns:xtce="http://www.omg.org/space/xtce"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">

  <xtce:CommandMetaData>

    <xtce:ParameterTypeSet>

      <xtce:IntegerParameterType name="JSDC00CC0780KType"
        shortDescription="APID EXT.">
    </xtce:IntegerParameterType>

      <xtce:IntegerParameterType name="JSDC00CC0800KType"
        shortDescription="Command Code">
    </xtce:IntegerParameterType>

      <xtce:IntegerParameterType name="LAPR96IM0152KType"
        shortDescription="RPCM_LA1B_A_RPC_04_C1">
    </xtce:IntegerParameterType>

      <xtce:IntegerParameterType name="LAPR96IM0350KType"
        shortDescription="RPCM_LA1B_A_RPC_04_Op">
    </xtce:IntegerParameterType>

      <xtce:IntegerParameterType name="P6PS96IM0032KType"
        shortDescription="SSU_2B_PVCE_1_2_3_Off">
    </xtce:IntegerParameterType>

      <xtce:IntegerParameterType name="P6PS96IM0035KType"
        shortDescription="SSU_2B_PVCE_1_2_3_On">
    </xtce:IntegerParameterType>

      <xtce:IntegerParameterType name="SPAREType"
        shortDescription="">
    </xtce:IntegerParameterType>

      <xtce:IntegerParameterType name="USDG00CC0110KType"
        shortDescription="Version Number">
    </xtce:IntegerParameterType>

      <xtce:IntegerParameterType name="USDG00CC0140KType"
        shortDescription="APID">
    </xtce:IntegerParameterType>

      <xtce:IntegerParameterType name="USDG00CC0220KType"
        shortDescription="Packet Sequence Count">
```

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```

</xtce:IntegerParameterType>

<xtce:IntegerParameterType name="USDG00CC0300KType"
  shortDescription="Packet Length">
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<xtce:IntegerParameterType name="USDG00CC0400KType"
  shortDescription="Coarse Time">
</xtce:IntegerParameterType>

<xtce:IntegerParameterType name="USDG00CC0610KType"
  shortDescription="Fine Time">
</xtce:IntegerParameterType>

<xtce:IntegerParameterType name="USDG00CC0810KType"
  shortDescription="Packet ID Command ID">
</xtce:IntegerParameterType>

<xtce:IntegerParameterType name="USDG00CC0820KType"
  shortDescription="Function Code">
</xtce:IntegerParameterType>

<xtce:IntegerParameterType name="USDG00CC1001KType"
  shortDescription="LSM Override Code">
</xtce:IntegerParameterType>

<xtce:IntegerParameterType name="USPZ20MD0128KType"
  shortDescription="RPCM_Switches_Close">
</xtce:IntegerParameterType>

<xtce:IntegerParameterType name="USPZ21MD1983KType"
  shortDescription="PV_PSN_Targeted_Mode_Select">
</xtce:IntegerParameterType>

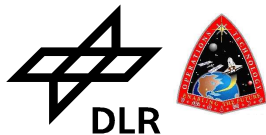
<xtce:EnumeratedParameterType name="JSDC00CC0760KType"
  shortDescription="Command Flag 2">
  <xtce:EnumerationList>
    <xtce:Enumeration label="All commands except for FMT Commands"
value="0"/>
    <xtce:Enumeration label="FMT Commands" value="1"/>
  </xtce:EnumerationList>
</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="USDG00CC0120KType"
  shortDescription="Type Core">
  <xtce:EnumerationList>
    <xtce:Enumeration label="Core Packet" value="0"/>
    <xtce:Enumeration label="Payload Packet" value="1"/>
  </xtce:EnumerationList>
</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="USDG00CC0130KType"
  shortDescription="Secondary Header Flag">
  <xtce:EnumerationList>
    <xtce:Enumeration label="Secondary Header Present" value="1"/>
  </xtce:EnumerationList>
</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="USDG00CC0210KType"
  shortDescription="Sequence Flags">
  <xtce:EnumerationList>
    <xtce:Enumeration label="Unsegmented Data" value="3"/>
  </xtce:EnumerationList>

```



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</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="USDG00CC0620KType"
  shortDescription="Time ID">
  <xtce:EnumerationList>
    <xtce:Enumeration label="Time Field Not Used for Authentication"
value="0"/>
    <xtce:Enumeration label="Time Field Is Used for Authentication"
value="1"/>
  </xtce:EnumerationList>
</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="USDG00CC0630KType"
  shortDescription="Checkword Indication">
  <xtce:EnumerationList>
    <xtce:Enumeration label="Checkword Present" value="1"/>
  </xtce:EnumerationList>
</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="JSDC00CC06C0KType"
  shortDescription="Packet Type (NASDA)">
  <xtce:EnumerationList>
    <xtce:Enumeration label="CCSDS Command Packet - RT Payload Cmd"
value="10"/>
    <xtce:Enumeration label="CCSDS Command Packet - Essential Command"
value="8"/>
    <xtce:Enumeration label="CCSDS Command Packet - System Command"
value="9"/>
  </xtce:EnumerationList>
</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="USDG00CC0650KType"
  shortDescription="Packet Type">
  <xtce:EnumerationList>
    <xtce:Enumeration label="CCSDS Command Packet - RT Payload Cmd"
value="10"/>
    <xtce:Enumeration label="CCSDS Command Packet - Essential Command"
value="8"/>
    <xtce:Enumeration label="CCSDS Command Packet - System Command"
value="9"/>
  </xtce:EnumerationList>
</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="USDG00CC0710KType"
  shortDescription="Element ID">
  <xtce:EnumerationList>
    <xtce:Enumeration label="NASA defines the packet" value="1"/>
    <xtce:Enumeration label="NASDA owns the packet definition"
value="3"/>
    <xtce:Enumeration label="RSA owns the packet definition" value="4"/>
    <xtce:Enumeration label="CSA owns the packet definition" value="5"/>
    <xtce:Enumeration label="ASI owns the packet definition" value="7"/>
  </xtce:EnumerationList>
</xtce:EnumeratedParameterType>

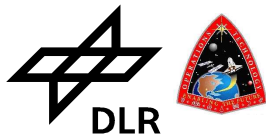
<xtce:EnumeratedParameterType name="USDG00CC0712KType"
  shortDescription="Packet Data Type">
  <xtce:EnumerationList>
    <xtce:Enumeration label="Command Packet" value="0"/>
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</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="USDG00CC0720KType"
```

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shortDescription="Logical Destination Processor">
<xtce:EnumerationList>
  <xtce:Enumeration label="C&C_HOT" value="10"/>
  <xtce:Enumeration label="RWS_CEU_Cupola" value="100"/>
  <xtce:Enumeration label="JEM_RMS" value="103"/>
  <xtce:Enumeration label="PL_Pri" value="105"/>
  <xtce:Enumeration label="PL_Back" value="106"/>
  <xtce:Enumeration label="C&C_WARM" value="11"/>
  <xtce:Enumeration label="C&C_COLD" value="12"/>
  <xtce:Enumeration label="N2-1" value="142"/>
  <xtce:Enumeration label="N2-2" value="143"/>
  <xtce:Enumeration label="RWS_CEU_Active" value="148"/>
  <xtce:Enumeration label="HCZ_Primary" value="151"/>
  <xtce:Enumeration label="HCZ_Backup" value="152"/>
  <xtce:Enumeration label="N3-1" value="153"/>
  <xtce:Enumeration label="N3-2" value="154"/>
  <xtce:Enumeration label="Int_Primary_N1_Pri" value="158"/>
  <xtce:Enumeration label="PCS C-1" value="2"/>
  <xtce:Enumeration label="N1_Primary" value="20"/>
  <xtce:Enumeration label="N1_Secondary" value="21"/>
  <xtce:Enumeration label="GNC_Pri" value="22"/>
  <xtce:Enumeration label="GNC_Back" value="23"/>
  <xtce:Enumeration label="PEHG-APM" value="238"/>
  <xtce:Enumeration label="PEHG-1" value="254"/>
  <xtce:Enumeration label="PEHG-2" value="255"/>
  <xtce:Enumeration label="APS-1" value="28"/>
  <xtce:Enumeration label="APS-2" value="29"/>
  <xtce:Enumeration label="PCS C-2" value="3"/>
  <xtce:Enumeration label="JCP_Active" value="33"/>
  <xtce:Enumeration label="EXT_Pri" value="35"/>
  <xtce:Enumeration label="EXT_Back" value="36"/>
  <xtce:Enumeration label="STR" value="37"/>
  <xtce:Enumeration label="PTR" value="38"/>
  <xtce:Enumeration label="P1-2" value="39"/>
  <xtce:Enumeration label="PCS C-3" value="4"/>
  <xtce:Enumeration label="P1-1" value="40"/>
  <xtce:Enumeration label="S1-1" value="41"/>
  <xtce:Enumeration label="S1-2" value="42"/>
  <xtce:Enumeration label="S0-1" value="43"/>
  <xtce:Enumeration label="S0-2" value="44"/>
  <xtce:Enumeration label="PMCU_Pri" value="49"/>
  <xtce:Enumeration label="PCS C-4" value="5"/>
  <xtce:Enumeration label="PMCU_Back" value="50"/>
  <xtce:Enumeration label="PVCU_S4_Pri" value="51"/>
  <xtce:Enumeration label="PVCU_S4_Bk" value="52"/>
  <xtce:Enumeration label="PVCU_S6_Pri" value="53"/>
  <xtce:Enumeration label="PVCU_S6_Bk" value="54"/>
  <xtce:Enumeration label="PVCU_P4_Pri" value="55"/>
  <xtce:Enumeration label="PVCU_P4_Bk" value="56"/>
  <xtce:Enumeration label="PVCU_P6_Pri" value="57"/>
  <xtce:Enumeration label="PVCU_P6_Bk" value="58"/>
  <xtce:Enumeration label="S3-1" value="59"/>
  <xtce:Enumeration label="PCS C-5" value="6"/>
  <xtce:Enumeration label="S3-2" value="60"/>
  <xtce:Enumeration label="P3-2" value="61"/>
  <xtce:Enumeration label="P3-1" value="62"/>
  <xtce:Enumeration label="PCS C-6" value="7"/>
  <xtce:Enumeration label="INT_Primary" value="72"/>
  <xtce:Enumeration label="INT_Backup" value="73"/>
  <xtce:Enumeration label="LAB-1" value="74"/>
  <xtce:Enumeration label="LAB-2" value="75"/>
  <xtce:Enumeration label="LAB-3" value="76"/>
  <xtce:Enumeration label="PCS C-7" value="8"/>

```



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<xtce:Enumeration label="Airlock" value="80"/>
<xtce:Enumeration label="CH_MEC" value="82"/>
<xtce:Enumeration label="CH_IV_CPDS" value="83"/>
<xtce:Enumeration label="CH_TEPC" value="84"/>
<xtce:Enumeration label="CH_CPDS-1" value="85"/>
<xtce:Enumeration label="CH_CPDS-2" value="86"/>
<xtce:Enumeration label="CH_CPDS-3" value="87"/>
<xtce:Enumeration label="CH_VOA" value="89"/>
<xtce:Enumeration label="PCS C-8" value="9"/>
<xtce:Enumeration label="N1-1" value="92"/>
<xtce:Enumeration label="N1-2" value="93"/>
<xtce:Enumeration label="MPLM" value="94"/>
<xtce:Enumeration label="RWS_CEU_Lab" value="99"/>
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</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="USDG00CC0812KType"
  shortDescription="Command Queue">
  <xtce:EnumerationList>
    <xtce:Enumeration label="Command goes into the Application Queue"
value="0"/>
    <xtce:Enumeration label="Command goes into the System Queue"
value="1"/>
  </xtce:EnumerationList>
</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="USDG00CC0910KType"
  shortDescription="ASCR Mode, Untended State">
  <xtce:EnumerationList>
    <xtce:Enumeration label="Message Effective in this mode" value="1"/>
  </xtce:EnumerationList>
</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="USDG00CC0911KType"
  shortDescription="Survival Mode, Untended State">
  <xtce:EnumerationList>
    <xtce:Enumeration label="Message Effective in this mode" value="1"/>
  </xtce:EnumerationList>
</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="USDG00CC0912KType"
  shortDescription="External Ops Mode, Untended State">
  <xtce:EnumerationList>
    <xtce:Enumeration label="Message Effective in this mode" value="1"/>
  </xtce:EnumerationList>
</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="USDG00CC0913KType"
  shortDescription="Proximity Ops Mode, Untended State">
  <xtce:EnumerationList>
    <xtce:Enumeration label="Message Effective in this mode" value="1"/>
  </xtce:EnumerationList>
</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="USDG00CC0914KType"
  shortDescription="Reboost Mode, Untended State">
  <xtce:EnumerationList>
    <xtce:Enumeration label="Message Effective in this mode" value="1"/>
  </xtce:EnumerationList>
</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="USDG00CC0915KType"
  shortDescription="Microgravity Mode, Untended State">
```



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<xtce:EnumerationList>
  <xtce:Enumeration label="Message Effective in this mode" value="1"/>
</xtce:EnumerationList>
</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="USDG00CC0916KType"
  shortDescription="Standard Mode, Untended State">
  <xtce:EnumerationList>
    <xtce:Enumeration label="Message Effective in this mode" value="1"/>
  </xtce:EnumerationList>
</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="USDG00CC1010KType"
  shortDescription="ASCR Mode, Habitable State">
  <xtce:EnumerationList>
    <xtce:Enumeration label="Message Effective in this mode" value="1"/>
  </xtce:EnumerationList>
</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="USDG00CC1011KType"
  shortDescription="Survival Mode, Habitable State">
  <xtce:EnumerationList>
    <xtce:Enumeration label="Message Effective in this mode" value="1"/>
  </xtce:EnumerationList>
</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="USDG00CC1012KType"
  shortDescription="External Ops Mode, Habitable State">
  <xtce:EnumerationList>
    <xtce:Enumeration label="Message Effective in this mode" value="1"/>
  </xtce:EnumerationList>
</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="USDG00CC1013KType"
  shortDescription="Proximity Ops Mode, Habitable State">
  <xtce:EnumerationList>
    <xtce:Enumeration label="Message Effective in this mode" value="1"/>
  </xtce:EnumerationList>
</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="USDG00CC1014KType"
  shortDescription="Reboost Mode, Habitable State">
  <xtce:EnumerationList>
    <xtce:Enumeration label="Message Effective in this mode" value="1"/>
  </xtce:EnumerationList>
</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="USDG00CC1015KType"
  shortDescription="Microgravity Mode, Habitable State">
  <xtce:EnumerationList>
    <xtce:Enumeration label="Message Effective in this mode" value="1"/>
  </xtce:EnumerationList>
</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="USDG00CC1016KType"
  shortDescription="Standard Mode, Habitable State">
  <xtce:EnumerationList>
    <xtce:Enumeration label="Message Effective in this mode" value="1"/>
  </xtce:EnumerationList>
</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="USPZ21MD1381KType"
  shortDescription="PV_ECU_BGA_Targeted_Mode">
```



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<xtce:EnumerationList>
  <xtce:Enumeration label="Autotrack" value="0"/>
  <xtce:Enumeration label="Directed Position" value="1"/>
  <xtce:Enumeration label="Rate" value="2"/>
  <xtce:Enumeration label="Manual Free" value="3"/>
  <xtce:Enumeration label="Null" value="4"/>
  <xtce:Enumeration label="Safe Lock" value="5"/>
  <xtce:Enumeration label="Blind" value="6"/>
</xtce:EnumerationList>
</xtce:EnumeratedParameterType>

<xtce:EnumeratedParameterType name="USPZ20MD0102KType"
  shortDescription="RPCM_x">
  <xtce:EnumerationList>
    <xtce:Enumeration label="RPCM LAP3-1A4A-A34" value="44"/>
    <xtce:Enumeration label="RPCM LAC6-2A3B-A25" value="45"/>
    <xtce:Enumeration label="RPCM LAC6-2A3B-A26" value="46"/>
    <xtce:Enumeration label="RPCM LAC6-2A3B-A31" value="47"/>
    <xtce:Enumeration label="RPCM LAP3-1A4A-A32" value="48"/>
    <xtce:Enumeration label="RPCM LAP3-1A4A-A33" value="49"/>
    <xtce:Enumeration label="RPCM LAP3-1A4A-A38" value="50"/>
    <xtce:Enumeration label="RPCM CAM-1A-A" value="51"/>
    <xtce:Enumeration label="RPCM CAM-1A-B" value="52"/>
    <xtce:Enumeration label="RPCM CAM-1A-C" value="53"/>
    <xtce:Enumeration label="RPCM CAM-1A-D" value="54"/>
    <xtce:Enumeration label="RPCM CAM-3B-B" value="55"/>
    <xtce:Enumeration label="RPCM CAM-3B-C" value="56"/>
    <xtce:Enumeration label="RPCM CAM-3B-D" value="57"/>
    <xtce:Enumeration label="RPCM N3O4-1B4A-1F" value="58"/>
    <xtce:Enumeration label="RPCM N3O5-2A2B-1F" value="59"/>
    <xtce:Enumeration label="RPCM LAAFT-2B-A13" value="60"/>
    <xtce:Enumeration label="RPCM LAAFT-2B-A24" value="61"/>
    <xtce:Enumeration label="RPCM LAC6-2A3B-A29" value="62"/>
    <xtce:Enumeration label="RPCM LAF2-2B-A58" value="63"/>
    <xtce:Enumeration label="RPCM LAF4-2B-A59" value="64"/>
    <xtce:Enumeration label="RPCM LAFWD-1B-A1" value="65"/>
    <xtce:Enumeration label="RPCM LAFWD-1B-A11" value="66"/>
    <xtce:Enumeration label="RPCM LAP5-1A4A-A60" value="67"/>
    <xtce:Enumeration label="RPCM LAS5-2A3B-A61" value="68"/>
    <xtce:Enumeration label="RPCM N2NAD-1B4B-A" value="69"/>
    <xtce:Enumeration label="RPCM N2PRT-2A3A-A" value="70"/>
    <xtce:Enumeration label="RPCM N2STB-1B4A-B" value="71"/>
    <xtce:Enumeration label="RPCM N2ZEN-2B3A-B" value="72"/>
    <xtce:Enumeration label="RPCM CAM-3B-A" value="73"/>
    <xtce:Enumeration label="RPCM N2STB-1B4A-C" value="74"/>
    <xtce:Enumeration label="RPCM N2PRT-2A3A-C" value="75"/>
    <xtce:Enumeration label="RPCM LAP4-2A3B-A63" value="90"/>
  </xtce:EnumerationList>
</xtce:EnumeratedParameterType>

</xtce:ParameterTypeSet>

<xtce:ArgumentTypeSet>

  <xtce:EnumeratedArgumentType name="JSDC00SWV156KType"
  shortDescription="HCTL_heater_mode">
    <xtce:EnumerationList>
      <xtce:Enumeration label="Temp_cnt1" value="1"></xtce:Enumeration>
      <xtce:Enumeration label="Heater_on" value="2"></xtce:Enumeration>
      <xtce:Enumeration label="Heater_off" value="3"></xtce:Enumeration>
    </xtce:EnumerationList>
  </xtce:EnumeratedArgumentType>

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    <xtce:EnumeratedArgumentType name="USPZ21MD1986KType"
shortDescription="PV_PSN_Targeted_Mode">
    <xtce:EnumerationList>
    <xtce:Enumeration label="Fully Commanded"
value="0"></xtce:Enumeration>
    <xtce:Enumeration label="Autonomous" value="1"></xtce:Enumeration>
    <xtce:Enumeration label="Non-Solar Tracking"
value="2"></xtce:Enumeration>
    <xtce:Enumeration label="Contingency Safe"
value="3"></xtce:Enumeration>
    </xtce:EnumerationList>
    </xtce:EnumeratedArgumentType>

    <xtce:EnumeratedArgumentType name="USPZ21MD1003KType"
shortDescription="PV_Cmd_Hdr">
    <xtce:EnumerationList>
    <xtce:Enumeration label="Arm" value="1"></xtce:Enumeration>
    <xtce:Enumeration label="Fire" value="2"></xtce:Enumeration>
    <xtce:Enumeration label="2-Step" value="4"></xtce:Enumeration>
    <xtce:Enumeration label="1-Step" value="8"></xtce:Enumeration>
    </xtce:EnumerationList>
    </xtce:EnumeratedArgumentType>

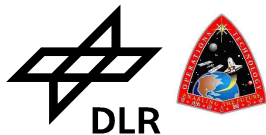
    <xtce:EnumeratedArgumentType name="USPZ20MD0129KType"
shortDescription="RPCM_Switches_Close_Cmd_Hdr">
    <xtce:EnumerationList>
    <xtce:Enumeration label="Arm" value="1"></xtce:Enumeration>
    <xtce:Enumeration label="Fire" value="2"></xtce:Enumeration>
    <xtce:Enumeration label="2-Step" value="4"></xtce:Enumeration>
    <xtce:Enumeration label="1-Step" value="8"></xtce:Enumeration>
    </xtce:EnumerationList>
    </xtce:EnumeratedArgumentType>

    <xtce:EnumeratedArgumentType name="USPZ20MD0130KType"
shortDescription="RPCM_Close_Selected_Switches_1">
    <xtce:EnumerationList>
    <xtce:Enumeration label="No Change" value="0"></xtce:Enumeration>
    <xtce:Enumeration label="Switch 1" value="1"></xtce:Enumeration>
    <xtce:Enumeration label="Switch 8" value="128"></xtce:Enumeration>
    <xtce:Enumeration label="Switch 5" value="16"></xtce:Enumeration>
    <xtce:Enumeration label="Switch 2" value="2"></xtce:Enumeration>
    <xtce:Enumeration label="Switch 6" value="32"></xtce:Enumeration>
    <xtce:Enumeration label="Switch 3" value="4"></xtce:Enumeration>
    <xtce:Enumeration label="Switch 7" value="64"></xtce:Enumeration>
    <xtce:Enumeration label="Switch 4" value="8"></xtce:Enumeration>
    </xtce:EnumerationList>
    </xtce:EnumeratedArgumentType>

    <xtce:EnumeratedArgumentType name="USPZ20MD0132KType"
shortDescription="RPCM_Close_Selected_Switches_3">
    <xtce:EnumerationList>
    <xtce:Enumeration label="No Change" value="0"></xtce:Enumeration>
    <xtce:Enumeration label="Switch 17" value="1"></xtce:Enumeration>
    <xtce:Enumeration label="Switch 18" value="2"></xtce:Enumeration>
    </xtce:EnumerationList>
    </xtce:EnumeratedArgumentType>

    <xtce:EnumeratedArgumentType name="USPZ21MD1222KType"
shortDescription="PSN_x">
    <xtce:EnumerationList>
    <xtce:Enumeration label="PSN_S4LWR_1A"
value="16668"></xtce:Enumeration>

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<xtce:Enumeration label="PSN_S6LWR_3B"
value="16924"></xtce:Enumeration>
<xtce:Enumeration label="PSN_P4LWR_2A"
value="17180"></xtce:Enumeration>
<xtce:Enumeration label="PSN_P6LWR_4B"
value="17436"></xtce:Enumeration>
<xtce:Enumeration label="PSN_S4UPR_3A"
value="33052"></xtce:Enumeration>
<xtce:Enumeration label="PSN_S6UPR_1B"
value="33308"></xtce:Enumeration>
<xtce:Enumeration label="PSN_P4UPR_4A"
value="33564"></xtce:Enumeration>
<xtce:Enumeration label="PSN_P6UPR_2B"
value="33820"></xtce:Enumeration>
</xtce:EnumerationList>
</xtce:EnumeratedArgumentType>

<xtce:EnumeratedArgumentType name="USPZ20MD0131KType"
shortDescription="RPCM_Close_Selected_Switches_2">
  <xtce:EnumerationList>
    <xtce:Enumeration label="No Change" value="0"></xtce:Enumeration>
    <xtce:Enumeration label="Switch 9" value="1"></xtce:Enumeration>
    <xtce:Enumeration label="Switch 16" value="128"></xtce:Enumeration>
    <xtce:Enumeration label="Switch 13" value="16"></xtce:Enumeration>
    <xtce:Enumeration label="Switch 10" value="2"></xtce:Enumeration>
    <xtce:Enumeration label="Switch 14" value="32"></xtce:Enumeration>
    <xtce:Enumeration label="Switch 11" value="4"></xtce:Enumeration>
    <xtce:Enumeration label="Switch 15" value="64"></xtce:Enumeration>
    <xtce:Enumeration label="Switch 12" value="8"></xtce:Enumeration>
  </xtce:EnumerationList>
</xtce:EnumeratedArgumentType>

</xtce:ArgumentTypeSet>

<xtce:ParameterSet>

  <xtce:Parameter name="JSDC00CC0780K"
    shortDescription="APID EXT."
    parameterTypeRef="JSDC00CC0780KType"
    initialValue="0">
  </xtce:Parameter>

  <xtce:Parameter name="JSDC00CC0800K-1"
    shortDescription="Command Code"
    parameterTypeRef="JSDC00CC0800KType"
    initialValue="1973">
  </xtce:Parameter>

  <xtce:Parameter name="JSDC00CC0800K-2"
    shortDescription="Command Code"
    parameterTypeRef="JSDC00CC0800KType"
    initialValue="1974">
  </xtce:Parameter>

  <xtce:Parameter name="JSDC00CC0800K-3"
    shortDescription="Command Code"
    parameterTypeRef="JSDC00CC0800KType"
    initialValue="1975">
  </xtce:Parameter>

  <xtce:Parameter name="JSDC00CC0800K-4"
    shortDescription="Command Code"
    parameterTypeRef="JSDC00CC0800KType">
```

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        initialValue="1976">
</xtce:Parameter>

<xtce:Parameter name="LAPR96IM0152K-1"
  shortDescription="RPCM_LA1B_A_RPC_04_C1"
  parameterTypeRef="LAPR96IM0152KType"
  initialValue="0x007f007f">
</xtce:Parameter>

<xtce:Parameter name="LAPR96IM0152K-2"
  shortDescription="RPCM_LA1B_A_RPC_04_C1"
  parameterTypeRef="LAPR96IM0152KType"
  initialValue="0x020d0041">
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<xtce:Parameter name="LAPR96IM0152K-3"
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  parameterTypeRef="LAPR96IM0152KType"
  initialValue="0x00020008">
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<xtce:Parameter name="LAPR96IM0152K-4"
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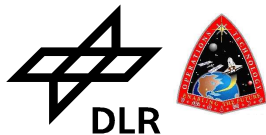
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  parameterTypeRef="P6PS96IM0032KType"
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<xtce:Parameter name="P6PS96IM0032K-2"
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  parameterTypeRef="P6PS96IM0032KType"
  initialValue="0x010f840d">
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  parameterTypeRef="P6PS96IM0032KType"
  initialValue="0x00020007">
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<xtce:Parameter name="P6PS96IM0035K-1"
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  initialValue="0x007f007f">
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  initialValue="0x010d840d">
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<xtce:Parameter name="P6PS96IM0035K-3"
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<xtce:Parameter name="SPARE"
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<xtce:Parameter name="USDG00CC0110K"
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  parameterTypeRef="USDG00CC0110KType"
  initialValue="0">
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<xtce:Parameter name="USDG00CC0140K-1"
  shortDescription="APID"
  parameterTypeRef="USDG00CC0140KType"
  initialValue="33">
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<xtce:Parameter name="USDG00CC0140K-2"
  shortDescription="APID"
  parameterTypeRef="USDG00CC0140KType"
  initialValue="57">
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<xtce:Parameter name="USDG00CC0140K-3"
  shortDescription="APID"
  parameterTypeRef="USDG00CC0140KType"
  initialValue="49">
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<xtce:Parameter name="USDG00CC0220K"
  shortDescription="Packet Sequence Count"
  parameterTypeRef="USDG00CC0220KType"
  initialValue="0">
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<xtce:Parameter name="USDG00CC0300K-1"
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<xtce:Parameter name="USDG00CC0300K-3"
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  parameterTypeRef="USDG00CC0300KType"
  initialValue="27">
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<xtce:Parameter name="USDG00CC0400K"
  shortDescription="Coarse Time"
  parameterTypeRef="USDG00CC0400KType"
  initialValue="0">
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<xtce:Parameter name="USDG00CC0610K"
  shortDescription="Fine Time"
  parameterTypeRef="USDG00CC0610KType"
  initialValue="0">
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<xtce:Parameter name="USDG00CC0810K"
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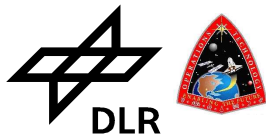
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  shortDescription="LSM Override Code"
  parameterTypeRef="USDG00CC1001KType"
  initialValue="0">
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<xtce:Parameter name="USPZ20MD0128K"
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  parameterTypeRef="USPZ20MD0128KType"
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<xtce:Parameter name="USPZ21MD1983K"
  shortDescription="PV_PSN_Targeted_Mode_Select"
  parameterTypeRef="USPZ21MD1983KType"
  initialValue="1409">
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<xtce:Parameter name="JSDC00CC0760K"
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  initialValue="0 - All commands except for FMT Commands">
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<xtce:Parameter name="USDG00CC0120K"
  shortDescription="Type Core"
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  initialValue="0 - Core Packet">
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<xtce:Parameter name="USDG00CC0210K"
  shortDescription="Sequence Flags"
  parameterTypeRef="USDG00CC0210KType"
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<xtce:Parameter name="USDG00CC0620K"
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  parameterTypeRef="USDG00CC0620KType"
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<xtce:Parameter name="USDG00CC0630K"
  shortDescription="Checksum Indication"
  parameterTypeRef="USDG00CC0630KType"
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<xtce:Parameter name="JSDC00CC06C0K"
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  parameterTypeRef="JSDC00CC06C0KType"
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<xtce:Parameter name="USDG00CC0650K"
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<xtce:Parameter name="USDG00CC0710K-1"
  shortDescription="Element ID"
  parameterTypeRef="USDG00CC0710KType"
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<xtce:Parameter name="USDG00CC0710K-2"
  shortDescription="Element ID"
  parameterTypeRef="USDG00CC0710KType"
  initialValue="1 - NASA defines the packet">
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<xtce:Parameter name="USDG00CC0712K"
  shortDescription="Packet Data Type"
  parameterTypeRef="USDG00CC0712KType"
  initialValue="0 - Command Packet">
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<xtce:Parameter name="USDG00CC0720K-1"
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<xtce:Parameter name="USDG00CC0720K-2"
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  parameterTypeRef="USDG00CC0720KType"
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<xtce:Parameter name="USDG00CC0812K"
  shortDescription="Command Queue"
  parameterTypeRef="USDG00CC0812KType"
  initialValue="0 - Command goes into the Application Queue">
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<xtce:Parameter name="USDG00CC0910K"
  shortDescription="ASCR Mode, Untended State"
  parameterTypeRef="USDG00CC0910KType"
  initialValue="1 - Message Effective in this mode">
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<xtce:Parameter name="USDG00CC0911K"
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  parameterTypeRef="USDG00CC0911KType"
  initialValue="1 - Message Effective in this mode">
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<xtce:Parameter name="USDG00CC0912K"
  shortDescription="External Ops Mode, Untended State"
  parameterTypeRef="USDG00CC0912KType"
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<xtce:Parameter name="USDG00CC0913K"
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  parameterTypeRef="USDG00CC0913KType"
  initialValue="1 - Message Effective in this mode">
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<xtce:Parameter name="USDG00CC0914K"
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<xtce:Parameter name="USDG00CC0915K"
  shortDescription="Microgravity Mode, Untended State"
  parameterTypeRef="USDG00CC0915KType"
  initialValue="1 - Message Effective in this mode">
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<xtce:Parameter name="USDG00CC0916K"
  shortDescription="Standard Mode, Untended State"
  parameterTypeRef="USDG00CC0916KType"
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<xtce:Parameter name="USDG00CC1010K"
  shortDescription="ASCR Mode, Habitable State"
  parameterTypeRef="USDG00CC1010KType"
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<xtce:Parameter name="USDG00CC1011K"
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<xtce:Parameter name="USDG00CC1013K"
  shortDescription="Proximity Ops Mode, Habitable State"
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  initialValue="1 - Message Effective in this mode">
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<xtce:Parameter name="USDG00CC1014K"
  shortDescription="Reboost Mode, Habitable State"
  parameterTypeRef="USDG00CC1014KType"
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<xtce:Parameter name="USDG00CC1015K"
  shortDescription="Microgravity Mode, Habitable State"
  parameterTypeRef="USDG00CC1015KType"
  initialValue="1 - Message Effective in this mode">
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<xtce:Parameter name="USDG00CC1016K"
  shortDescription="Standard Mode, Habitable State"
  parameterTypeRef="USDG00CC1016KType"
  initialValue="1 - Message Effective in this mode">
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<xtce:Parameter name="USPZ21MD1381K-1"
  shortDescription="PV_ECU_BGA_Targeted_Mode"
  parameterTypeRef="USPZ21MD1381KType"
  initialValue="0 - Autotrack">
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<xtce:Parameter name="USPZ21MD1381K-2"
  shortDescription="PV_ECU_BGA_Targeted_Mode"
  parameterTypeRef="USPZ21MD1381KType"
  initialValue="4 - Null">
</xtce:Parameter>

<xtce:Parameter name="USPZ20MD0102K"
  shortDescription="RPCM_x"
  parameterTypeRef="USPZ20MD0102KType"
  initialValue="65 - RPCM LAFWD-1B-A1">
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</xtce:ParameterSet>

<xtce:MetaCommandSet>

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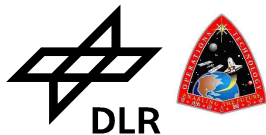
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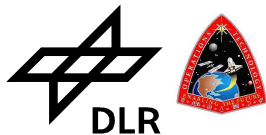
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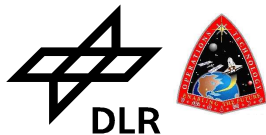
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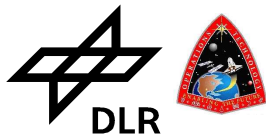
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      <xtce:ArgumentRefEntry argumentRef="USPZ21MD1003K"/>
      <xtce:ArgumentRefEntry parameterRef="USPZ21MD1381K"/>
      <xtce:ArgumentRefEntry argumentRef="USPZ21MD1986K"/>
    </xtce:EntryList>
  </xtce:CommandContainer>
</xtce:ArgumentList>
```



```
<xtce:Argument name="USPZ21MD1222K"
  argumentTypeRef="USPZ21MD1222KType"
  shortDescription="PSN_x"
  initialValue="17436">
</xtce:Argument>
<xtce:Argument name="USPZ21MD1003K"
  argumentTypeRef="USPZ21MD1003KType"
  shortDescription="PV_Cmd_Hdr"
  initialValue="2">
</xtce:Argument>
<xtce:Argument name="USPZ21MD1986K"
  argumentTypeRef="USPZ21MD1986KType"
  shortDescription="PV_PSN_Targeted_Mode"
  initialValue="1">
</xtce:Argument>
</xtce:ArgumentList>
</xtce:MetaCommand>

<xtce:MetaCommand name="P6PX96IM0055K"
shortDescription="P6_BGA_Null_Ch_Tgtd_Mode_Sel_Tmplt">
  <xtce:CommandContainer name="P6PX96IM0055KPacket">
    <xtce:EntryList>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0110K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0120K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0130K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0140K-2"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0210K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0220K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0300K-2"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0400K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0610K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0620K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0630K"/>
      <xtce:ParameterRefEntry parameterRef="SPARE"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0650K"/>
      <xtce:ParameterRefEntry parameterRef="SPARE"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0710K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0712K"/>
      <xtce:ParameterRefEntry parameterRef="SPARE"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0720K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0810K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0812K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0820K"/>
      <xtce:ParameterRefEntry parameterRef="SPARE"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0910K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0911K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0912K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0913K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0914K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0915K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0916K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC1001K"/>
      <xtce:ParameterRefEntry parameterRef="SPARE"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC1010K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC1011K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC1012K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC1013K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC1014K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC1015K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC1016K"/>
      <xtce:ParameterRefEntry parameterRef="USPZ21MD1983K"/>
      <xtce:ArgumentRefEntry argumentRef="USPZ21MD1222K"/>
      <xtce:ArgumentRefEntry argumentRef="USPZ21MD1003K"/>
    </xtce:EntryList>
  </xtce:CommandContainer>
</xtce:MetaCommand>
```



```
<xtce:ParameterRefEntry parameterRef="USPZ21MD1381K"/>
<xtce:ArgumentRefEntry argumentRef="USPZ21MD1986K"/>
</xtce:EntryList>
</xtce:CommandContainer>
<xtce:ArgumentList>
  <xtce:Argument name="USPZ21MD1222K"
    argumentTypeRef="USPZ21MD1222KType"
    shortDescription="PSN_x"
    initialValue="17436">
  </xtce:Argument>
  <xtce:Argument name="USPZ21MD1003K"
    argumentTypeRef="USPZ21MD1003KType"
    shortDescription="PV_Cmd_Hdr"
    initialValue="2">
  </xtce:Argument>
  <xtce:Argument name="USPZ21MD1986K"
    argumentTypeRef="USPZ21MD1986KType"
    shortDescription="PV_PSN_Targeted_Mode"
    initialValue="2">
  </xtce:Argument>
</xtce:ArgumentList>
</xtce:MetaCommand>

<xtce:MetaCommand name="LAPR96IM0152K"
shortDescription="RPCM_LA1B_A_RPC_04_C1">
  <xtce:CommandContainer name="LAPR96IM0152KPacket">
    <xtce:EntryList>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0110K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0120K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0130K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0140K-3"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0210K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0220K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0300K-3"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0400K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0610K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0620K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0630K"/>
      <xtce:ParameterRefEntry parameterRef="SPARE"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0650K"/>
      <xtce:ParameterRefEntry parameterRef="SPARE"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0710K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0712K"/>
      <xtce:ParameterRefEntry parameterRef="SPARE"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0720K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0810K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0812K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0820K"/>
      <xtce:ParameterRefEntry parameterRef="LAPR96IM0152K-1"/>
      <xtce:ParameterRefEntry parameterRef="LAPR96IM0152K-2"/>
      <xtce:ParameterRefEntry parameterRef="LAPR96IM0152K-3"/>
      <xtce:ParameterRefEntry parameterRef="LAPR96IM0152K-4"/>
    </xtce:EntryList>
  </xtce:CommandContainer>
</xtce:MetaCommand>

<xtce:MetaCommand name="LAPR96IM0350K"
shortDescription="RPCM_LA1B_A_RPC_04_Op">
  <xtce:CommandContainer name="LAPR96IM0350KPacket">
    <xtce:EntryList>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0110K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0120K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0130K"/>
```





```
<xtce:ParameterRefEntry parameterRef="USDG00CC0140K-3" />
<xtce:ParameterRefEntry parameterRef="USDG00CC0210K" />
<xtce:ParameterRefEntry parameterRef="USDG00CC0220K" />
<xtce:ParameterRefEntry parameterRef="USDG00CC0300K-3" />
<xtce:ParameterRefEntry parameterRef="USDG00CC0400K" />
<xtce:ParameterRefEntry parameterRef="USDG00CC0610K" />
<xtce:ParameterRefEntry parameterRef="USDG00CC0620K" />
<xtce:ParameterRefEntry parameterRef="USDG00CC0630K" />
<xtce:ParameterRefEntry parameterRef="SPARE" />
<xtce:ParameterRefEntry parameterRef="USDG00CC0650K" />
<xtce:ParameterRefEntry parameterRef="SPARE" />
<xtce:ParameterRefEntry parameterRef="USDG00CC0710K" />
<xtce:ParameterRefEntry parameterRef="USDG00CC0712K" />
<xtce:ParameterRefEntry parameterRef="SPARE" />
<xtce:ParameterRefEntry parameterRef="USDG00CC0720K" />
<xtce:ParameterRefEntry parameterRef="USDG00CC0810K" />
<xtce:ParameterRefEntry parameterRef="USDG00CC0812K" />
<xtce:ParameterRefEntry parameterRef="USDG00CC0820K" />
<xtce:ParameterRefEntry parameterRef="LAPR96IM0350K-1" />
<xtce:ParameterRefEntry parameterRef="LAPR96IM0350K-2" />
<xtce:ParameterRefEntry parameterRef="LAPR96IM0350K-3" />
<xtce:ParameterRefEntry parameterRef="LAPR96IM0350K-4" />
</xtce:EntryList>
</xtce:CommandContainer>
</xtce:MetaCommand>

<xtce:MetaCommand name="LAPR96IM0035K"
shortDescription="RPCM_LA1B_A_RPC_Cl_Tmplt">
  <xtce:CommandContainer name="LAPR96IM0035KPacket">
    <xtce:EntryList>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0110K" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC0120K" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC0130K" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC0140K-3" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC0210K" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC0220K" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC0300K-3" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC0400K" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC0610K" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC0620K" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC0630K" />
      <xtce:ParameterRefEntry parameterRef="SPARE" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC0650K" />
      <xtce:ParameterRefEntry parameterRef="SPARE" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC0710K" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC0712K" />
      <xtce:ParameterRefEntry parameterRef="SPARE" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC0720K" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC0810K" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC0812K" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC0820K" />
      <xtce:ParameterRefEntry parameterRef="SPARE" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC0910K" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC0911K" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC0912K" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC0913K" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC0914K" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC0915K" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC0916K" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC1001K" />
      <xtce:ParameterRefEntry parameterRef="SPARE" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC1010K" />
      <xtce:ParameterRefEntry parameterRef="USDG00CC1011K" />
    </xtce:EntryList>
  </xtce:CommandContainer>
</xtce:MetaCommand>
```

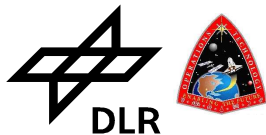
```

<xtce:ParameterRefEntry parameterRef="USDG00CC1012K"/>
<xtce:ParameterRefEntry parameterRef="USDG00CC1013K"/>
<xtce:ParameterRefEntry parameterRef="USDG00CC1014K"/>
<xtce:ParameterRefEntry parameterRef="USDG00CC1015K"/>
<xtce:ParameterRefEntry parameterRef="USDG00CC1016K"/>
<xtce:ParameterRefEntry parameterRef="USPZ20MD0128K"/>
<xtce:ParameterRefEntry parameterRef="USPZ20MD0102K"/>
<xtce:ArgumentRefEntry argumentRef="USPZ20MD0129K"/>
<xtce:ArgumentRefEntry argumentRef="USPZ20MD0130K"/>
<xtce:ArgumentRefEntry argumentRef="USPZ20MD0131K"/>
<xtce:ArgumentRefEntry argumentRef="USPZ20MD0132K"/>
</xtce:EntryList>
</xtce:CommandContainer>
<xtce:ArgumentList>
  <xtce:Argument name="USPZ20MD0129K"
    argumentTypeRef="USPZ20MD0129KType"
    shortDescription="RPCM_Switches_Close_Cmd_Hdr"
    initialValue="2">
  </xtce:Argument>
  <xtce:Argument name="USPZ20MD0130K"
    argumentTypeRef="USPZ20MD0130KType"
    shortDescription="RPCM_Close_Selected_Switches_1"
    initialValue="1">
  </xtce:Argument>
  <xtce:Argument name="USPZ20MD0131K"
    argumentTypeRef="USPZ20MD0131KType"
    shortDescription="RPCM_Close_Selected_Switches_2"
    initialValue="0">
  </xtce:Argument>
  <xtce:Argument name="USPZ20MD0132K"
    argumentTypeRef="USPZ20MD0132KType"
    shortDescription="RPCM_Close_Selected_Switches_3"
    initialValue="0">
  </xtce:Argument>
</xtce:ArgumentList>
</xtce:MetaCommand>

<xtce:MetaCommand name="P6PS96IM0032K"
shortDescription="SSU_2B_PVCE_1_2_3_Off">
  <xtce:CommandContainer name="P6PS96IM0032KPacket">
    <xtce:EntryList>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0110K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0120K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0130K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0140K-2"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0210K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0220K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0300K-2"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0400K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0610K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0620K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0630K"/>
      <xtce:ParameterRefEntry parameterRef="SPARE"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0650K"/>
      <xtce:ParameterRefEntry parameterRef="SPARE"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0710K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0712K"/>
      <xtce:ParameterRefEntry parameterRef="SPARE"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0720K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0810K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0812K"/>
      <xtce:ParameterRefEntry parameterRef="USDG00CC0820K"/>
      <xtce:ParameterRefEntry parameterRef="P6PS96IM0032K-1"/>
    </xtce:EntryList>
  </xtce:CommandContainer>
</xtce:MetaCommand>

```





```

        <xtce:ParameterRefEntry parameterRef="P6PS96IM0032K-2"/>
        <xtce:ParameterRefEntry parameterRef="P6PS96IM0032K-3"/>
    </xtce:EntryList>
</xtce:CommandContainer>
</xtce:MetaCommand>

<xtce:MetaCommand name="P6PS96IM0035K"
shortDescription="SSU_2B_PVCE_1_2_3_On">
    <xtce:CommandContainer name="P6PS96IM0035KPacket">
        <xtce:EntryList>
            <xtce:ParameterRefEntry parameterRef="USDG00CC0110K"/>
            <xtce:ParameterRefEntry parameterRef="USDG00CC0120K"/>
            <xtce:ParameterRefEntry parameterRef="USDG00CC0130K"/>
            <xtce:ParameterRefEntry parameterRef="USDG00CC0140K-2"/>
            <xtce:ParameterRefEntry parameterRef="USDG00CC0210K"/>
            <xtce:ParameterRefEntry parameterRef="USDG00CC0220K"/>
            <xtce:ParameterRefEntry parameterRef="USDG00CC0300K-2"/>
            <xtce:ParameterRefEntry parameterRef="USDG00CC0400K"/>
            <xtce:ParameterRefEntry parameterRef="USDG00CC0610K"/>
            <xtce:ParameterRefEntry parameterRef="USDG00CC0620K"/>
            <xtce:ParameterRefEntry parameterRef="USDG00CC0630K"/>
            <xtce:ParameterRefEntry parameterRef="SPARE"/>
            <xtce:ParameterRefEntry parameterRef="USDG00CC0650K"/>
            <xtce:ParameterRefEntry parameterRef="SPARE"/>
            <xtce:ParameterRefEntry parameterRef="USDG00CC0710K"/>
            <xtce:ParameterRefEntry parameterRef="USDG00CC0712K"/>
            <xtce:ParameterRefEntry parameterRef="SPARE"/>
            <xtce:ParameterRefEntry parameterRef="USDG00CC0720K"/>
            <xtce:ParameterRefEntry parameterRef="USDG00CC0810K"/>
            <xtce:ParameterRefEntry parameterRef="USDG00CC0812K"/>
            <xtce:ParameterRefEntry parameterRef="USDG00CC0820K"/>
            <xtce:ParameterRefEntry parameterRef="P6PS96IM0035K-1"/>
            <xtce:ParameterRefEntry parameterRef="P6PS96IM0035K-2"/>
            <xtce:ParameterRefEntry parameterRef="P6PS96IM0035K-3"/>
        </xtce:EntryList>
    </xtce:CommandContainer>
</xtce:MetaCommand>

</xtce:MetaCommandSet>

</xtce:CommandMetaData>

</xtce:SpaceSystem>

```

**Listing 6-1 Action Service Configuration Data**

## 6.1.2 ACTION DEFINITION

The Action Definition data structure for the Action Service is based upon the XTCE file in Section 6.1.1. Static data for this structure is shown in Table 6-1. The action **serverity** is always INFORMATIONAL and is not illustrated.

Action Definition				
EntityId	DefinitionId	Description		
JSTH96IM0066K	JSTH96IM0066K	JLP_HCTL_Htr01_Cntl_Mode_Sel_Tmplt		
Arguments		EntityId	DefinitionId	



PROTOTYPE INTEROPERABILITY DOCUMENT BETWEEN  
NASA-JSC AND DLR-GSOC DESCRIBING THE CCSDS  
SM&C MISSION OPERATIONS PROTOTYPE

Doc:  
Issue: 1.4  
Date: 17.09.2010  
Page: 90 of 104

		JSDC00SWV156K	JSDC00SWV156K
EntityId	DefinitionId	Description	
JSTH96IM0067K	JSTH96IM0067K	JLP_HCTL_Htr02_Cntl_Mode_Sel_TmplT	
Arguments		EntityId	DefinitionId
		JSDC00SWV156K	JSDC00SWV156K
EntityId	DefinitionId	Description	
JSTH96IM0068K	JSTH96IM0068K	JLP_HCTL_Htr03_Cntl_Mode_Sel_TmplT	
Arguments		EntityId	DefinitionId
		JSDC00SWV156K	JSDC00SWV156K
EntityId	DefinitionId	Description	
JSTH96IM0069K	JSTH96IM0069K	JLP_HCTL_Htr04_Cntl_Mode_Sel_TmplT	
Arguments		EntityId	DefinitionId
		JSDC00SWV156K	JSDC00SWV156K
EntityId	DefinitionId	Description	
P6PX96IM0051K	P6PX96IM0051K	P6_BGA_AutotrK_Ch_Tgtd_Mode_Sel_TmplT	
Arguments		EntityId	DefinitionId
		USPZ21MD1222K	USPZ21MD1222K
		USPZ21MD1003K	USPZ21MD1003K
		USPZ21MD1986K	USPZ21MD1986K
EntityId	DefinitionId	Description	
P6PX96IM0055K	P6PX96IM0055K	P6_BGA_Null_Ch_Tgtd_Mode_Sel_TmplT	
Arguments		EntityId	DefinitionId
		USPZ21MD1222K	USPZ21MD1222K
		USPZ21MD1003K	USPZ21MD1003K
		USPZ21MD1986K	USPZ21MD1986K
EntityId	DefinitionId	Description	
LAPR96IM0152K	LAPR96IM0152K	RPCM_LA1B_A_RPC_04_C1	
Arguments		EntityId	DefinitionId
		N/A	N/A
EntityId	DefinitionId	Description	

LAPR96IM0350K	LAPR96IM0350K	RPCM_LA1B_A_RPC_04_Op	
Arguments		EntityId	DefinitionId
		N/A	N/A
EntityId	DefinitionId	Description	
LAPR96IM0035K	LAPR96IM0035K	RPCM_LA1B_A_RPC_C1_Tmplt	
Arguments		EntityId	DefinitionId
		USPZ20MD0129K	USPZ20MD0129K
		USPZ20MD0130K	USPZ20MD0130K
		USPZ20MD0131K	USPZ20MD0131K
		USPZ20MD0132K	USPZ20MD0132K
EntityId	DefinitionId	Description	
P6PS96IM0032K	P6PS96IM0032K	SSU_2B_PVCE_1_2_3_Off	
Arguments		EntityId	DefinitionId
		N/A	N/A
EntityId	DefinitionId	Description	
P6PS96IM0035K	P6PS96IM0035K	SSU_2B_PVCE_1_2_3_On	
Arguments		EntityId	DefinitionId
		N/A	N/A

Table 6-1 Action Definition Data Structure

## 6.2 PARAMETER SERVICE

### 6.2.1 XTCE ENTITY DEFINITIONS

The Parameter Service configuration data is provided in XTCE format. The data is contained in Listing 6-2

```
<?xml version="1.0" encoding="UTF-8"?>
<xtce:SpaceSystem
  name="otf.dlr.smc.prototype"
  xsi:schemaLocation="http://www.omg.org/space/xtce
http://www.omg.org/spec/XTCE/20061101/06-11-06.xsd"
  xmlns:xtce="http://www.omg.org/space/xtce"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">

  <xtce:TelemetryMetaData>

    <xtce:ParameterTypeSet>
```



```
<xtce:FloatParameterType name="JSDC00FCT21BJType"
  shortDescription="JLP_HCTL_Htr01_Cntl_Status">
</xtce:FloatParameterType>

<xtce:FloatParameterType name="JSDC00FCT21CJType"
  shortDescription="JLP_HCTL_Htr02_Cntl_Status">
</xtce:FloatParameterType>

<xtce:FloatParameterType name="JSDC00FCT21DJType"
  shortDescription="JLP_HCTL_Htr03_Cntl_Status">
</xtce:FloatParameterType>

<xtce:FloatParameterType name="JSDC00FCT21EJType"
  shortDescription="JLP_HCTL_Htr04_Cntl_Status">
</xtce:FloatParameterType>

<xtce:FloatParameterType name="JSDC00FCT22NJType"
  shortDescription="JLP_HCTL_Htr01_Temp">
</xtce:FloatParameterType>

<xtce:FloatParameterType name="JSDC00FCT22OJType"
  shortDescription="JLP_HCTL_Htr02_Temp">
</xtce:FloatParameterType>

<xtce:FloatParameterType name="JSDC00FCT22PJType"
  shortDescription="JLP_HCTL_Htr03_Temp">
</xtce:FloatParameterType>

<xtce:FloatParameterType name="JSDC00FCT22QJType"
  shortDescription="JLP_HCTL_Htr04_Temp">
</xtce:FloatParameterType>

<xtce:FloatParameterType name="P6PB08FC0462UType"
  shortDescription="BGA_2B_Integration_Counter">
</xtce:FloatParameterType>

<xtce:FloatParameterType name="P6DP34MD5464JType"
  shortDescription="PVCU_P6_Prim_Channel_2B_Mode">
</xtce:FloatParameterType>

<xtce:FloatParameterType name="P6DP34MD5468JType"
  shortDescription="PVCU_P6_Prim_BGA_2B_BGA_Mode">
</xtce:FloatParameterType>

<xtce:FloatParameterType name="LAPR01FC0617UType"
  shortDescription="RPCM_LA1B_A_Integration_Counter">
</xtce:FloatParameterType>

<xtce:FloatParameterType name="LAPR01FC1019JType"
  shortDescription="RPCM_LA1B_A_RPC_04_Load_On_Off_Stat">
</xtce:FloatParameterType>

<xtce:FloatParameterType name="P6PS08FC0290UType"
  shortDescription="SSU_2B_Integration_Counter">
</xtce:FloatParameterType>

<xtce:FloatParameterType name="LAPR01FC1044JType"
  shortDescription="RPCM_LA1B_A_RPC_04_Load_Cl_Cmd_Stat">
</xtce:FloatParameterType>

<xtce:FloatParameterType name="P6PS08FC0295VType"
  shortDescription="SSU_2B_PVCE_1_V">
```

---

```
</xtce:FloatParameterType>

<xtce:FloatParameterType name="P6PS08FC0296VType"
  shortDescription="SSU_2B_PVCE_2_V">
</xtce:FloatParameterType>

<xtce:FloatParameterType name="P6PS08FC0297VType"
  shortDescription="SSU_2B_PVCE_3_V">
</xtce:FloatParameterType>

<xtce:FloatParameterType name="P6PS08FC0324CType"
  shortDescription="SSU_2B_Integ_Iout">
</xtce:FloatParameterType>

<xtce:FloatParameterType name="P6PS08FC0327VType"
  shortDescription="SSU_2B_PVCE_Error_Bus_Integ_V">
</xtce:FloatParameterType>

</xtce:ParameterTypeSet>

<xtce:ParameterSet>

  <xtce:Parameter name="JSDC00FCT21BJ"
    shortDescription="JLP_HCTL_Htr01_Cntl_Status"
    parameterTypeRef="JSDC00FCT21BJType">
  </xtce:Parameter>

  <xtce:Parameter name="JSDC00FCT21CJ"
    shortDescription="JLP_HCTL_Htr02_Cntl_Status"
    parameterTypeRef="JSDC00FCT21CJType">
  </xtce:Parameter>

  <xtce:Parameter name="JSDC00FCT21DJ"
    shortDescription="JLP_HCTL_Htr03_Cntl_Status"
    parameterTypeRef="JSDC00FCT21DJType">
  </xtce:Parameter>

  <xtce:Parameter name="JSDC00FCT21EJ"
    shortDescription="JLP_HCTL_Htr04_Cntl_Status"
    parameterTypeRef="JSDC00FCT21EJType">
  </xtce:Parameter>

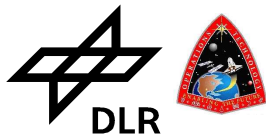
  <xtce:Parameter name="JSDC00FCT22NJ"
    shortDescription="JLP_HCTL_Htr01_Temp"
    parameterTypeRef="JSDC00FCT22NJType">
  </xtce:Parameter>

  <xtce:Parameter name="JSDC00FCT22OJ"
    shortDescription="JLP_HCTL_Htr02_Temp"
    parameterTypeRef="JSDC00FCT22OJType">
  </xtce:Parameter>

  <xtce:Parameter name="JSDC00FCT22PJ"
    shortDescription="JLP_HCTL_Htr03_Temp"
    parameterTypeRef="JSDC00FCT22PJType">
  </xtce:Parameter>

  <xtce:Parameter name="JSDC00FCT22QJ"
    shortDescription="JLP_HCTL_Htr04_Temp"
    parameterTypeRef="JSDC00FCT22QJType">
  </xtce:Parameter>

  <xtce:Parameter name="P6PB08FC0462U"
```



```
        shortDescription="BGA_2B_Integration_Counter"
        parameterTypeRef="P6PB08FC0462UType">
</xtce:Parameter>

<xtce:Parameter name="P6DP34MD5464J"
    shortDescription="PVCU_P6_Prim_Channel_2B_Mode"
    parameterTypeRef="P6DP34MD5464JType">
</xtce:Parameter>

<xtce:Parameter name="P6DP34MD5468J"
    shortDescription="PVCU_P6_Prim_BGA_2B_BGA_Mode"
    parameterTypeRef="P6DP34MD5468JType">
</xtce:Parameter>

<xtce:Parameter name="LAPR01FC0617U"
    shortDescription="RPCM_LA1B_A_Integration_Counter"
    parameterTypeRef="LAPR01FC0617UType">
</xtce:Parameter>

<xtce:Parameter name="LAPR01FC1019J"
    shortDescription="RPCM_LA1B_A_RPC_04_Load_On_Off_Stat"
    parameterTypeRef="LAPR01FC1019JType">
</xtce:Parameter>

<xtce:Parameter name="P6PS08FC0290U"
    shortDescription="SSU_2B_Integration_Counter"
    parameterTypeRef="P6PS08FC0290UType">
</xtce:Parameter>

<xtce:Parameter name="LAPR01FC1044J"
    shortDescription="RPCM_LA1B_A_RPC_04_Load_Cl_Cmd_Stat"
    parameterTypeRef="LAPR01FC1044JType">
</xtce:Parameter>

<xtce:Parameter name="P6PS08FC0295V"
    shortDescription="SSU_2B_PVCE_1_V"
    parameterTypeRef="P6PS08FC0295VType">
</xtce:Parameter>

<xtce:Parameter name="P6PS08FC0296V"
    shortDescription="SSU_2B_PVCE_2_V"
    parameterTypeRef="P6PS08FC0296VType">
</xtce:Parameter>

<xtce:Parameter name="P6PS08FC0297V"
    shortDescription="SSU_2B_PVCE_3_V"
    parameterTypeRef="P6PS08FC0297VType">
</xtce:Parameter>

<xtce:Parameter name="P6PS08FC0324C"
    shortDescription="SSU_2B_Integ_Iout"
    parameterTypeRef="P6PS08FC0324CType">
</xtce:Parameter>

<xtce:Parameter name="P6PS08FC0327V"
    shortDescription="SSU_2B_PVCE_Error_Bus_Integ_V"
    parameterTypeRef="P6PS08FC0327VType">
</xtce:Parameter>

</xtce:ParameterSet>

</xtce:TelemetryMetaData>
```



</xtce:SpaceSystem>

## Listing 6-2 Parameter Service Configuration Data

### 6.2.2 PARAMETER DEFINITION

The Parameter Definition data structure for the Parameter Service is based upon the XTCE file in Section 6.2.1. Static data for this structure is shown in Table 6-2 Parameter Definition Data Structure.

Parameter Definition					
EntityId	DefinitionId	Validity Expression	Monitoring Interval	Check Criteria	Conversion Criteria
Description		Converted Unit	Apply Filter	Filtered Timeout	Parameter Filter
JSDC00FCT21BJ	JSDC00FCT21BJ	NULL	NULL	NULL	NULL
JLP_HCTL_Htr01_Cntl_Status		NULL	False	NULL	NULL
EntityId	DefinitionId	Validity Expression	Monitoring Interval	Check Criteria	Conversion Criteria
Description		Converted Unit	Apply Filter	Filtered Timeout	Parameter Filter
JSDC00FCT21CJ	JSDC00FCT21CJ	NULL	NULL	NULL	NULL
JLP_HCTL_Htr02_Cntl_Status		NULL	False	NULL	NULL
EntityId	DefinitionId	Validity Expression	Monitoring Interval	Check Criteria	Conversion Criteria
Description		Converted Unit	Apply Filter	Filtered Timeout	Parameter Filter
JSDC00FCT21DJ	JSDC00FCT21DJ	NULL	NULL	NULL	NULL
JLP_HCTL_Htr03_Cntl_Status		NULL	False	NULL	NULL
EntityId	DefinitionId	Validity Expression	Monitoring Interval	Check Criteria	Conversion Criteria
Description		Converted Unit	Apply Filter	Filtered Timeout	Parameter Filter
JSDC00FCT21EJ	JSDC00FCT21EJ	NULL	NULL	NULL	NULL
JLP_HCTL_Htr04_Cntl_Status		NULL	False	NULL	NULL
EntityId	DefinitionId	Validity Expression	Monitoring Interval	Check Criteria	Conversion Criteria
Description		Converted Unit	Apply Filter	Filtered Timeout	Parameter Filter



JSDC00FCT22NJ	JSDC00FCT22NJ	NULL	NULL	NULL	NULL
JLP_HCTL_Htr01_Temp		C	False	NULL	NULL
<b>EntityId</b>	<b>DefinitionId</b>	<b>Validity Expression</b>	<b>Monitoring Interval</b>	<b>Check Criteria</b>	<b>Conversion Criteria</b>
<b>Description</b>		<b>Converted Unit</b>	<b>Apply Filter</b>	<b>Filtered Timeout</b>	<b>Parameter Filter</b>
JSDC00FCT22OJ	JSDC00FCT22OJ	NULL	NULL	NULL	NULL
JLP_HCTL_Htr02_Temp		C	False	NULL	NULL
<b>EntityId</b>	<b>DefinitionId</b>	<b>Validity Expression</b>	<b>Monitoring Interval</b>	<b>Check Criteria</b>	<b>Conversion Criteria</b>
<b>Description</b>		<b>Converted Unit</b>	<b>Apply Filter</b>	<b>Filtered Timeout</b>	<b>Parameter Filter</b>
JSDC00FCT22PJ	JSDC00FCT22PJ	NULL	NULL	NULL	NULL
JLP_HCTL_Htr03_Temp		C	False	NULL	NULL
<b>EntityId</b>	<b>DefinitionId</b>	<b>Validity Expression</b>	<b>Monitoring Interval</b>	<b>Check Criteria</b>	<b>Conversion Criteria</b>
<b>Description</b>		<b>Converted Unit</b>	<b>Apply Filter</b>	<b>Filtered Timeout</b>	<b>Parameter Filter</b>
JSDC00FCT22QJ	JSDC00FCT22QJ	NULL	NULL	NULL	NULL
JLP_HCTL_Htr04_Temp		C	False	NULL	NULL
<b>EntityId</b>	<b>DefinitionId</b>	<b>Validity Expression</b>	<b>Monitoring Interval</b>	<b>Check Criteria</b>	<b>Conversion Criteria</b>
<b>Description</b>		<b>Converted Unit</b>	<b>Apply Filter</b>	<b>Filtered Timeout</b>	<b>Parameter Filter</b>
P6PB08FC0462U	P6PB08FC0462U	NULL	NULL	NULL	NULL
BGA_2B_Integration_Counter		NULL	False	NULL	NULL
<b>EntityId</b>	<b>DefinitionId</b>	<b>Validity Expression</b>	<b>Monitoring Interval</b>	<b>Check Criteria</b>	<b>Conversion Criteria</b>
<b>Description</b>		<b>Converted Unit</b>	<b>Apply Filter</b>	<b>Filtered Timeout</b>	<b>Parameter Filter</b>
P6DP34MD5464J	P6DP34MD5464J	NULL	NULL	NULL	NULL
PVCU_P6_Prim_Channel_2B_Mode		NULL	False	NULL	NULL



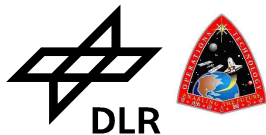


EntityId	DefinitionId	Validity Expression	Monitoring Interval	Check Criteria	Conversion Criteria
Description		Converted Unit	Apply Filter	Filtered Timeout	Parameter Filter
P6DP34MD5468J	P6DP34MD5468J	NULL	NULL	NULL	NULL
PVCU_P6_Prim_BGA_2B_BGA_Mode		NULL	False	NULL	NULL
EntityId	DefinitionId	Validity Expression	Monitoring Interval	Check Criteria	Conversion Criteria
Description		Converted Unit	Apply Filter	Filtered Timeout	Parameter Filter
LAPR01FC0617U	LAPR01FC0617U	NULL	NULL	NULL	NULL
RPCM_LA1B_A_Integration_Counter		NULL	False	NULL	NULL
EntityId	DefinitionId	Validity Expression	Monitoring Interval	Check Criteria	Conversion Criteria
Description		Converted Unit	Apply Filter	Filtered Timeout	Parameter Filter
LAPR01FC1019J	LAPR01FC1019J	NULL	NULL	NULL	NULL
RPCM_LA1B_A_RPC_04_Load_On_Off_Stat		NULL	False	NULL	NULL
EntityId	DefinitionId	Validity Expression	Monitoring Interval	Check Criteria	Conversion Criteria
Description		Converted Unit	Apply Filter	Filtered Timeout	Parameter Filter
P6PS08FC0290U	P6PS08FC0290U	NULL	NULL	NULL	NULL
SSU_2B_Integration_Counter		NULL	False	NULL	NULL
EntityId	DefinitionId	Validity Expression	Monitoring Interval	Check Criteria	Conversion Criteria
Description		Converted Unit	Apply Filter	Filtered Timeout	Parameter Filter
LAPR01FC1044J	LAPR01FC1044J	NULL	NULL	NULL	NULL
RPCM_LA1B_A_RPC_04_Load_Cl_Cmd_Stat		NULL	False	NULL	NULL
EntityId	DefinitionId	Validity	Monitoring	Check	Conversion



Description		Expression Converted Unit	Interval Apply Filter	Criteria Filtered Timeout	Criteria Parameter Filter
P6PS08FC0295V	P6PS08FC0295V	NULL	NULL	NULL	NULL
SSU_2B_PVCE_1_V		V	False	NULL	NULL
EntityId	DefinitionId	Validity Expression Converted Unit	Monitoring Interval Apply Filter	Check Criteria Filtered Timeout	Conversion Criteria Parameter Filter
P6PS08FC0296V	P6PS08FC0296V	NULL	NULL	NULL	NULL
SSU_2B_PVCE_2_V		V	False	NULL	NULL
EntityId	DefinitionId	Validity Expression Converted Unit	Monitoring Interval Apply Filter	Check Criteria Filtered Timeout	Conversion Criteria Parameter Filter
P6PS08FC0297V	P6PS08FC0297V	NULL	NULL	NULL	NULL
SSU_2B_PVCE_3_V		V	False	NULL	NULL
EntityId	DefinitionId	Validity Expression Converted Unit	Monitoring Interval Apply Filter	Check Criteria Filtered Timeout	Conversion Criteria Parameter Filter
P6PS08FC0324C	P6PS08FC0324C	NULL	NULL	NULL	NULL
SSU_2B_Integ_Iout		NULL	False	NULL	NULL
EntityId	DefinitionId	Validity Expression Converted Unit	Monitoring Interval Apply Filter	Check Criteria Filtered Timeout	Conversion Criteria Parameter Filter
P6PS08FC0327V	P6PS08FC0327V	NULL	NULL	NULL	NULL
SSU_2B_PVCE_Error_Bus_Integ_V		V	False	NULL	NULL

Table 6-2 Parameter Definition Data Structure



## 6.3 ALERT SERVICE

The Alert Service configuration data is provided in this section. The schema in Listing 6-3 is used to define the XML document containing the available alerts. This schema uses the MessageAbstractionLayer structures defined earlier.

```
<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns:MAL="http://otf.jsc.nasa.gov/smc/mal"
  xmlns:Alert="http://otf.jsc.nasa.gov/smc/core/alert"
  targetNamespace="http://otf.jsc.nasa.gov/smc/core/alert"
  elementFormDefault="qualified">

  <xsd:annotation>
    <xsd:documentation>
      This schema describes an Alert message that is part of the service
      configuration for the Mission Operations Alert Service. A
      sample alert based on this schema follows:

      <!--
      <Alert:alertEntity>
        <Alert:entityId>Action_0001</Alert:entityId>
        <Alert:text>Action {0} does not exist.</Alert:text>
        <Alert:ArgumentList>
          <Alert:Argument>
            <Alert:entityId>Action_0001_00</Alert:entityId>
            <Alert:name>Action Entity Identifier</Alert:name>
          </Alert:Argument>
        </Alert:ArgumentList>
        <Alert:description>Unknown Action</Alert:description>
        <Alert:severity>INFORMATIONAL</Alert:severity>
        <Alert:help>
          The selected action does not exists in the repository of
          available Actions.
        </Alert:help>
      </Alert:alertEntity>
      -->
```

The entityId is a unique identifier and consists of the form  
<service>\_<identifier>.

The first part of the entityId is the service to which it belongs or  
"Alert" if no service is applicable. The second part is a four digit  
numeric identifier to maintain uniqueness within the service.

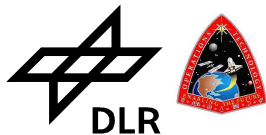
The text may contain arguments. The {0} is a place holder for the  
argument values of the message. The argument values are provided in the  
AlertOccurrence when the alert is raised. The index to the arguments  
starts at 0 as increments sequentially.

The arguments are also assigned an entityId. The entityId is a unique for  
the Alert and is composed of the form  
<service>\_<identifier>\_<index>;

The help text is optional and may be displayed by an Alert Service  
consumer.

```
</xsd:documentation>
</xsd:annotation>
```

```
<xsd:annotation>
  <xsd:documentation>
    This element is the root of the XML document
```



```
</xsd:documentation>
</xsd:annotation>
<xsd:element name="alertEntityList" type="Alert:AlertEntityListType"/>

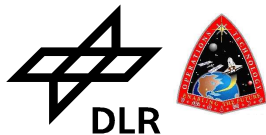
<xsd:annotation>
  <xsd:documentation>
    The AlertEntityId is composed of the following elements:
    &gt;service&lt;_&gt;identifier&lt;_&gt;index&lt;_&gt; The service and identifier are
    separated by an underscore. The pattern in the type definition
    validates an alphabetic string and a four digit numeric value.
  </xsd:documentation>
</xsd:annotation>
<xsd:simpleType name="AlertEntityId">
  <xsd:restriction base="xsd:string">
    <xsd:pattern value="^[a-zA-Z]+_[0-9]{4}$"/>
  </xsd:restriction>
</xsd:simpleType>

<xsd:annotation>
  <xsd:documentation>
    The AlertArgumentEntityId is composed of the following elements:
    &gt;service&lt;_&gt;identifier&lt;_&gt;index&lt;_&gt; The first part of this
    entity identifier is the AlertEntityId followed by an underscore and
    the two digit zero filled argument index.
    The pattern in the type definition validates an alphabetic
    string, a four digit numeric value and a two digit numeric value.
  </xsd:documentation>
</xsd:annotation>
<xsd:simpleType name="AlertArgumentEntityId">
  <xsd:restriction base="xsd:string">
    <xsd:pattern value="^[a-zA-Z]+_[0-9]{4}_[0-9]{2}$"/>
  </xsd:restriction>
</xsd:simpleType>

<xsd:complexType name="AlertEntityType">
  <xsd:annotation>
    <xsd:documentation>
      This structure holds all the information required by the Directory
      Service to uniquely identify a Node in the Directory Service tree
    </xsd:documentation>
  </xsd:annotation>
  <xsd:sequence>
    <xsd:element name="entityId" type="Alert:AlertEntityId"/>
    <xsd:element name="argumentList" type="Alert:AlertArgumentListType"/>
    <xsd:element name="text" type="xsd:string"/>
    <xsd:element name="help" type="xsd:string" nillable="true"/>
    <xsd:element name="description" type="xsd:string" nillable="true"/>
    <xsd:element name="severity" type="xsd:string" nillable="true"/>
  </xsd:sequence>
</xsd:complexType>

<xsd:complexType name="AlertEntityListType">
  <xsd:annotation>
    <xsd:documentation>
      This type represents a list of AlertEntityType structures
    </xsd:documentation>
  </xsd:annotation>
  <xsd:sequence minOccurs="0" maxOccurs="unbounded">
    <xsd:element name="alertEntity" type="Alert:AlertEntityType"/>
  </xsd:sequence>
</xsd:complexType>

<xsd:complexType name="AlertArgumentType">
```



```
<xsd:annotation>
  <xsd:documentation>
    This structure holds the information about the alert
    arguments such as the entityId and name. The Values will
    be provided as part of the AlertOccurrence
  </xsd:documentation>
</xsd:annotation>
<xsd:sequence>
  <xsd:element name="entityId" type="Alert:AlertArgumentEntityId"/>
  <xsd:element name="name" type="xsd:string"/>
</xsd:sequence>
</xsd:complexType>

<xsd:complexType name="AlertArgumentListType">
  <xsd:annotation>
    <xsd:documentation>
      This type represents a list of AlertArgument structures. The
      arguments represent variable parts of the alert text. The
      list may be empty.
    </xsd:documentation>
  </xsd:annotation>
  <xsd:sequence minOccurs="0" maxOccurs="99">
    <xsd:element name="argument" type="Alert:AlertArgumentListType"/>
  </xsd:sequence>
</xsd:complexType>

</xsd:schema>
```

### Listing 6-3 Alert Service Configuration Schema

#### 6.3.1 JSC-OTF ALERT SERVICE PROVIDER CONFIGURATION DATA

The Alerts that may be raised by the JSC-OTF Alert Service provider are included in Listing 6-4. The XML document is based upon the schema in the presented in the previous section.

```
<?xml version="1.0" encoding="UTF-16"?>
<Alert:alertEntityList
  xmlns:Alert="http://otf.jsc.nasa.gov/smc/core/alert"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  schemaLocation="http://otf.jsc.nasa.gov/smc/core/alert
AlertServiceConfiguration.xsd">

  <Alert:alertEntity>
    <Alert:entityId>Action_0001</Alert:entityId>
    <Alert:text>Action {0} does not exist.</Alert:text>
    <Alert:argumentList>
      <Alert:argument>
        <Alert:entityId>Action_0001_00</Alert:entityId>
        <Alert:name>ActionEntityIdentifier</Alert:name>
      </Alert:argument>
    </Alert:argumentList>
    <Alert:description>Unknown Action</Alert:description>
    <Alert:severity>INFORMATIONAL</Alert:severity>
    <Alert:help>
      The selected action does not exist in the repository of available
      Actions.
    </Alert:help>
  </Alert:alertEntity>

  <Alert:alertEntity>
    <Alert:entityId>Action_0002</Alert:entityId>
```

---

```

<Alert:text>Execution status of Action {0} is unkown.</Alert:text>
<Alert:argumentList>
  <Alert:argument>
    <Alert:entityId>Action_0002_00</Alert:entityId>
    <Alert:name>ActionEntityIdentifier</Alert:name>
  </Alert:argument>
</Alert:argumentList>
<Alert:description>Action Status Unknown</Alert:description>
<Alert:severity>INFORMATIONAL</Alert:severity>
<Alert:help>
  The execution status of the invoked action was not received from the
  spacecraft.
</Alert:help>
</Alert:alertEntity>

<Alert:alertEntity>
  <Alert:entityId>Action_0003</Alert:entityId>
  <Alert:text>
    Execution of Action {0} was rejected onboard due to {1}.
  </Alert:text>
  <Alert:argumentList>
    <Alert:argument>
      <Alert:entityId>Action_0003_00</Alert:entityId>
      <Alert:name>ActionEntityIdentifier</Alert:name>
    </Alert:argument>
    <Alert:argument>
      <Alert:entityId>Action_0003_01</Alert:entityId>
      <Alert:name>RejectionReason</Alert:name>
    </Alert:argument>
  </Alert:argumentList>
  <Alert:description>Action Rejected Onboard</Alert:description>
  <Alert:severity>INFORMATIONAL</Alert:severity>
  <Alert:help>
    The execution of the invoked action was rejected by the spacecraft due
    to the reason provided.
  </Alert:help>
</Alert:alertEntity>

<Alert:alertEntity>
  <Alert:entityId>Action_0004</Alert:entityId>
  <Alert:text>Action {0} release rejected: {1}.</Alert:text>
  <Alert:argumentList>
    <Alert:argument>
      <Alert:entityId>Action_0004_00</Alert:entityId>
      <Alert:name>ActionEntityIdentifier</Alert:name>
    </Alert:argument>
    <Alert:argument>
      <Alert:entityId>Action_0004_01</Alert:entityId>
      <Alert:name>RejectionReason</Alert:name>
    </Alert:argument>
  </Alert:argumentList>
  <Alert:description>Action Release Rejected</Alert:description>
  <Alert:severity>INFORMATIONAL</Alert:severity>
  <Alert:help>
    The release of the invoked action was rejected due to the reason
    provided.
  </Alert:help>
</Alert:alertEntity>
</Alert:alertEntityList>

```

**Listing 6-4 JSC-OTF Alert Service Provider Configuration Data**

### 6.3.2 JSC OTF ALERT DEFINITION

The Alert Definition data structure for the Alert Service is based upon the XML listing in Section 6.3.2. Static data for this structure is shown in Table 6-3 JSC-OTF Alert Definition. The Severity will default to INFORMATIONAL and the Generation Enabled indicator is always true.

Action Definition		
EntityId	DefinitionId	Description
Action_0001	Action_0001	Unknown Action
Arguments		
	Action_0001_01	Action_0001_01
EntityId	DefinitionId	Description
Action_0002	Action_0003	Action Status Unknown
Arguments		
	Action_0002_01	Action_0002_01
EntityId	DefinitionId	Description
Action_0003	Action_0003	Action Rejected Onboard
Arguments		
	Action_0001_01	Action_0001_01

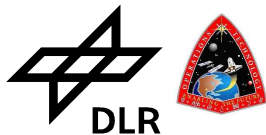
Table 6-3 JSC-OTF Alert Definition Data Structure

### 6.3.3 DLR-GSOC ALERT SERVICE CONFIGURATION DATA

```
<?xml version="1.0" encoding="UTF-16"?>
<Alert:alertEntityList
  xmlns:Alert="http://dlr.de/smc/core/alert"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  schemaLocation="http://dlr.de/smc/core/alert
AlertServiceConfiguration.xsd">

  <Alert:alertEntity>
    <Alert:entityId>Action_0001</Alert:entityId>
    <Alert:text>
      The communications link is not available.
    </Alert:text>
    <Alert:argumentList>
    </Alert:argumentList>
    <Alert:description>
      Communications Link is not available
    </Alert:description>
    <Alert:severity>INFORMATIONAL</Alert:severity>
    <Alert:help>
      The communications link to the controlled device is not available.
    </Alert:help>
  </Alert:alertEntity>

</Alert:alertEntityList>
```



#### 6.3.4 GSOC-DLR ALERT DEFINITION

The Alert Definition data structure for the Alert Service is based upon the XML listing in Section 6.3.3. Static data for this structure is shown in Table 6-4 GSOC-DLR Alert Definition. The Severity will default to INFORMATIONAL and the Generation Enabled indicator is always true.

Action Definition		
EntityId	DefinitionId	Description
Action_0001	Action_0001	Communications Link is not available
Arguments		EntityId
		DefinitionId

Table 6-4 GSOC-DLR Alert Definition Data Structure