OPS-SAT Experimenter Framework

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Presentation plan

• System overview
• Nanosat MO Framework (NMF) – capabilities and architecture
• NMF Simulator
• NMF Consumer Test Tool
• Light-Weight Mission Control System (LWMCS – EUD4MO)
• Demo
System overview

**OPS-SAT**

- **GPS (through OBC)**
- **Power Subsystem (through OBC)**

**SEPP**

- **NMF: Libraries, Supervisor, Apps**
- **Payload drivers**

**Ground MO Proxy**

- **Custom ground application**
- **Custom MO/NMF ground application**
- **Web Browser**

**SDR**

- **Camera**
- **OPT-RX**
- **iADCS**

**Light-Weight MCS**

- **Ground MO Proxy (per experiment)**
- **Light-Weight MCS & custom tooling**

**ESOC**

- **Data Proxy** (part of the OPS-SAT MCS routing data)

**CCSDS Engine**

- **CAN**
- **SpW**

**Data Proxy**

- **Ground MO Proxy for supervisor**

**Experiment**

- **Custom ground application**
- **Custom MO/NMF ground application**

**Power Subsystem**

- **Power Subsystem (through OBC)**

**GPS**

- **GPS (through OBC)**

**CCSDS Engine**

- **CCSDS Engine**

**Light-Weight MCS**

- **Light-Weight MCS**
Nanosat MO Framework – Capabilities

• Monitoring & Control
• Payloads Abstraction Layer
• Supervises applications through a management component (NMF Supervisor)
• Implements handling of basic signals required by the OPS-SAT system
• Space to ground replication (Ground MO Proxy)
• Offline mirroring of the M&C data on the ground
Nanosat MO Framework – Space app stack

Your code

Application

NMF Core

NMF Generic Composites

Platform Adapters
(Sim or OPS-SAT)

Payloads Abstraction Layer (Platform Services)

M&C Services Implementation

iADCS, Camera, OPT-RX, SDR, Power, GNSS

Satellite Platform

Satellite Bus

NMF Core

CAN, SpW, TCP/IP
Service APIs

<table>
<thead>
<tr>
<th>Area Identifier</th>
<th>Service Identifier</th>
<th>Area Number</th>
<th>Service Number</th>
<th>Area Version</th>
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<tr>
<td>Platform</td>
<td>Camera</td>
<td>105</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Interaction Pattern</td>
<td>Operation Identifier</td>
<td>Operation Number</td>
<td>Support in Replay</td>
<td>Capability Set</td>
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<tr>
<td>Pub-Sub</td>
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<td>1</td>
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<td>Submit</td>
<td>enableStream</td>
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<td>2</td>
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<td>Request</td>
<td>previewPicture</td>
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<td>Invoke</td>
<td>takePicture</td>
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</table>

**High Level Requirements**

The Camera service shall provide:

1. the capability for streaming pictures;
2. the capability for previewing pictures;
3. the capability for taking pictures;
4. the capability for requesting the service and camera properties.

**Functional Requirements**

**Comment**

The Camera service allows a consumer to acquire pictures and control a camera in the spacecraft platform. The service can perform format conversions in case the consumer selects a specific format other than raw. The service can also stream pictures periodically.
NMF SDK – Simulator

- Simulates core OPS-SAT payloads - GPS, iADCS, Camera
- Allows executing simulation scenarios
- Time control
- Visualisation interface (Celestia)
- Portable implementation
- Hybrid mode
## Communication Settings

**Directory Service URI:**
maltcp://172.17.0.1:1024/nanosat-mo-supervisor-Directory

### Providers List:

<table>
<thead>
<tr>
<th>Service name</th>
<th>Supported Capabilities</th>
<th>Service Properties</th>
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<th>Broker URI Address</th>
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<td>maltcp://172.17.0.1:10...</td>
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</tr>
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</table>
Light-Weight Mission Control System

- Web interface hosted on ESOC premises
- High level consumer of M&C services
- Visualising the telemetry (Parameters and Alerts)
- Browsing history of the telemetry
- Telecommanding in an organised manner (Actions)
- Browsing history of the telecommands
Production-like Connectivity

- Satellite Platform
- NMF stack
- Ground MO Proxy
- EUD4MO
- Consumer Test Tool
- Simulator Node
- Simulator GUI
SDK Connectivity – Ground

Satellite Platform

NMF stack

Simulator Node

Simulator GUI

Consumer Test Tool

EUD4MO

Satellite Platform

NMF stack

Simulator Node

Simulator GUI

Consumer Test Tool

EUD4MO
Demos

- Code + CTT + LWMCS
- Camera Acquisitor System (Lorenzo)
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ESOC

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Experimenter

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Ground MO Proxy (per experiment)

Light-Weight MCS

Space link

SDR
Camera
OPT-RX
iADCS

CCSDS Engine

CAN
SpW

Lightweight MCS

Custom ground application

Web Browser