OTF CCSDS Mission Operations
Prototype
Parameter Service

Phase I
Exit Presentation

John Stevens

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Project Goals

- Demonstrate the use of Mission Operations standards to implement the Parameter Service
- Demonstrate interoperability between Houston MCC and a CCSDS Mission Operations compliant mission operations center
- Utilize Mission Operations Common Architecture
Project Goals

Utilize Common Architecture

- Service Provider (Center A)
- Service Consumer (Center B)
- SM&C Standards (blue boxes)
  - MAL provides
    - Standard Patterns of Interaction
    - Fundamental definitions
  - Common Services provides
    - Standard Model for Services to Extend
    - Infrastructure Services
  - Mission Operations
    - Core Monitoring and Control, Planning, ...
- Messaging Technology (e.g. AMS, SOAP, …)
Project Benefits

• Demonstration
  - Prototype CCSDS Blue Book service specifications
  - Pathfinder for inter-center communications

• Use of CCSDS Standards
  - International agreement
  - Reduce Cost

• Investigation of new technologies
  - Service Oriented Architecture (SOA) concepts
Project Definition

• Demonstrate Mission Operations Protocols
  - Scope
    • Implement the Core Services Parameter Service
    • Implement the Common Services Common Model Service
    • Implement the Message Abstraction Layer (MAL)
    • Implement Information Sharing Protocol (ISP) for the transport layer
    • Interface with a Common Services Directory Service
Project Definition

- Out of scope (Related Services)
  - Core Services Check Service
  - Common Services Common Model Service Operations
    - request, list Status
    - request, list, monitor, add, modify, delete, and delete all Definitions
  - Core Service Parameter Service
    - set/get Filtered
    - set/get Timeouts
  - Common Services Configuration Management Service
- Dependencies
  - OTF MO Common Services Directory Services Interface
Parameter Service Design

- Parameter Service Provider and Consumer Integrated Products
  - ANSI C
  - Based on the MCC Information Sharing Protocol (ISP) Client Toolkit
  - ANSI C GSOAP-XML Directory Service API
- Parameter Service Broker Integrated Products
  - ANSI C
  - Based on the MCC Information Sharing Protocol (ISP) Server Toolkit
  - ANSI C GSOAP-XML Directory Service API
ISP’ is a revised version of the ISP protocol for SM&C compliant messages.
Parameter Service - Interfaces

1 SM&C ANSI C Implementation (MAL, Common Services, and Core Services).
Parameter Service - Interfaces

Parameter Service Consumer (Directory Service Consumer)
- Common Services
  - MAL
- HTTP/GSOAP-XML

Parameter Service Broker (Directory Service Consumer)
- Common Services
  - MAL
- HTTP/GSOAP-XML

Parameter Service Provider (Directory Service Consumer)
- Common Services
  - MAL
- HTTP/GSOAP-XML

Transport/Encoding Mappings
Language Mappings

2 SM&C ANSI C GSOAP-XML Implementation (MAL, Common Services).
3 SM&C Java JAXB-XML Implementation (MAL, Common Services).
Parameter Service - Structures

- **Attribute**
- **Enumerator**
- **Container**

**Enumerators**
- **Parameter Service**
  - Validity
- **MAL**
  - InteractionType
  - QoSLevel
  - SessionType
  - UpdateType

**Attributes**
- **MAL**
  - Boolean
  - Blob
  - Double
  - Duration
  - FineTime
  - Float
  - Identifier
  - Integer
  - Long
  - Octet
  - Short
  - String
  - Time
  - URI

**Containers**
- **MAL**
  - Domain
  - EntityKeyList
  - EntityRequest
  - InteractionType
  - IdentifierList
  - MessageHeader
  - StandardError
  - Subscription
  - SubscriptionList
  - SubscriptionUpdate
  - SubscriptionUpdateList
  - Update
  - UpdateList

- **Common Services**
  - (Common Model)
  - CompleteStatusUpdate
  - Status
  - StatusIdentifier
  - StatusUpdate

- **Parameter Service**
  - ParameterStatus
ANSI C Parameter Service

- ANSI C API Layer
  - Monitor Status operations support the Consumer-Broker-Provider interaction
    - SmcInitialize
    - CP_registerMonitorStatus
    - CP_deregisterMonitorStatus
    - CP_publishMonitorStatus
    - CP_notifyMonitorStatus

- MAL, Common Services, and Parameter Service Layers
  - Constructors, Destructors, Accessors

- Transport/Encoding Mappings
  - MCC ISP transport modified to support MAL PUBLISH SUBSCRIBE Pattern of Interaction
  - Binary Encoding of MO Structures
Results

• Four (4) RIDS against MAL Book
• Two (2) RIDS against Common Services Book
• Two (2) RIDS against Core Services Book
• Three (3) generalized RIDS across the MAL, Common Services, and Core Services Books
Lessons Learned

• Significant amount of effort to modify legacy applications for SOA
• Message sizes significantly larger for Mission Operations than for legacy telemetry distribution
Conclusions

• Findings
  - To verify the CCSDS MO Standards meets manned spaceflight telemetry requirements, at a minimum the Parameter Service must be evaluated with the Check Service
  - Large amount of effort to modify legacy applications for SOA
  - Message sizes are significantly larger for Mission Operations
Contacts

• Management
  - Lindolfo Martinez (281) 483-4346 / 2099
  - lindolfo.martinez-1@nasa.gov

• Technical Lead (MO Prototype)
  - Walter Reynolds (281) 483-6723 / 2099
  - walter.f.reynolds@nasa.gov

• Responsible Engineer (Parameter Service)
  - John Stevens (281) 853-2343 / 595 Gemini
  - john.e.stevens@nasa.gov

• Project Sponsors
  - Eric Wolfer (281) 483-6709 / 2014A
  - eric.j.wolfer@nasa.gov
Thank You

• Questions
CCSDS Mission Operations
Parameter Service Demonstration

Screen Shots
1. Parameter Service Provider Log File
2. Parameter Service Broker Log File
3. Parameter Service Subscriber Log File
4. Parameter Service Test Display

Quick Example msk Display of SMC Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<td>ISP_SERVER_TIME</td>
<td>054/20:05:31</td>
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<tr>
<td>MET_sec</td>
<td>773.001</td>
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<td>773.002</td>
</tr>
<tr>
<td>nonconserv_accel_mag</td>
<td>773.003</td>
</tr>
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</tr>
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<td>773.005</td>
</tr>
<tr>
<td>MISSING_PARM</td>
<td>M</td>
</tr>
<tr>
<td>SIN0000</td>
<td>45.399</td>
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<tr>
<td>RAND0000</td>
<td>48.725</td>
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History Tab of RAND0000

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<td>054/14:05:30:839</td>
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<tr>
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<td>4.392</td>
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<td>054/14:05:26:864</td>
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Plot of SIN0000

/ Resized 626 x 477 (requested 610 x 475)