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# EDS Parser used for generation of on-board software

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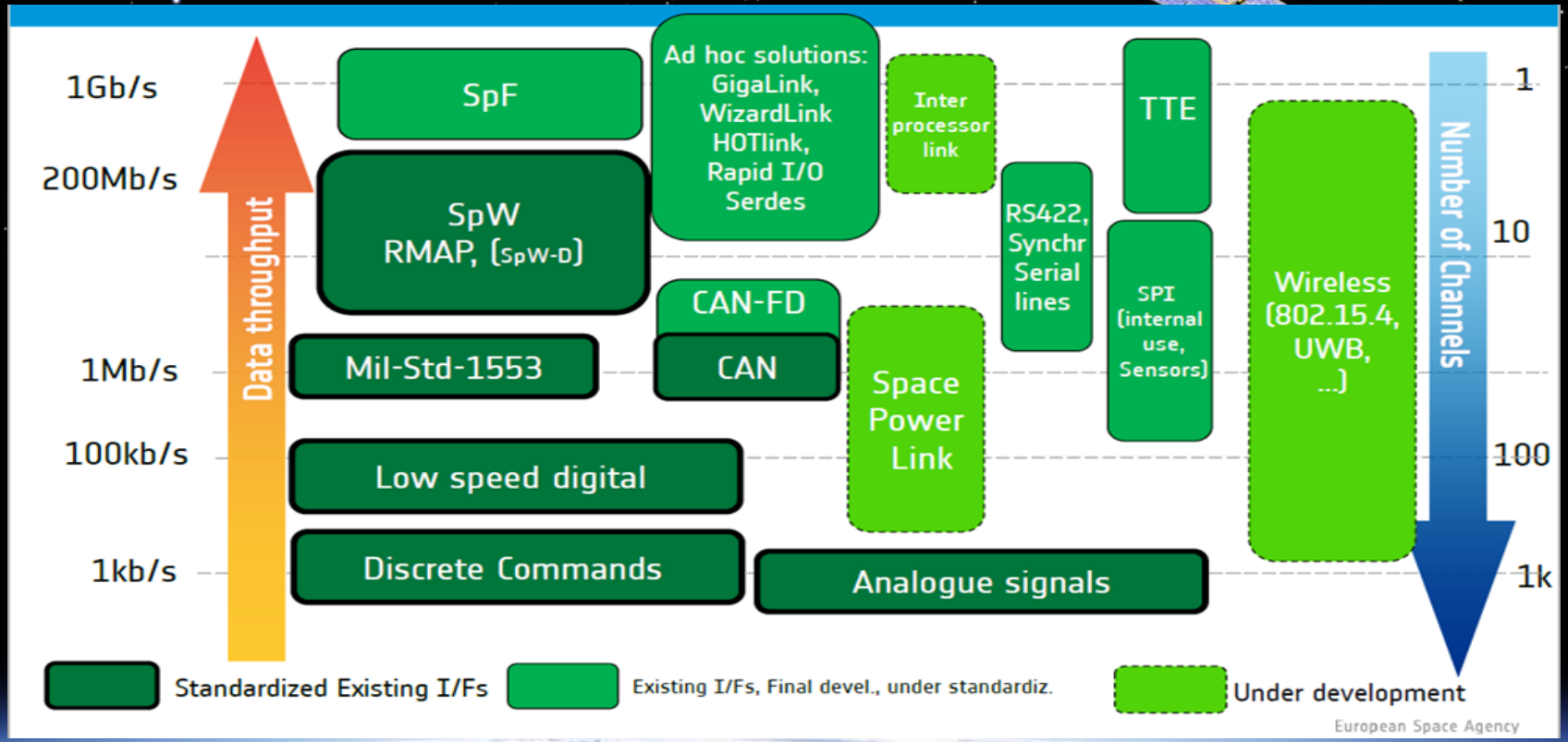
# PROBLEM: TOO MANY SPACE INTERFACES




Credit ESA

# IMPLEMENTING PLUG AND PLAY IN SPACE

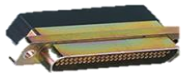
Current Subsystem Integration

Plug and Play through Standardization

Plug and Play through MA61C

**Subsystem**

**Dedicated connector**

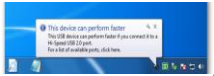


**Computer**

**Change hardware to add datasheet**


**Replace all connectors**

**Change software to recognize connection**




Subsystem Datasheets EDS

All space interfaces

MA61C onboard driver

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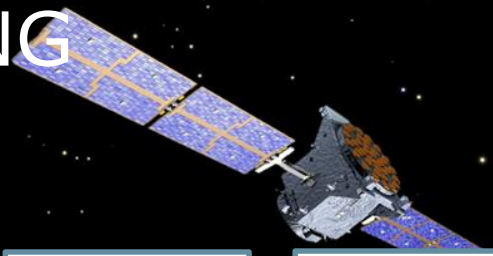
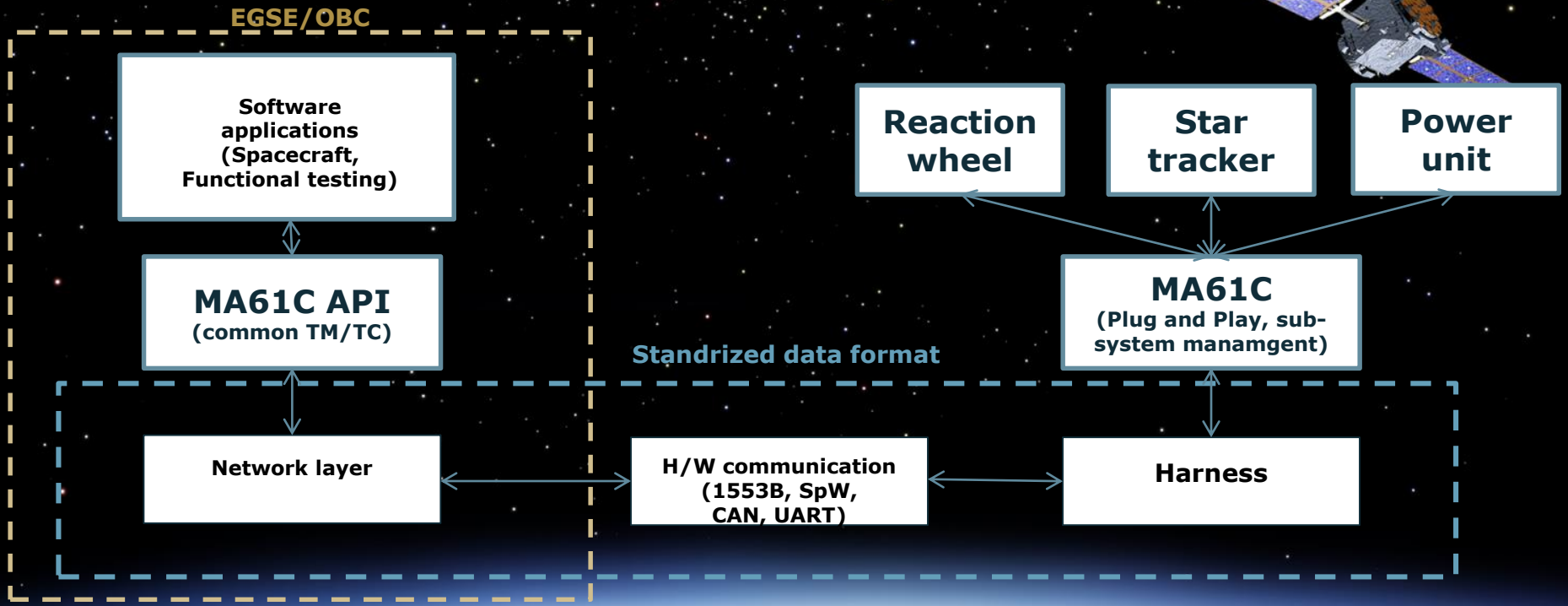
# DECENTRALIZE YOUR COMPUTING

## THROUGH COST-EFFECTIVE PLUG AND PLAY



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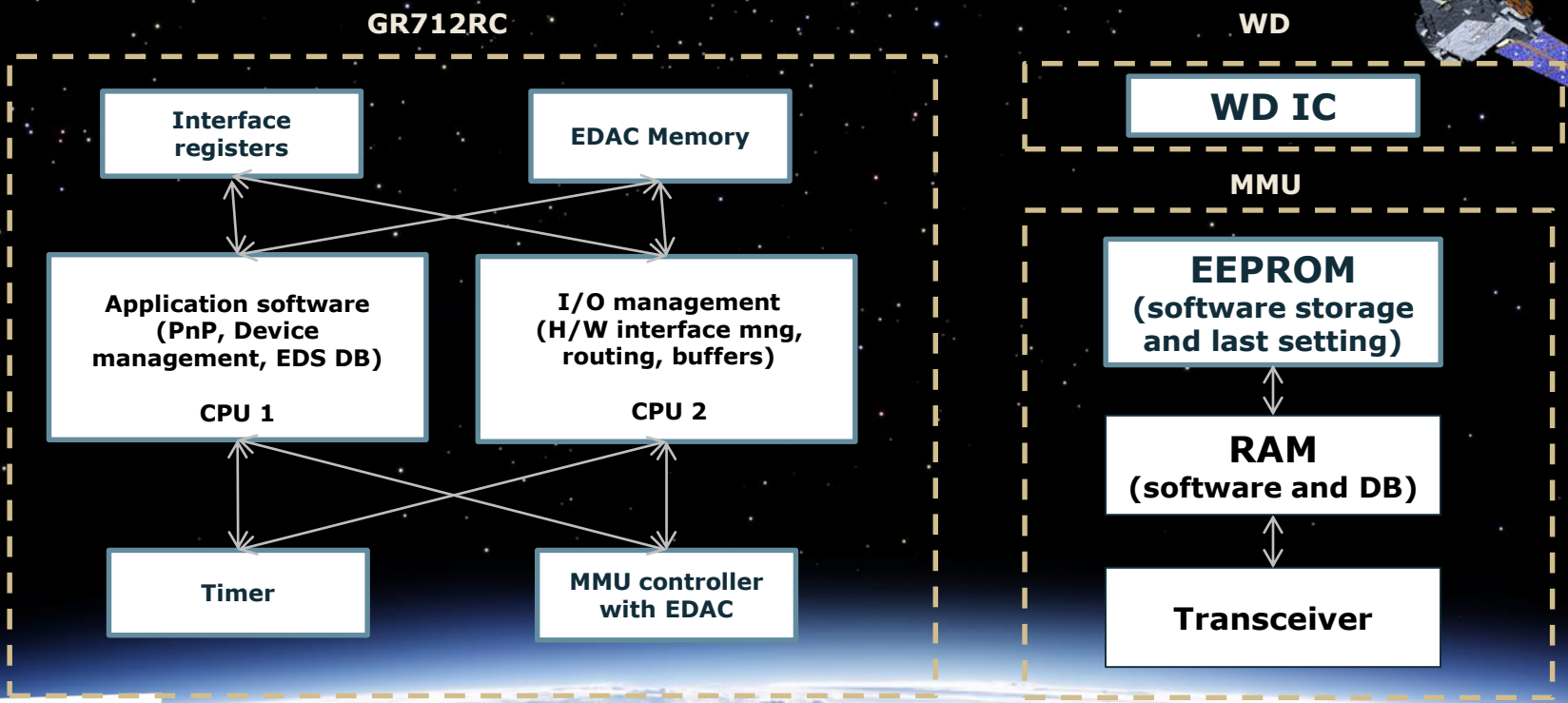
# MA61C EGSE BASELINE



# MA61C plug and fly Functionalities

## Management

- Device management
- Device recognition
- Memory management

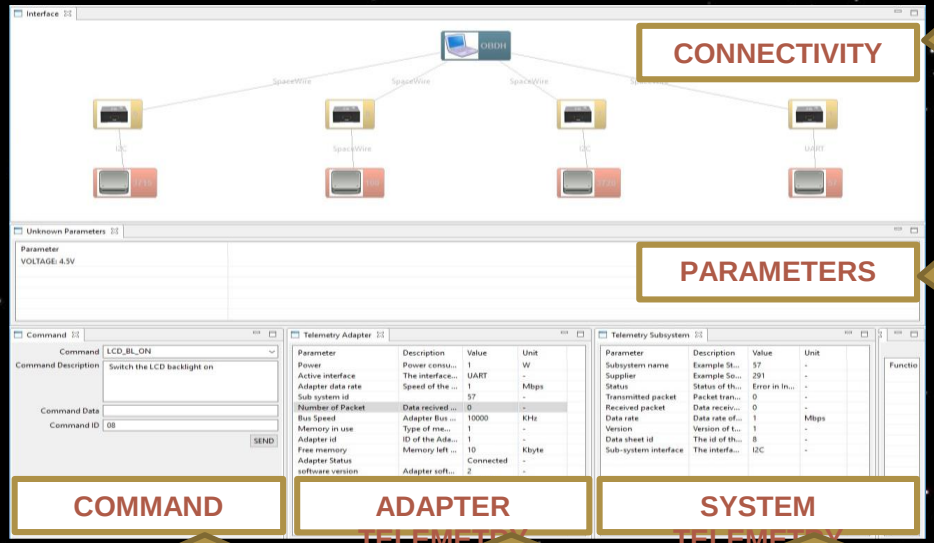
## Communication

- Data routing
- Protocol management
- Interface management
- Hardware drivers (SpW/CAN/1553B/UART/I2C)

## Memory

- Electronic data sheets
- HKTM storage
- Configuration

# GRAPHIC USER INTERFACE




**CONNECTIVITY**

automatically identifies and shows connected devices
(allows to select them)

**PARAMETERS**

Freely display any parameters coming from the sub-system

**COMMAND**

Automatically display subsystem commands and allows to send them.

**ADAPTER TELEMETRY**

Quick view to the most relevant parameters, updates every cycle.

**SYSTEM TELEMETRY**

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# EDS Parser used for generation of on-board software

- Why?
  - New business case for software development
  - Knowledge gain on new markets
  - Upcoming spin-off – EDS for simulation, EDS for smallsats OBDH, EDS for mission databases (SCOS/EGOS-CC)
  - Digital models for cyberfactory, in orbit manufacturing
- What is needed?
  - A collection of ICD/XML
  - XML parser
  - Validation tool (conformity)

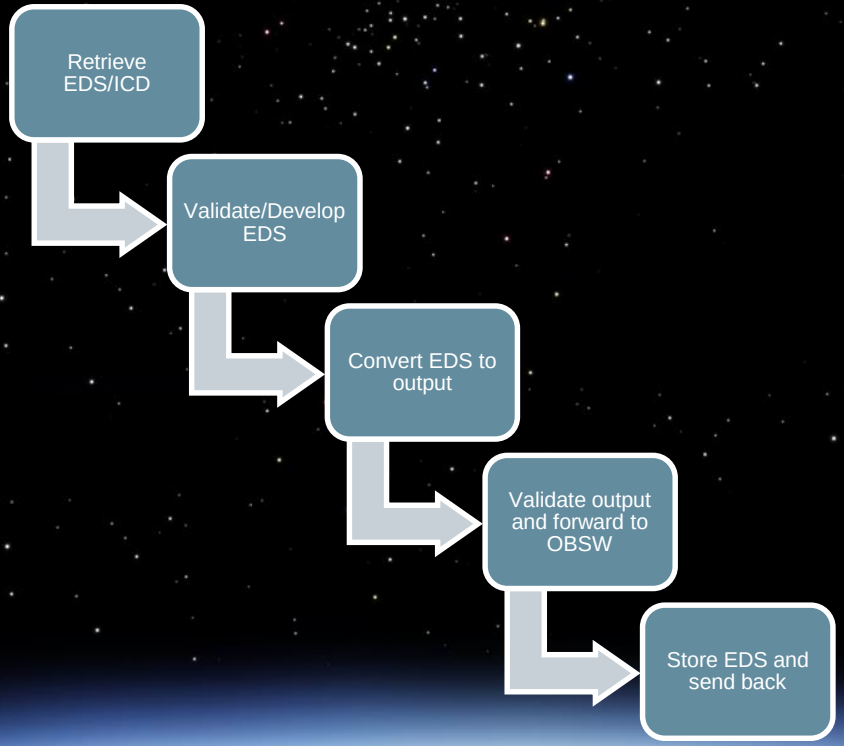
# Why not embed EDS to MA61C?

- The EDS has additional information not currently required by the MA61C software, and the onboard memory is limited.
- The xml format adds extra information to the file, which increases the size.
- The data can be organized in an more efficient process that allows to search and retrieve results faster
- The EDS format is still evolving and any change would require changed to the onboard software and complete re-validation

# XML parser - Goals

- Validate individual EDS file
- Extract selected data (such at TM/TC definition) from EDS.
- Arrange the extracted data in a relevant order
- Format the extracted data to fit the MA61C API
- Format the extracted command list to MA61C GUI
- Deliver the data to the MA61C API

# EDS process through the parser

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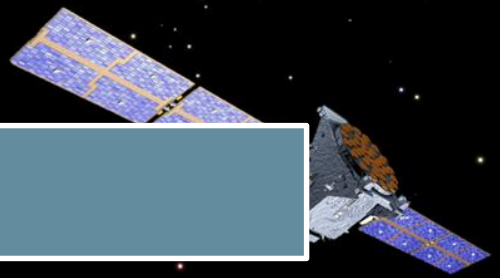
# Development process



XML reader

↓

EDS Schema validation (rule based)

↓

Retriever

↓

Convertor

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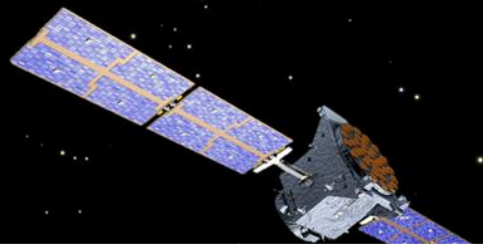
# Arranging EDS TM extract (1/3)



## EDS

```
<ContainerDataType
baseType="JENA/PACKET_UTILISATION/PUS_DIAGNOSTIC_REP
ORT" name="TM_EDB">
        <ConstraintSet>
            <Constraint entry="packetDataLength">
                <ValueConstraint value="455"/>
            </Constraint>
            <Constraint entry="sid">
                <ValueConstraint value="232"/>
            </Constraint>
        </ConstraintSet>
```

## Driver

| ID | Command/Telemetry | SID/Size |
|---|---|---|
| 2D | Update_TM_Table | E8 |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

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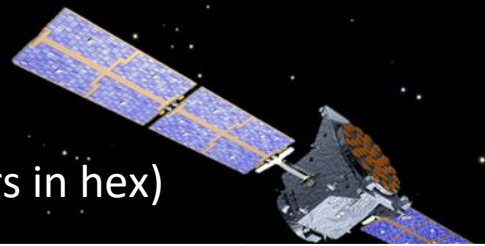
# Arranging EDS TM extract (2/3)



## EDS

```
<EntryList>
        <Entry type="TM_EDBrawTrackingType"
name="rawTracking">
            <ArrayDimensions>
                <Dimension size="16"/>
            </ArrayDimensions>
        </Entry>
        <Entry type="TM_EDBstarFlagsType"
name="starFlags">
            <ArrayDimensions>
                <Dimension size="16"/>
            </ArrayDimensions>
        </Entry>
```

## Driver (all numbers in hex)

| ID | Command/Telemetry | SID/Size |
|---|---|---|
| 2D | Update_TM_Table | E8 |
| 1 | rawTracking | 10 |
| 2 | starFlags | 10 |
| | | |
| | | |
| | | |
| | | |
| | | |

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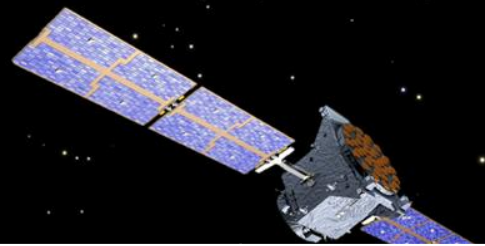
# Arranging EDS TM extract (3/3)



## EDS

```
<Entry type="CCSDS/SOIS/SEDS/UINT16" name="numObjectsL1"/>
        <Entry type="CCSDS/SOIS/SEDS/UINT16" name="numObjectsL2"/>
        <Entry type="CCSDS/SOIS/SEDS/FLOAT32" name="focusScale"/>
        <Entry type="CCSDS/SOIS/SEDS/FLOAT32" name="tcScale"/>
```

## Driver

| ID | Command/Telemetry | SID/Size |
|---|---|---|
| 2D | Update_TM_Table | E8 |
| 1 | rawTracking | 10 |
| 2 | starFlags | 10 |
| 3 | numObjectsL1 | 10 |
| 4 | numObjectsL2 | 10 |
| 5 | FocusScale | 20 |
| 6 | tcScale | 20 |
| 2D | Update_TM_Table | 0 |

# Parsing EDS TM to MA61C API format

## Driver

| ID | Command/Telemetry | SID/Size |
|---|---|---|
| 2D | Update_TM_Table | E8 |
| 1 | rawTracking | 10 |
| 2 | starFlags | 10 |
| 3 | numObjectsL1 | 10 |
| 4 | numObjectsL2 | 10 |
| 5 | FocusScale | 20 |
| 6 | tcScale | 20 |
| 2D | Update_TM_Table | 0 |

## CSV for MA61C

```
2D,Update_TM_Table,E8
1,rawTracking,10
2,starFlags,10
3,numObjectsL1,10
4,numObjectsL2,10
5,FocusScale,20
6,tcScale,20
2D,Update_TM_Table,0
```

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# Injection to onboard software

## CSV for MA61C

2D,Update_TM_Table,E8
1,rawTracking,10
2,starFlags,10
3,numObjectsL1,10
4,numObjectsL2,10
5,FocusScale,20
6,tcScale,20
2D,Update_TM_Table,0

MA61C API

MA61C OBSW

## Onboard MMU (TBC)

Memory start location: 0x43001220

1,rawTracking,10
2,starFlags,10 3,numObjectsL1,10
4,numObjectsL2,10 5,FocusScale,20
6,tcScale,20

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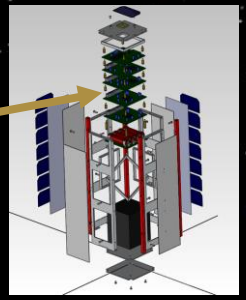
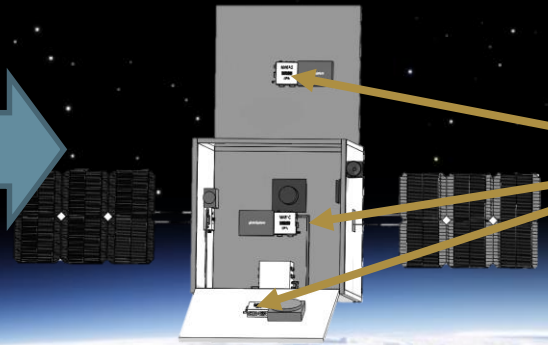
# Use cases

Cubesat uRIU

Holding drivers and interface



EFE / HIL SIM



Federated avionics approach

Holding drivers and interface + subsystem management

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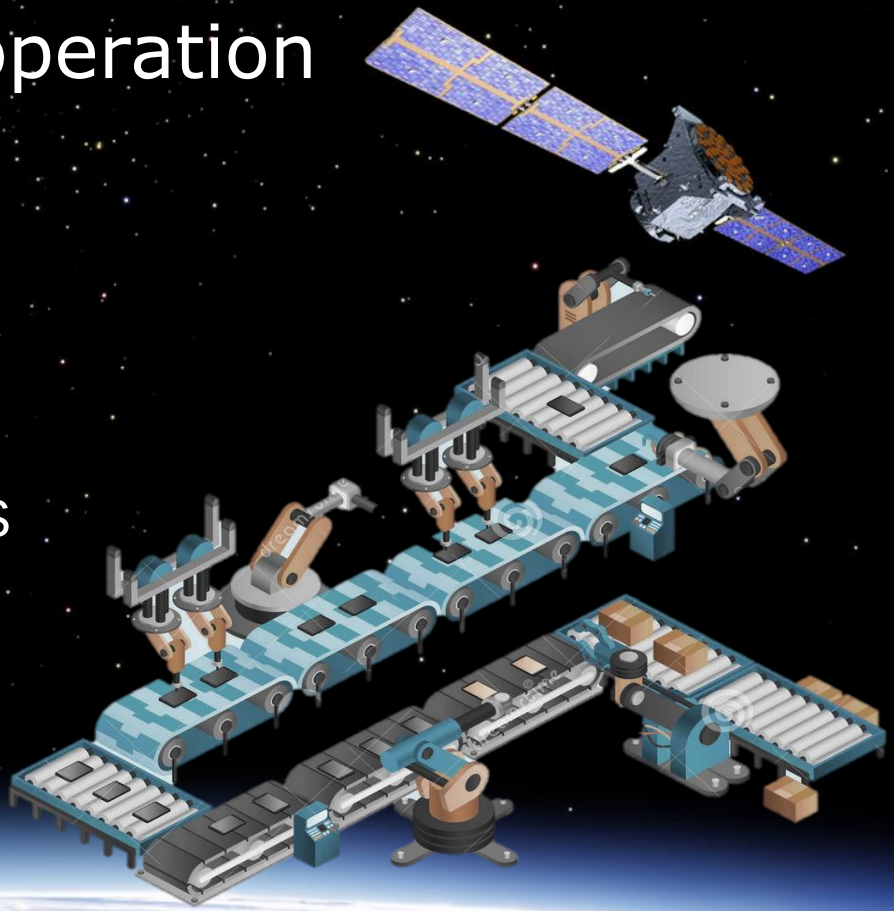
# SPiN and Telespazio cooperation



- Digital warehouse for EDS
- Expertise in EDS parsing
- Adaptable to changing EDS version
- Future: Parsing ICD/DB files to EDS

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