RUAG

SAVOIR

space avionics open interface architecture

SAVOIR general recommendations for Payload Platform interfaces

Torbjörn Hult

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Origin of the document

- The SAVOIR general recommendations for Payload Platform interfaces were generated as part of the ASRA (Avionics System Reference Architecture) study.
- ASRA defined an avionics reference architecture meeting the needs of the various mission domains. The work was focused on data management and communications architectures.
- First work package agreed on a common functional architecture and outlined the main functions per functional block and has been presented at earlier ADCSS workshops.
- Four subsequent work packages for generating:
  - Ground to Space interfacing, general recommendations
  - OBC functions, generic specification
  - RTU functions, generic specification
  - Platform/Payload interfacing, general recommendations

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Document style

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esa

estec

European Space Research
and Technology Centre
Keplerlaan 1
2201 AZ Noordwijk
The Netherlands
T +31 (0)71 565 6565
F +31 (0)71 565 6040
www.esa.int

DOCUMENT

SAVOIR general recommendations for Platform Payload interface

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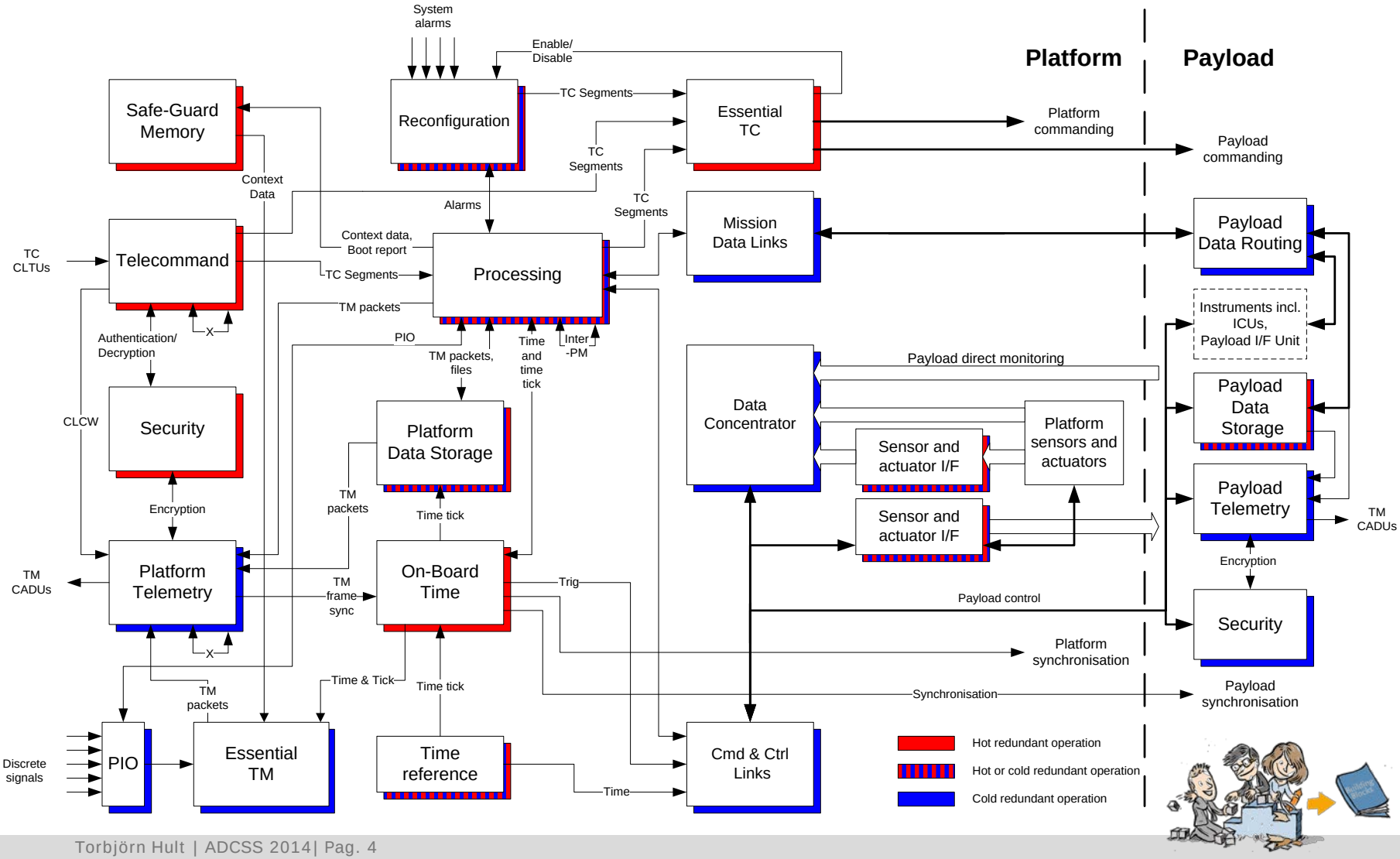
Avionics functions



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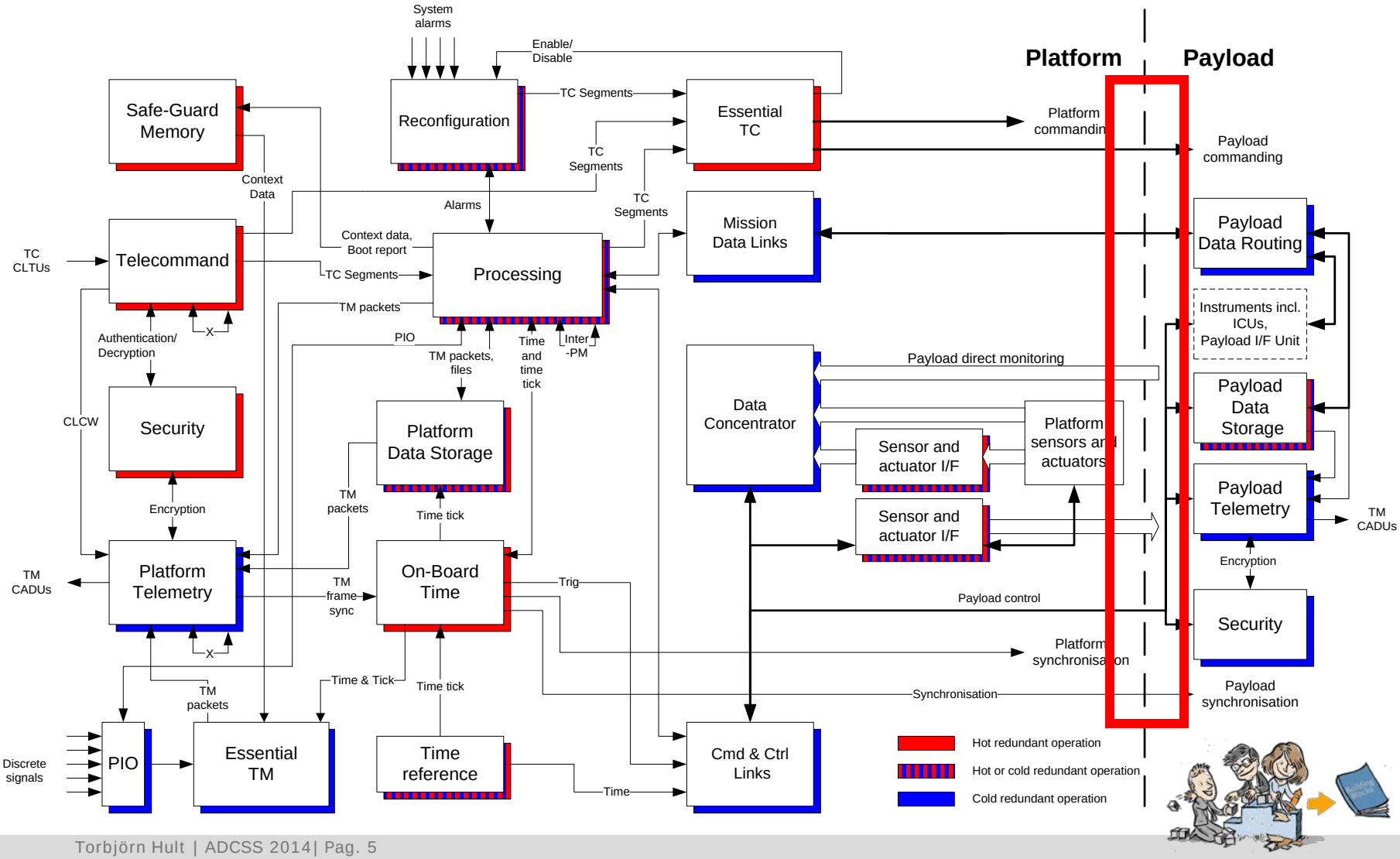
Payload platform interfaces



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Document contents

- Common terms are defined
- The interface is seen from two different views:
  - Functional view
    - Time management
    - Active thermal control
    - Payload mission (scheduled) operations
    - Payload contingency operations
    - Payload mission data management
    - Payload being part of platform control loops
    - Downlink of platform data
    - Security services
  - Implementation view (next slide)

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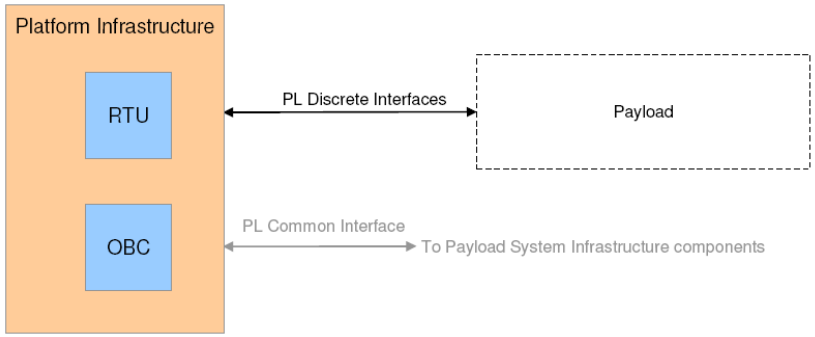
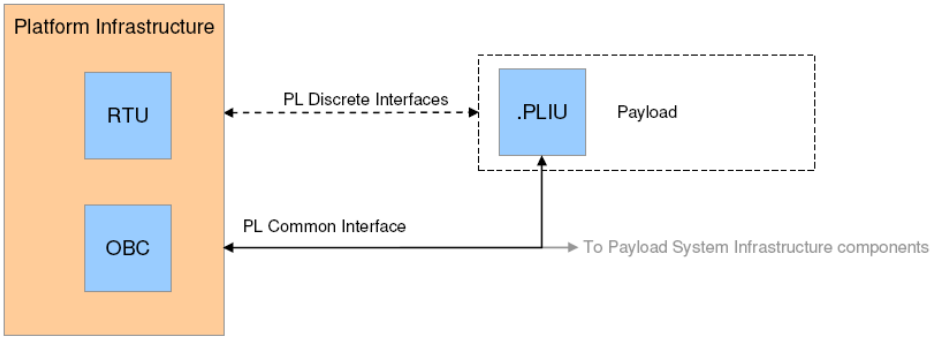
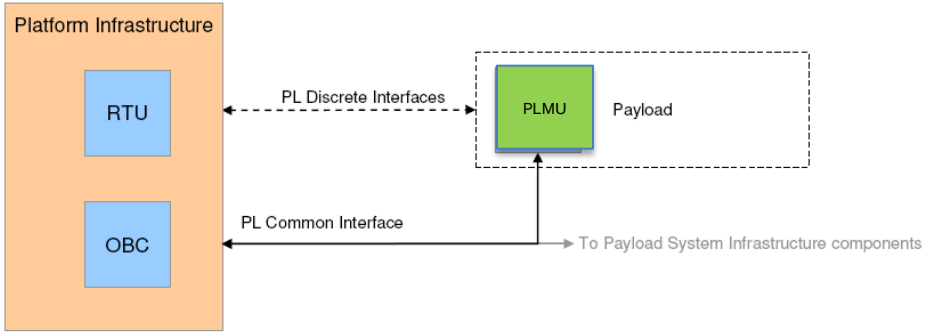
Platform to Payload interfacing implementation view



Direct interface



Interface via a
Payload Interface Unit



Interface via a
Payload Management Unit

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Deriving the requirements

- The functional view is mapped on each implementation view to establish the requirements for
  - Synchronisation interface
  - Data interface
    - Monitoring and control
    - Time distribution
    - Payload packets
  - Discrete monitoring and control (ECSS-E-ST-50-14C)
  - Protocols for the data interfaces
    - 1553 (ECSS-E-ST-50-13C with detailed Table A1)
    - CAN (awaiting ECSS standardization)
    - SpaceWire (ECSS -12C, -51C, -52C and -53C
  - Power, thermal etc. interfaces are not considered

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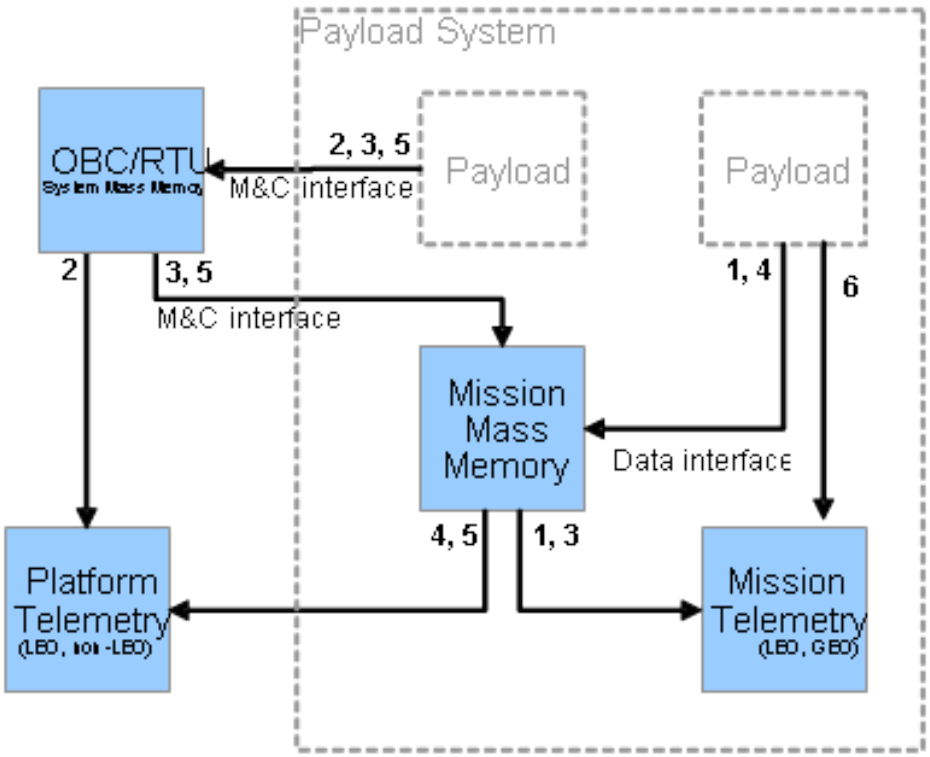
Analysis of mission data flow for different scenarios



1) High data rate
2) LEO, low data rate via S-band
3) LEO, low data rate via X-band
4) Non-LEO, primary payload via X-band
5) Non-LEO, secondary payload via X-band
6) GEO

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Other factors affecting the interfaces

- The very specific nature of the payload
  - does it need many discrete signals to be monitored and controlled?
  - does it need fast control loops not suitable for implementation in the OBC?
  - are there pointing requirements needing tight coupling between the payload and the platform AOCS?
- The satellite system constraints
  - does the payload need to be monitored and controlled by the platform for spacecraft safety and FDIR reasons?
  - are the power and mission control budgets major drivers of the payload design?
- Programmatic and industrial aspects
  - is the payload procured separately from the platform?
  - can the payload be verified separately?

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Recommendations from the ASRA study

- Payload C&C link:
  - 1553, CAN — P/F provides nom and red bus; P/L units interface both
  - SpaceWire — P/F provides four links; P/L units interface one, two or four links
- Mission data link — As for SpaceWire C&C link
- Synchronization signals — P/F provides nom and red for each pulse; P/L units interface one or both; Optionally P/L provides sync I/F
- Discrete pulse commands — P/F provides nom and red for each pulse; P/L units interface one or both
- Discrete monitoring — P/F provides nom and red for each signal; P/L units interface one or both

- Full cross-strap capability from the platform
  Full freedom for payload redundancy except for the buses

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Other details

- The frequency of a synchronisation signal shall be configurable to 1 or 2*N Hz, where N is an integer between 1 and 8.
- Packetised communication shall follow the PUS standard
- Packetised communication over SpaceWire shall use CPTP
- Packetised communication over 1553 shall use a max packet size same as max data block size
- Memory access type communication over SpaceWire shall use RMAP
  - RMAP not allowed for packetised communication
- Mission data shall be transported over a single interface type
  - Not allowed to use both 1553 and SpaceWire for science data

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Contact

Feedback: savoir@esa.int

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