CAN activities @ ESA

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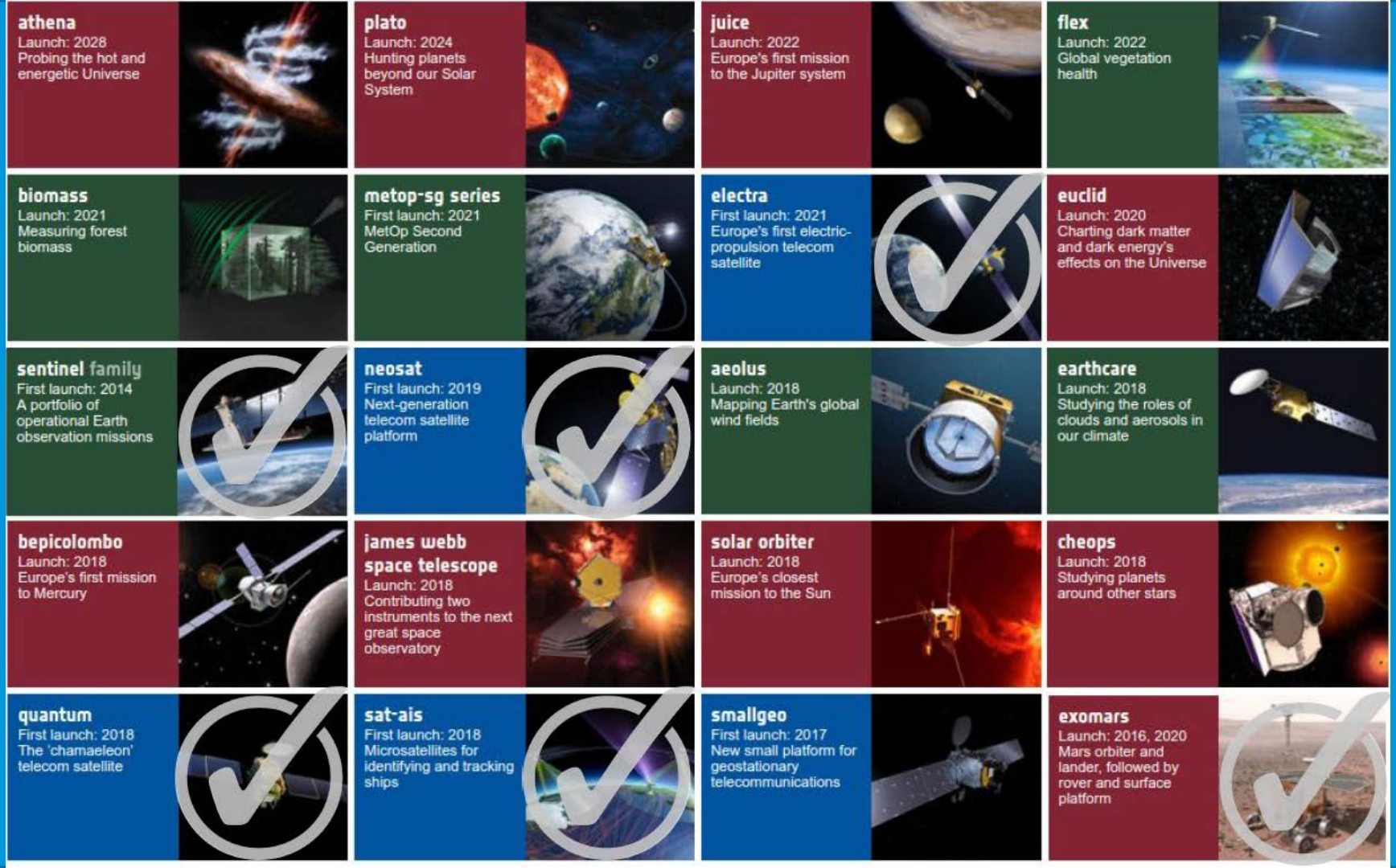
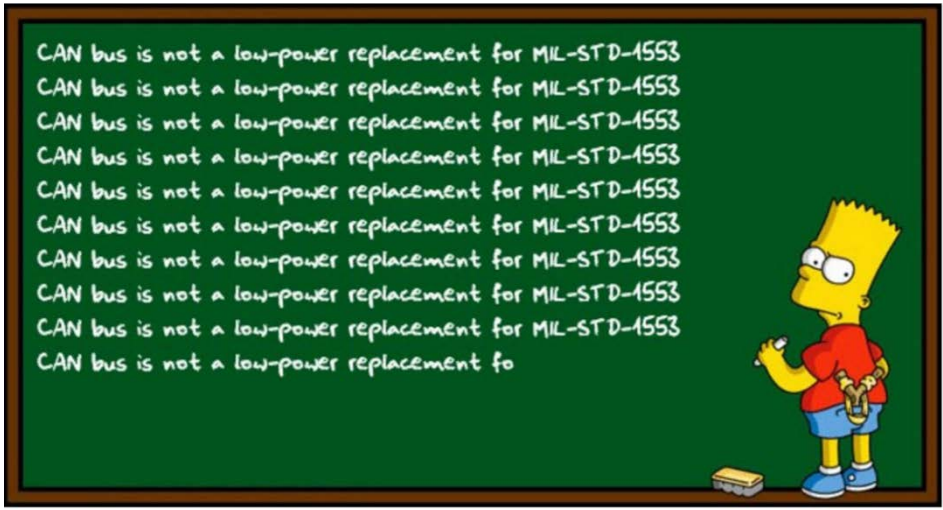
14/06/2017


athena
Launch: 2028
Probing the hot and energetic Universe
plato
Launch: 2024
Hunting planets beyond our Solar System
juice
Launch: 2022
Europe's first mission to the Jupiter system
flex
Launch: 2022
Global vegetation health
biomass
Launch: 2021
Measuring forest biomass
metop-sg series
First launch: 2021
MetOp Second Generation
electra
First launch: 2021
Europe's first electric-propulsion telecom satellite
euclid
Launch: 2020
Charting dark matter and dark energy's effects on the Universe
sentinel family
First launch: 2014
A portfolio of operational Earth observation missions
neosat
First launch: 2019
Next-generation telecom satellite platform
aeolus
Launch: 2018
Mapping Earth's global wind fields
earthcare
Launch: 2018
Studying the roles of clouds and aerosols in our climate
bepicolombo
Launch: 2018
Europe's first mission to Mercury
james webb space telescope
Launch: 2018
Contributing two instruments to the next great space observatory
solar orbiter
Launch: 2018
Europe's closest mission to the Sun
cheops
Launch: 2018
Studying planets around other stars
quantum
First launch: 2018
The 'chamaeleon' telecom satellite
sat-ais
First launch: 2018
Microsatellites for identifying and tracking ships
smallgeo
First launch: 2017
New small platform for geostationary telecommunications
exomars
Launch: 2016, 2020
Mars orbiter and lander, followed by rover and surface platform

CAN in ESA missions – Big Science & EO missions

- Low/no interest in replacing MIL-STD-1553
- Golden rule: “If it works don’t touch it”
- Lack of available avionic units with CAN: RTUs, Star trackers…

- Power savings are negligible at system
- Galvanic isolation has saved missions
- Lack of standard validation procedures

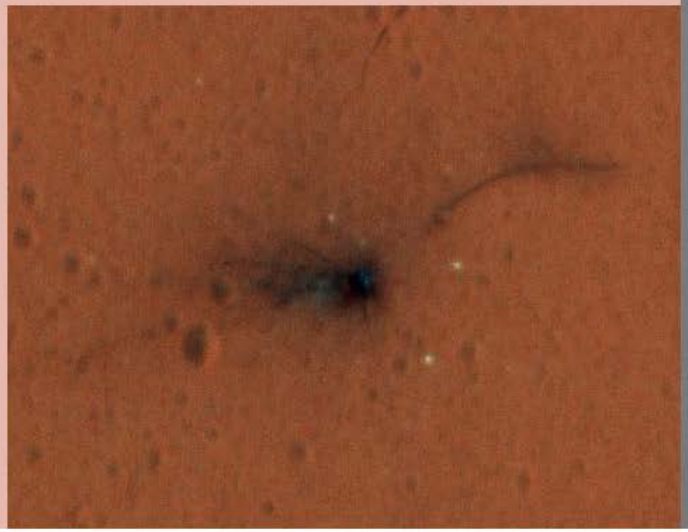


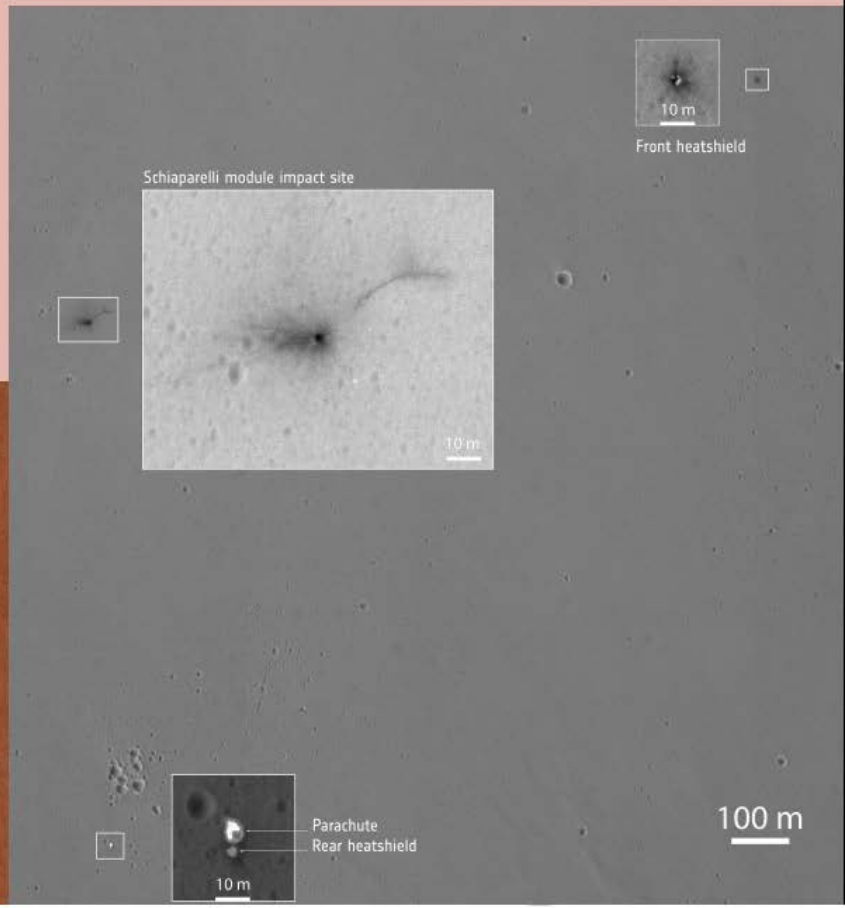
A robust, reliable and capable communication bus

CAN bus on Exomars 2016 EDM worked without issues until the last fateful moment.

The uninterrupted stream of telemetry during the descent phase allowed to understand the root causes of the failure.

The words ‘CAN bus’ and ‘computer’ are not even mentioned in the failure investigation report.





CAN in ESA missions – Early adopters

- Small and medium platforms
- Low power availability
- Low cost missions
- Large amount of nodes on the network

- But… Missions implement CAN ala MIL-STD-1553
- Master/slave communication
- Lack of distributed intelligence

ECSS-E-ST-50-15C - CANbus extension protocol (1 May 2015)

Posted on 2015-05-29 by Klaus Ehrlich (as webmaster)

CREATE CR

Scope

This standard is applicable to spacecraft projects that opt to use the CAN Network for spacecraft on-board communications and control. It also defines the optional use of the CANopen standard as an application layer protocol operating in conjunction with the CAN Network data link layer.
This standard does not modify the basic CAN Network specification and complies with ISO 11898-1/-2:2003. This standard does define protocol extensions needed to meet spacecraft specific requirements.
This standard covers the vast majority of the on-board data bus requirements for a broad range of different mission types. However, there can be some cases where a mission has particularly constraining requirements that are not fully in line with those specified in this standard. In those cases this standard is still applicable as the basis for the use of CAN Network, especially for physical layer and redundancy management.
This standard may be tailored for the specific characteristic and constrains of a space project in conformance with ECSS-S-ST-00.

Attachments:

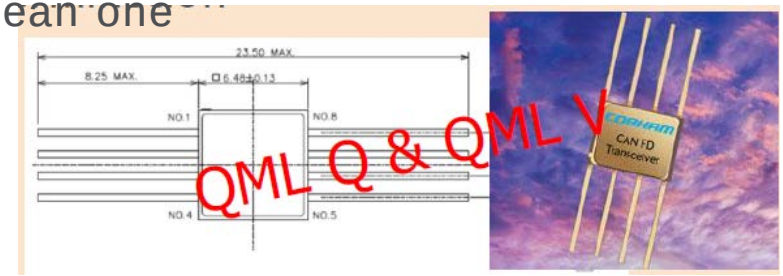
- ECSS-E-ST-50-15C(1May2015).pdf
- ECSS-E-ST-50-15C(1May2015).pdf

Md5 checksum .doc file = CC4EFCF915D1AA0CF3E3C971875812BD
Md5 checksum .pdf file = 8B8FAF8BC8069A603321213D687E464A

Posted in Active Standards, Standard Tagged Active Standard, Engineering, published, Standard permalink

CAN building blocks

- CAN transceivers from major non-UE manufacturers
- ESA failed to find budget to develop an European one



- Plenty of available microcontrollers and microprocessors with CAN controllers
  - Based on LEON2/3, ARM, MSP430 and ATmega

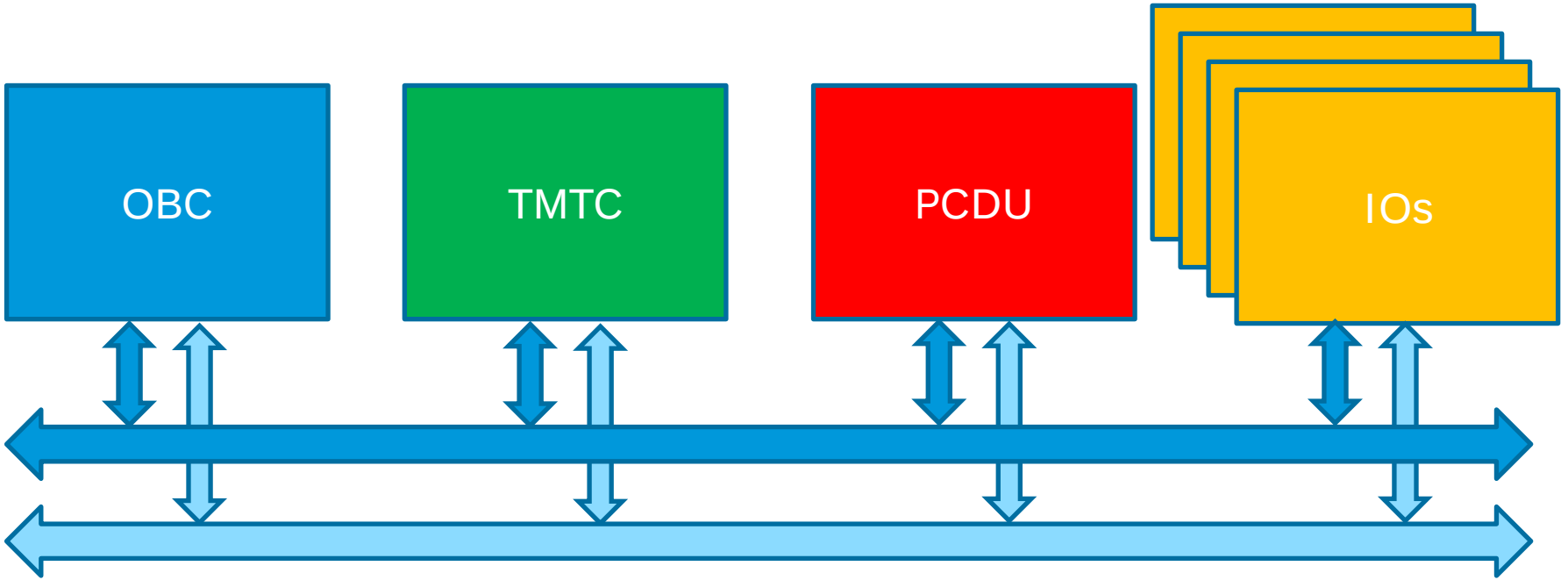
CAN building blocks (2)

- Higher level ECSS/CANopen implementations
  - SITAEL CCIPC/RCCIPC based on ESA HurriCANe for FPGAs
  - Several commercial SW implementations

Project Metrics	Vector	CAN Festival
Files	50	50
Program Units	105	115
Code Lines	4735	3735
Statements	2240	1774
Program Unit Complexity	**Vector**	**CAN Festival**
WC unit	CanCom	proceedSDO
Mod. Cyclomat	42	167
Nesting	9	6
Path Count	2040	169325

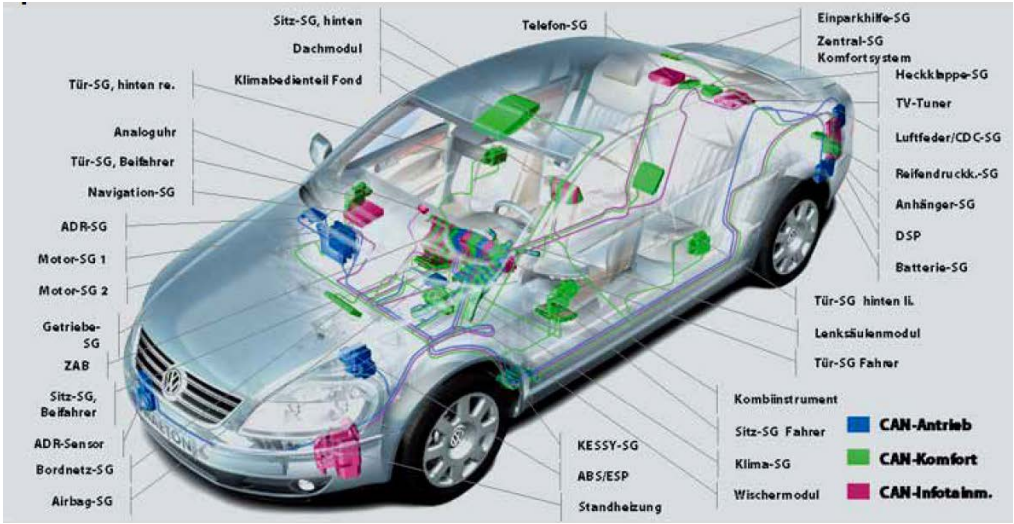
Multi-Master and Distributed intelligence (1)

- CAN is a multi-master bus. Enabler for distributed intelligence architectures



Multi-Master and Distributed intelligence (2)

- Most avionics units implement some sort of intelligence (FPGAs, uC, uP…)
- Even power engineering is starting to implement digital control (Workshop on Digital Power Control at ESTEC 22nd of June)
- Development of smart-RTUs concepts



Multi-Master and Distributed intelligence (3)

But…

- SW development costs outrageously high
- Average production is 2 lines/day
- Some have become “inventive” trying skip the ECSS-Q-ST-80C SW PA

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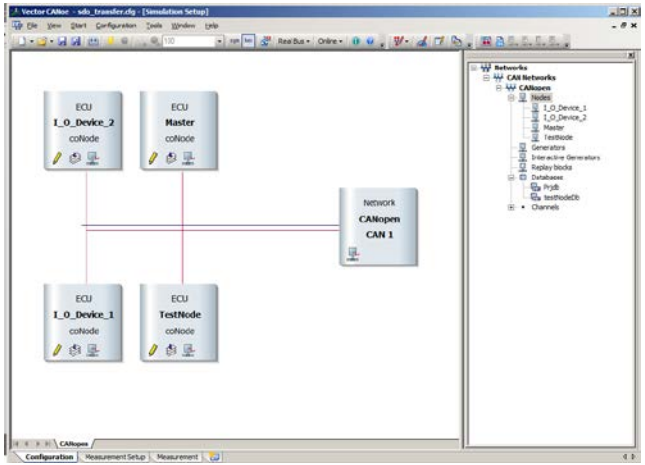
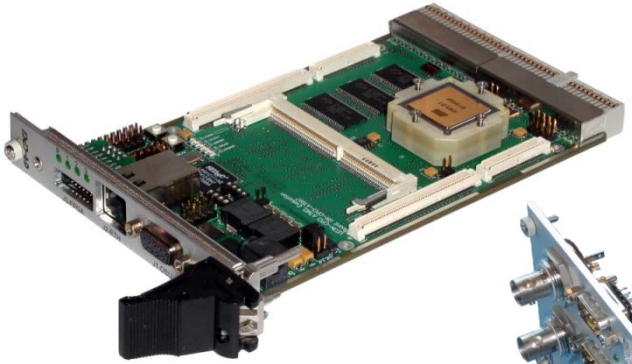
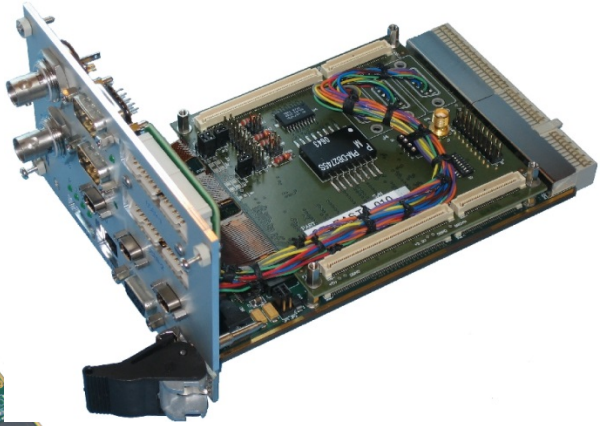
Multi-Master and Distributed intelligence (4)

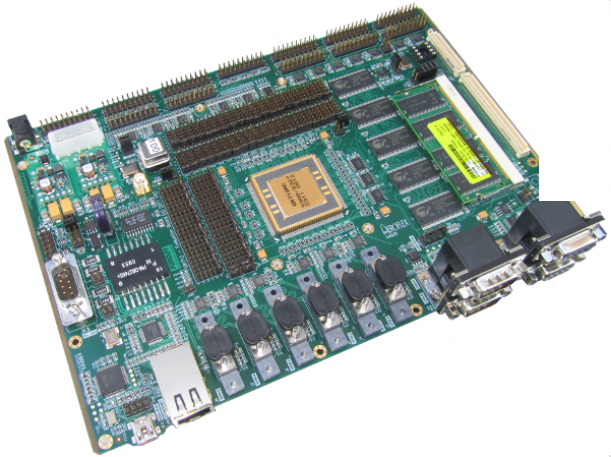
- Most of the FPGAs implement simple state-machines to acquire or actuate on IOs. Expensive, ITAR/EAR components
- ESA TEC-EDD is investing heavily in uC development. We believe that they could replace many of the FPGAs in the satellite
- However, SW development should be eased
    - Review of the PA/QA process for simple “state-machine-like” SW
    - Automating regression tests & automatic document generation
    - uC SW development costs should be comparable, if not cheaper than VHDL for FPGAs

ESTEC TEC-EDD Avionics lab (1)







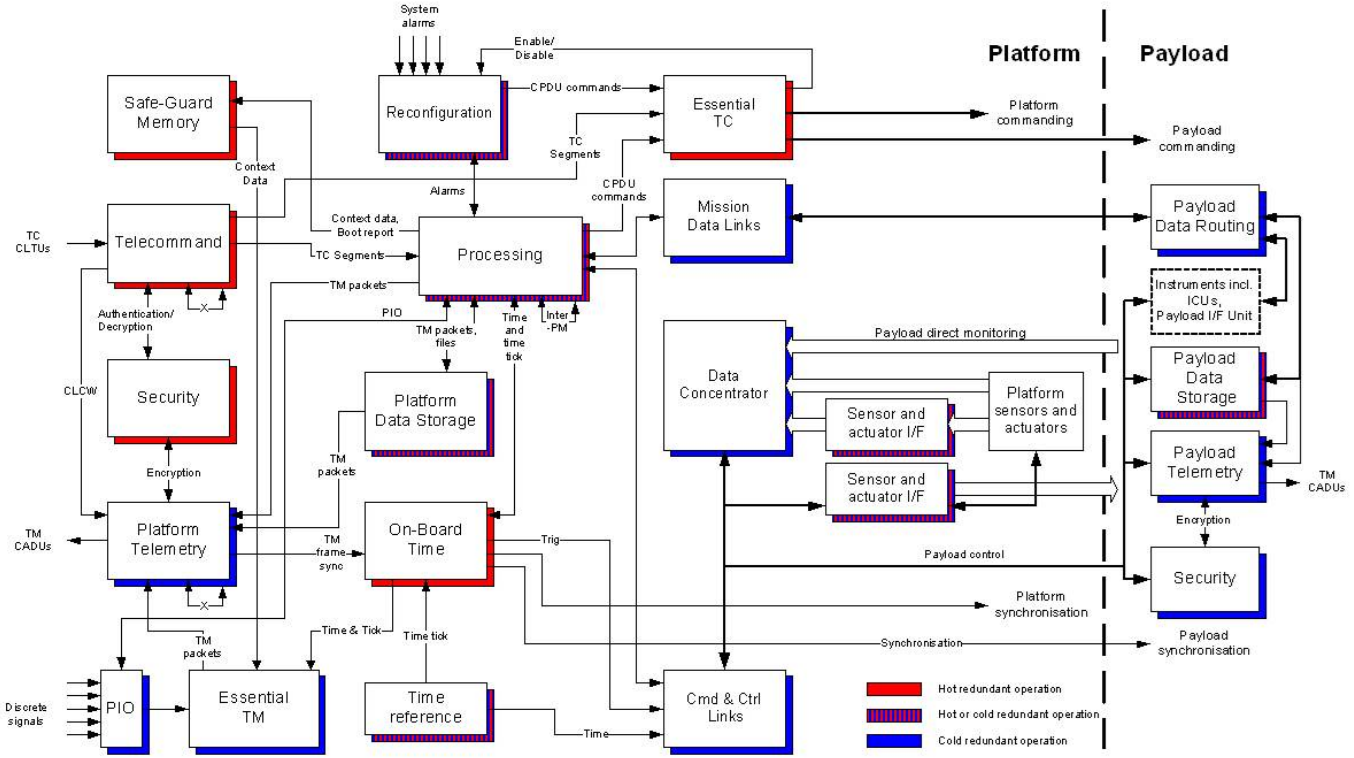


ESTEC TEC-EDD Avionics lab (2)

- Wide experience in CAN bus and ECSS-E-ST-50-15C in particular
- We can support you in the complete CAN network development cycle
- Ad-hoc “Introduction to CAN ECSS” workshops were organized for the primes of ELECTRA and SAT-AIS
- Plenty of available SW and HW tools and development environments. Simulation, prototyping, testing…

- We are eager to help you! Please contact us to request our services!

What's next? Savoir Sat



Questions?