ADCSS 2012 - Day 3

Mass Memories for Payload Applications and File Based Systems

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ESTEC
25/10/2012

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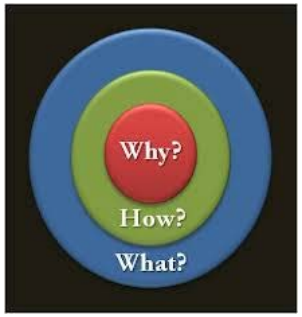
Scope



1. **Mission requirements and operational trends**
   Why do we need delivery protocols
   What benefits are there in file based operations?

2. **Architectures and communication aspects**
   How does file based operations affect the mass memory as well as communication with ground segment?

3. **Technology Trends and challenges for future solid state mass memories**
   What technology building blocks are available to meet next generation mission requirements?

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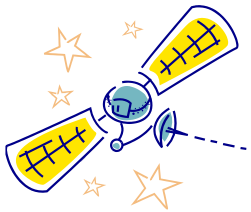
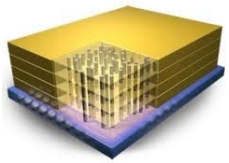
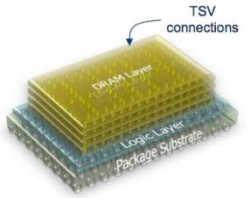
Future requirements – an outlook

1. High bandwidth down links (Ka-band or Optical terminals)
2. Very high data rate instruments (up to 12 Gbps record rate, 2Gbit replay rate)
3. Very high speed serial links for on-board unit to unit communication (>2.5Gbps)
4. Large on-board storage capability (up to 10 Tbits)



Rain fading is an issue of Ka and Optical terminals





Memory technology changes fast – **qualification is a major issue**

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File based operations - impacts

1. **File delivery protocol**
    a. CFDP (standard implementation)
2. **On-board data processing needs adaptation**
    a. On-board mass memory SW and HW
    b. On-board SW (SMU)
3. **Ground segment adaptations**
    a. File delivery protocol entities needs to be included in ground data handling
4. **Mission OPS procedure adaptations**
    a. Control services (small data structures TM/TC)
    b. Data services (typically instrument data)

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Agenda Session 1

Session 1: Mission requirements and operational trends

Time	Presentation	Presenter	Company
09:00	Welcome and Introduction	J.Ilstad	ESA/ESTEC
09:10	FTP for space - CFDP	C.Taylor	ESA/ESTEC
09:35	Proposed concepts for File Based Operations	M.Pecchioli	ESA/ESOC
09:55	EUCLID Needs for space and ground segment	L.Stagnaro	ESA/ESTEC
10:15	OPS concept for EUCLID	F.Keck	ESA/ESOC
10:35	JUICE mission – Mission overview and communication aspects	C.Erd	ESA/ESTEC
10:55	Sentinel-2 Mass Memory and Formatting Unit and Future File Based Operations	G.Mandorlo	ESA/ESTEC
11:15	**Session 1 Round Table Discussions**		
11:45	**Coffee Break**		

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Agenda Session 1 : Discussion points (1 of 2)

1. CFDP is an international standard with heritage and currently under review – inputs welcome
2. The file based operations study led by ESOC has completed and concluded that file based operations will bring benefits and is the way forward; CDFP has been selected as the baseline for file transfer and will be made available in the ground segment as a standard service
3. The use of K Band infers that transmission will be subject to increased data loss such that retransmission may be required
4. The study of Euclid requirements has led to the baselining of file based ops and CFDP, the actual implementation will be left to industry

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Agenda Session 1 : Discussion points (2 of 2)

5. ESOC is investigating the basic concepts of file based operations in preparation for Euclid
6. Earth ops may utilise optical communication in the future and such links may also incur data loss requiring transmission
7. Any move towards file based operations should involve all parties so that an end-to-end solution is developed
8. Possibly too soon to determine if CFDP would bring big benefits to Juice but long delays on uplink may be assisted by file based checksum

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Agenda Session 2

Session 2: Architectures and communication aspects

12:00	**Introduction**		ESA/ESTEC
12:05	A CFDP flight SW implementation	A.Bourdoux	Spacebel
12:25	Mass memory trend supporting file based operations	P.Lombardi	Syderal
12:45	**Lunch**		
13:45	**Session 2: Continuation**		
13:45	Current and Future Mass Memory Products	M.Staehle, T.Pike	EADS Astrium
14:10	Advanced Mass Memory units and outlook on implementing CFDP	G.Rosani, M.De Meo G.Saldi, T.Campanella	Thales Alenia Space
14:30	Development of the CFDP IP core	N.Dankert	C3E, Braunschweig
14:50	**Session 2 discussions**		
15:10	**Coffee Break**		

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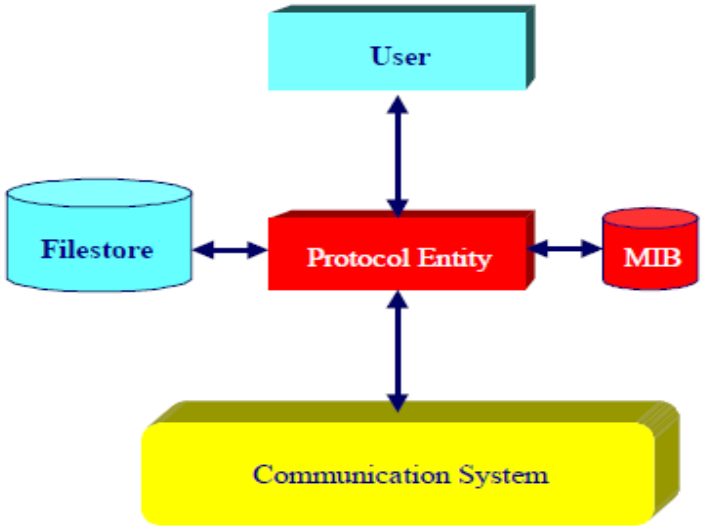
Agenda Session 2 : Discussion points

1. In order to reach high data rate performances the CFDP engine appears to require certain functions to reside in HW (e.g. Transaction and packet management, CRC calculation and validation ? , …) while other in SW (Configuration & control, File Store, …). What appears to the be the natural split?



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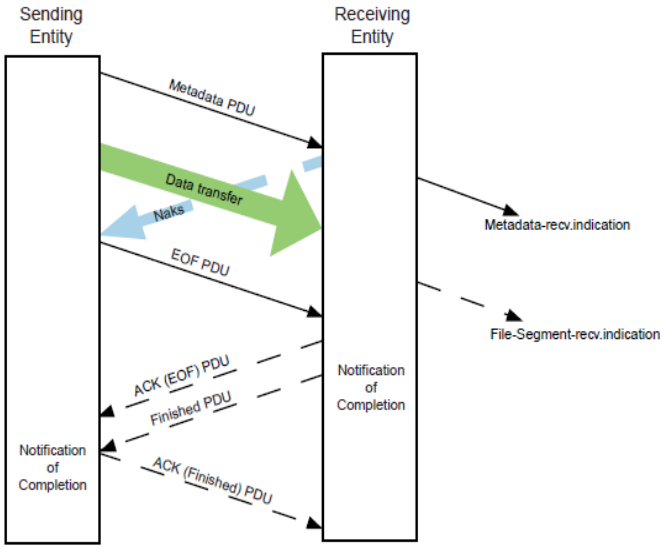
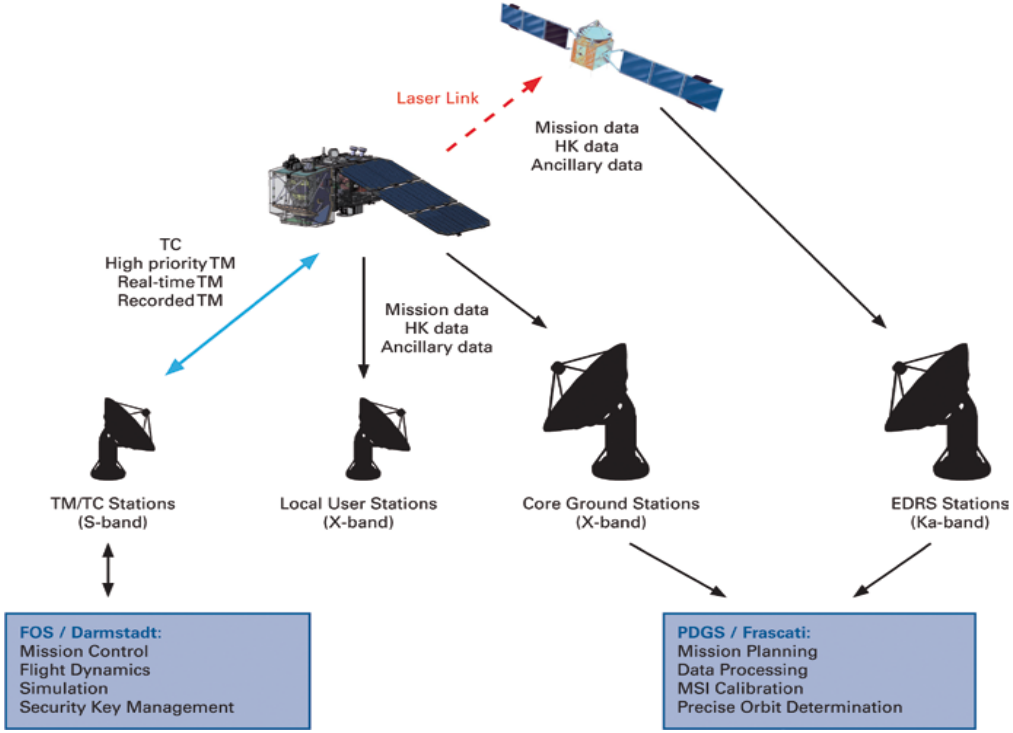
Agenda Session 2 : Discussion points

2. Should CFDP PDU as NAK, ACK PDU, Finished PDU be embedded as a distinct PUS packets part of a PUS service?





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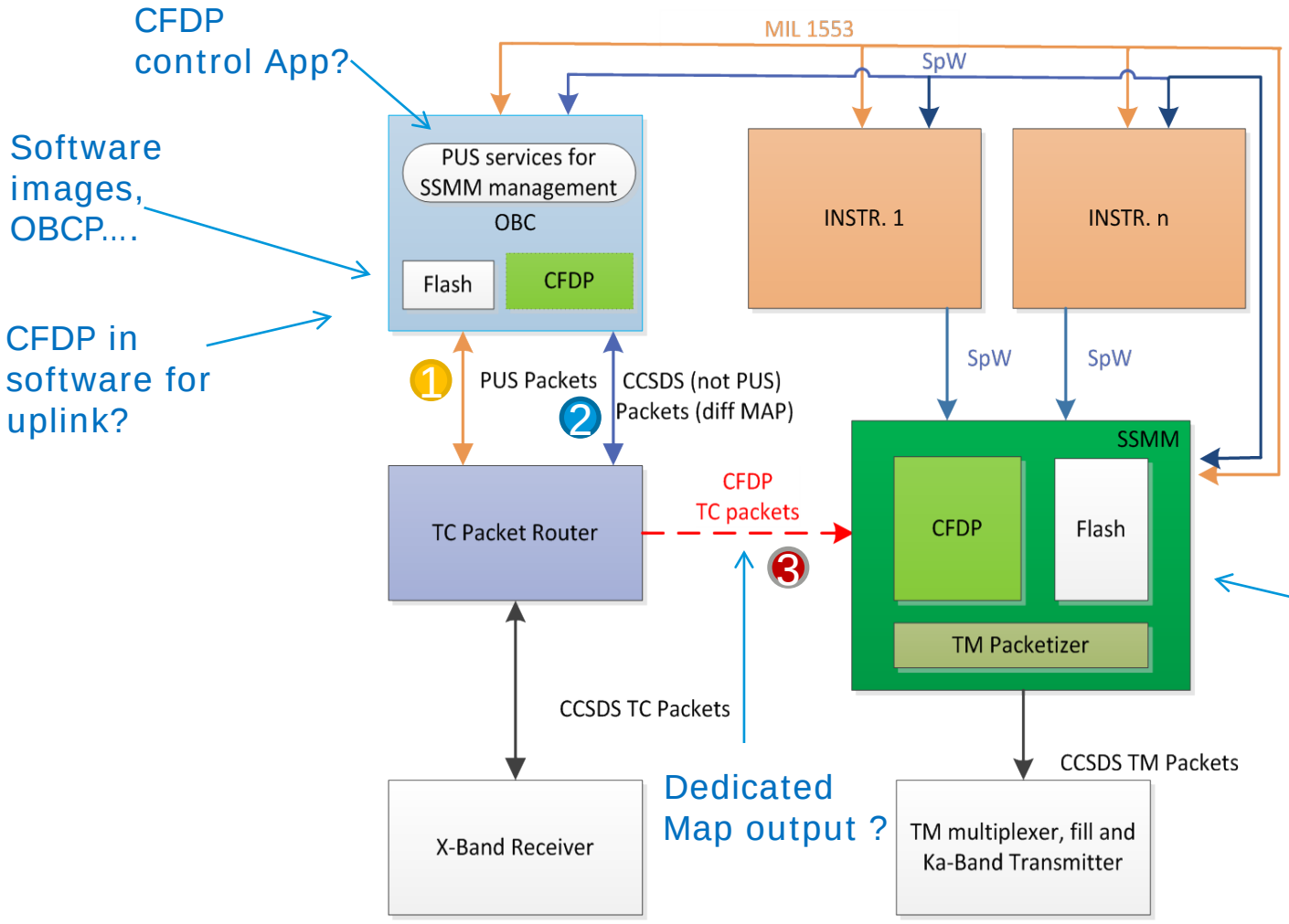
Agenda Session 2 : Discussions – CFDP Avionics Options



Should we use CFDP Meta data (2,3) to control CDFP transfer and file store or rely only on PUS services / applications (1)?

Embedded CFDP with H/W support for downlink?

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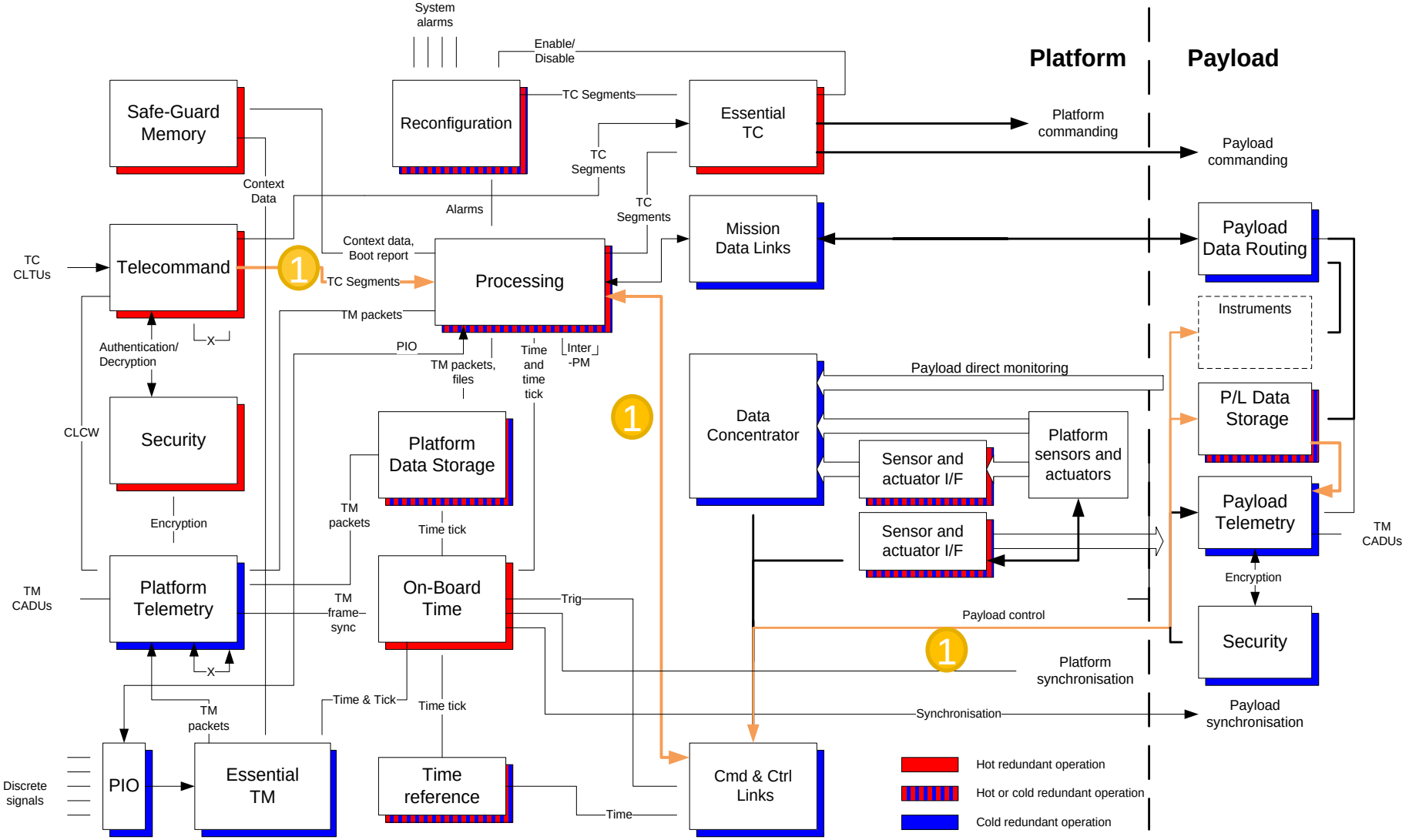
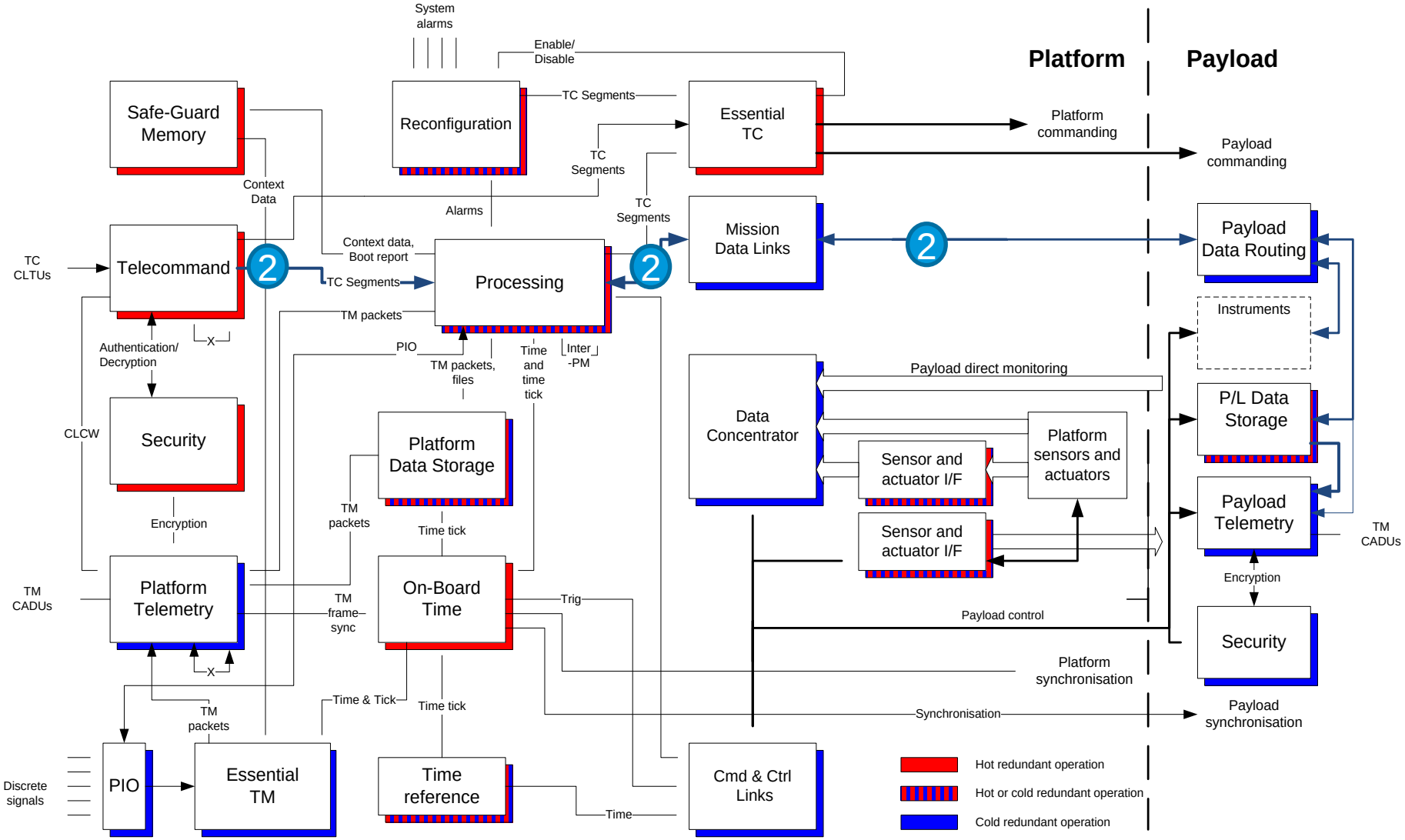
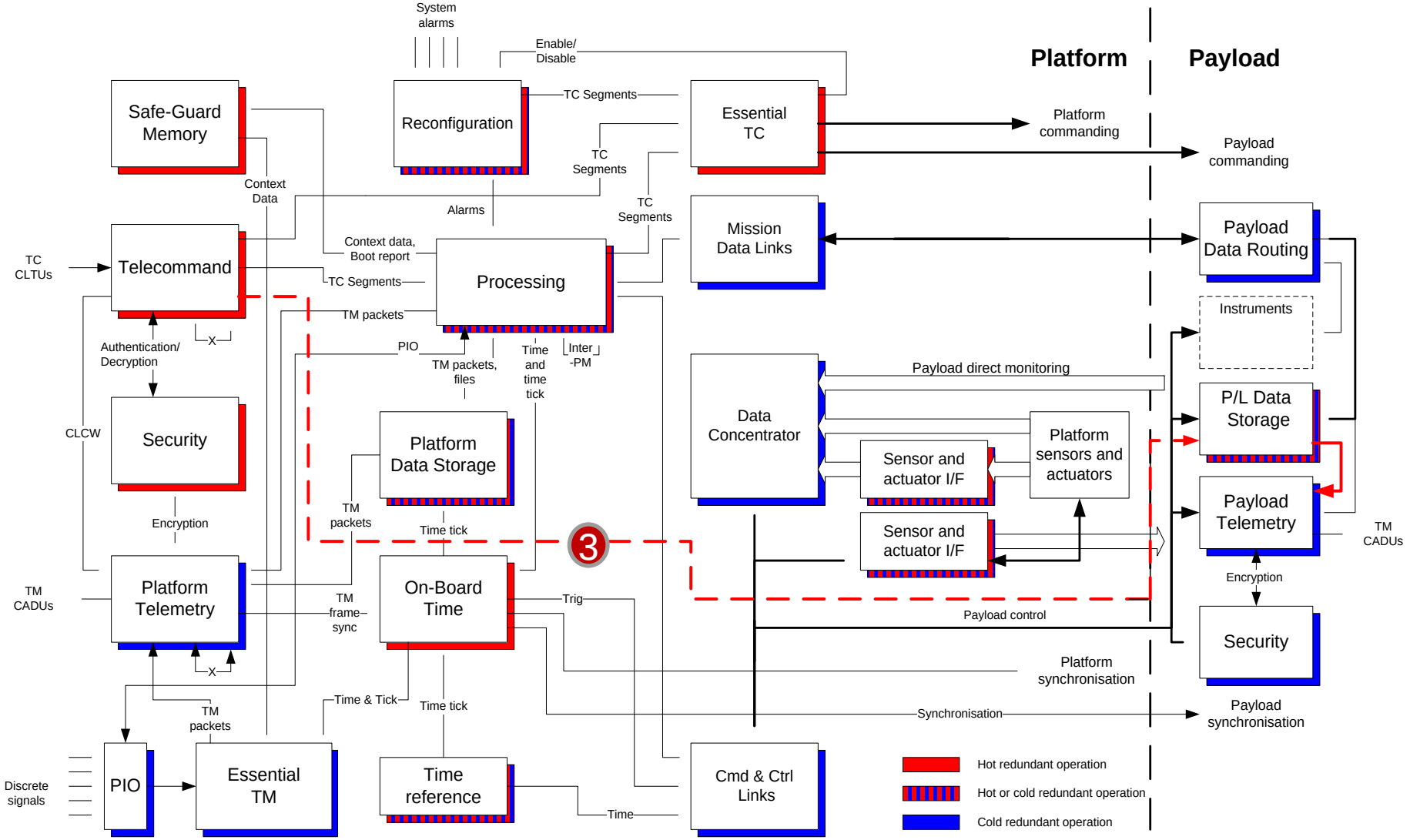
Agenda Session 2 : Discussions – CFDP Avionics options mapped in SAVOIR Architecture (1 of 3)



Agenda Session 2 : Discussions – CFDP Avionics options mapped in SAVOIR Architecture (2 of 3)



Agenda Session 2 : Discussions – CFDP Avionics options mapped in SAVOIR Architecture (3 of 3)



Agenda session 3

Session 3: Technology Trends and challenges for future solid state mass memories

15:30	**Introduction**		
15:35	Memory technology trends and qualification aspects	F.Gliem	IDA Braunschweig
15:55	ESA deep sub micron program - ST 65nm	L.Hili / D.Lehongre	ESA/ESTEC, ST Microelectronics
16:15	SpaceFiber	S.Parkes	University of Dundee, Star Dundee
16:35	Improved Memory Module for COTS NAND FLASH devices	W.Errico	Sitael
16:55	Use of CFDP in NASA/GSFC's fligth SW architecture	J. Wilmot	NASA/GSFC via Webex
17:15	**Session 3 discussions**		
17:30	**Wrap-up and conclusions**		ESA/ESTEC

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Thank you!

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