WE LOOK AFTER THE EARTH BEAT

TAS RTU PRODUCTS

ADCSS 2015
Noordwijk

23/10/2015

Ref.:

83230356-DOC-TAS-EN-001

Thales Alenia Space

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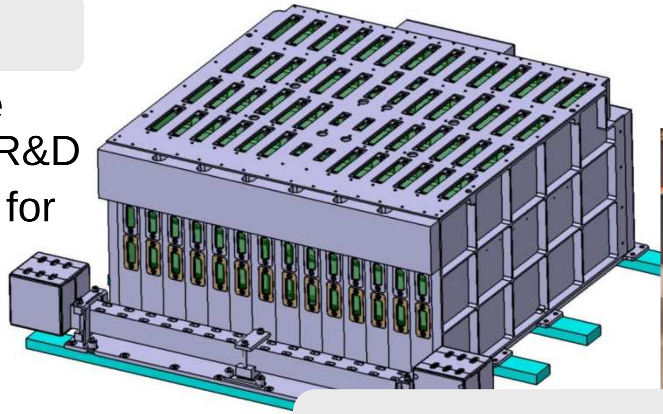
TAS-BELGIUM

HIGH POWER AVIONICS

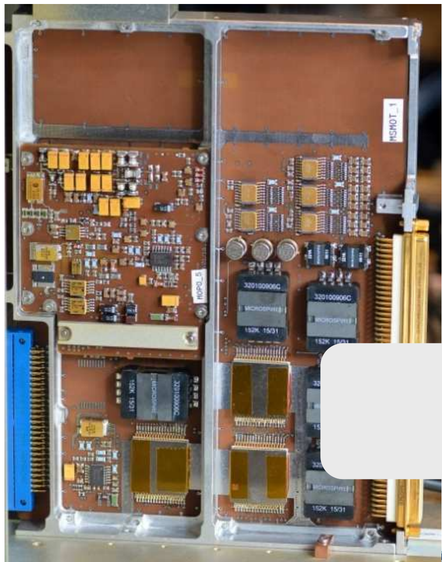
- Development programme underway under ARTES R&D
- Modular PLDIU & PFDIU for SB NEO platform
- Complete satellite power distribution and avionics
- CAN backplane bus
- DPC-based solution

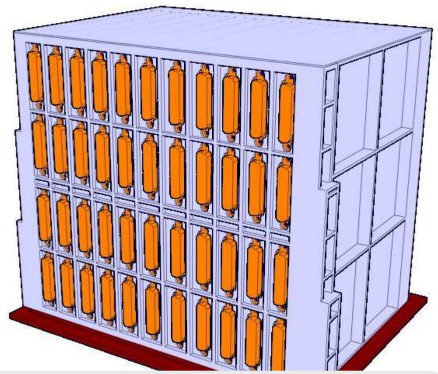


NEOSAT Qualification foreseen Q4/2016

MEDIUM POWER AVIONICS

- Generic RTU development program ongoing under GSTP R&D
- Application programs:
  - CERES
    - In partnership with EREMS
  - Exomars CRTU
    - In partnership with Qinetiq Space
- DPC solution with CAN backplane





RTU Qualification foreseen Q2/2016

TAS-ESPAÑA

REMOTE TERMINAL UNITS

- SPOT 5 - MGS
- HELIOS 2 - MGS
- SPOT 4 - RTU
- ROSETTA S/S - RTU
- ROSETTA P/L - RTU
- MARS EXPRESS - RTU
- VENUS EXPRESS - RTU
- GALILEO GIOVE - RTU

INSTRUMENT CONTROL UNITS

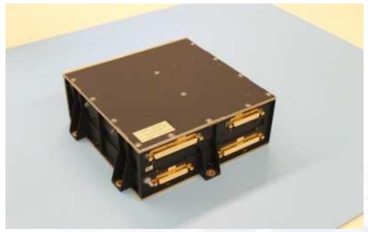
- HELIOS 2 MG - CIB
- PLEIADES - MSI
- SENTINEL 3 - OEU
- HREOS S3 - MSI
- HREOS S2 - PCU
- SEOSAT INGENIO - ICU
- TAS EXPORT OBSERVATION - ICU

PAYLOAD INTERFACE UNITS

- WORLDSTAR - PIU
- GLOBALSTAR2 - PLIU
- O3B – PLIU

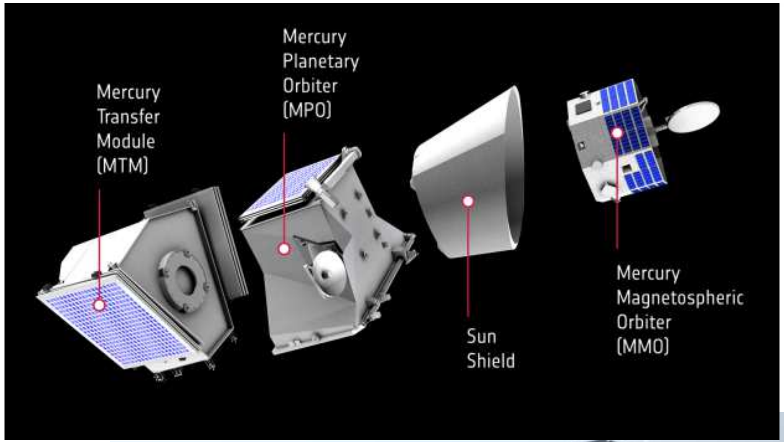
MECHANISM CONTROL UNITS

- ENVISAT/PPF - APME
- ARTEMIS - APME
- SESAT - APME
- ROSETTA - SADE
- MARS EXPRESS - SADE
- VENUS EXPRESS - SADE
- ATV - SADE
- SENTINEL 1- DCU
- EXOMARS RV - ADE



TAS-UK

- BepiColombo RIU's
  - MTM and MPO each have a TAS-UK (SEA) RIU.
  - Common modular architecture
    - reduced design time
    - reduced review cycle
    - SAVOIR-like
  - Simplicity of architecture for the customer
    - SpaceWire interface/ RMAP protocols.
    - Power management features.
    - Hot redundant operations.
    - Single point failure free.
    - >98% built in test coverage.
  - Status : MTM RIU delivered Dec 2014, MPO RIU delivered mid-2015, currently undergoing spacecraft integration



AVIONICS PRODUCT TREND

MODULARITY

- Unit to be fully modular based on ‘plug & play’ elements for I/O functions

FLEXIBILITY

- The elements for I/O functions as well as the unit controller to present adaptability to different needs

SCALABILITY

- The unit to provide capabity for extend the number and complexity of the elements

SCALABLE, FULLY FLEXIBLE, MODULAR AND AFFORDABLE

TAS RTU ARCHITECTURE

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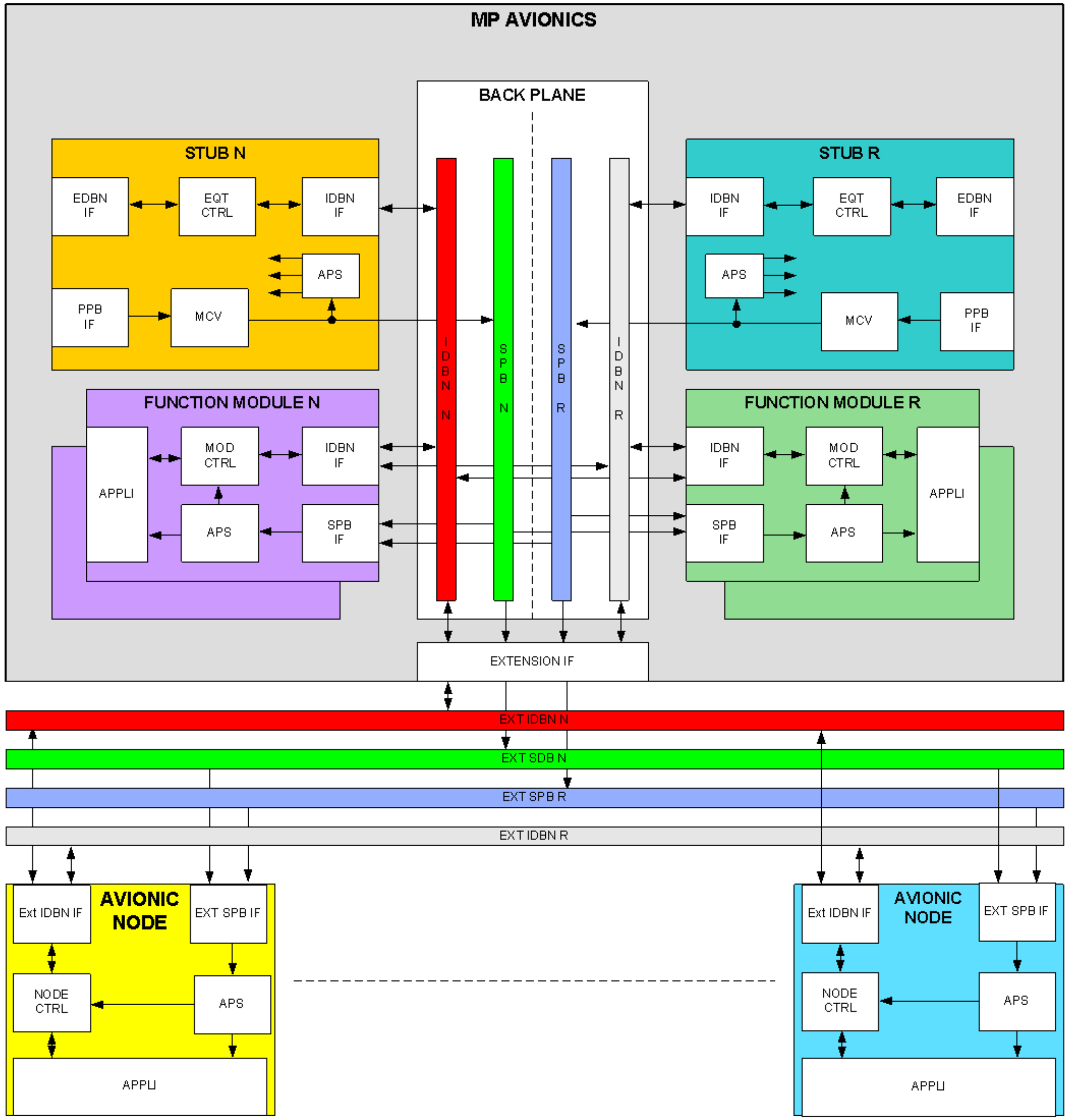
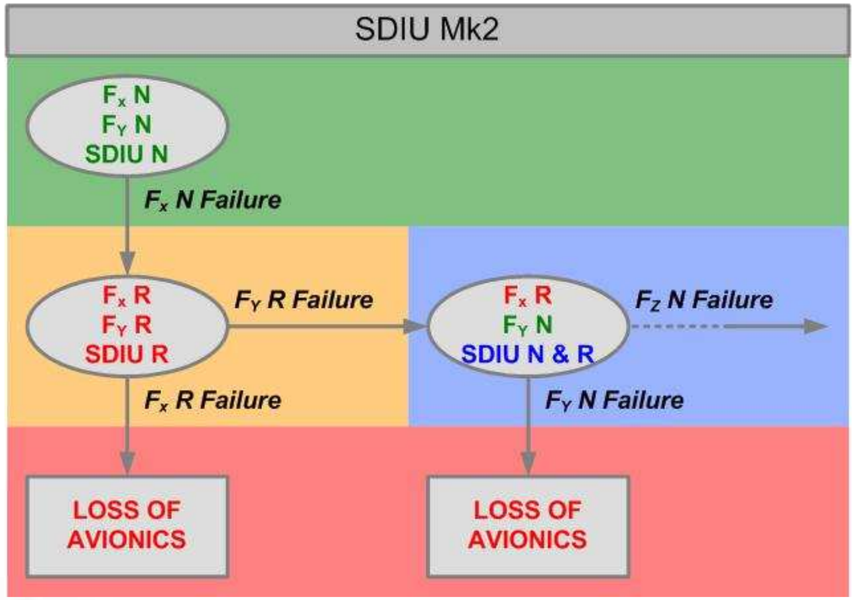
ARCHITECTURAL SOLUTIONS

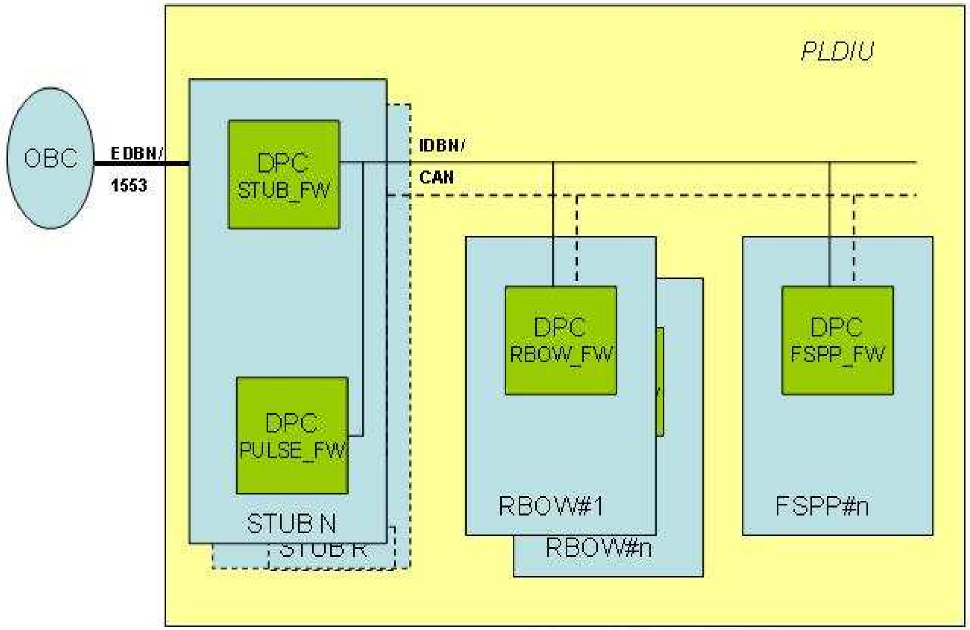
- Electrical architecture:
  - Very high modularity and versatility
    - Adapted to small equipment as SADE up to complete RTU or PIU
    - Compatible with simple N+R redundancy up to complete N/R cross-strapping with hot redundancy capability
  - Open to external unit extension
    - In terms of TM/TC and power supply architecture
  - Compatible with decentralised system



ARCHITECTURAL SOLUTIONS

- Failure Group Management - FDIR
  - Modular internal TMTC and Power supply concepts
  - Fully standardized backplane interface
  - Full internal cross-strap
  - Double crossed-failure tolerance





Can provide better reliability figure than classical cold redundancy

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BUILDING BLOCKS

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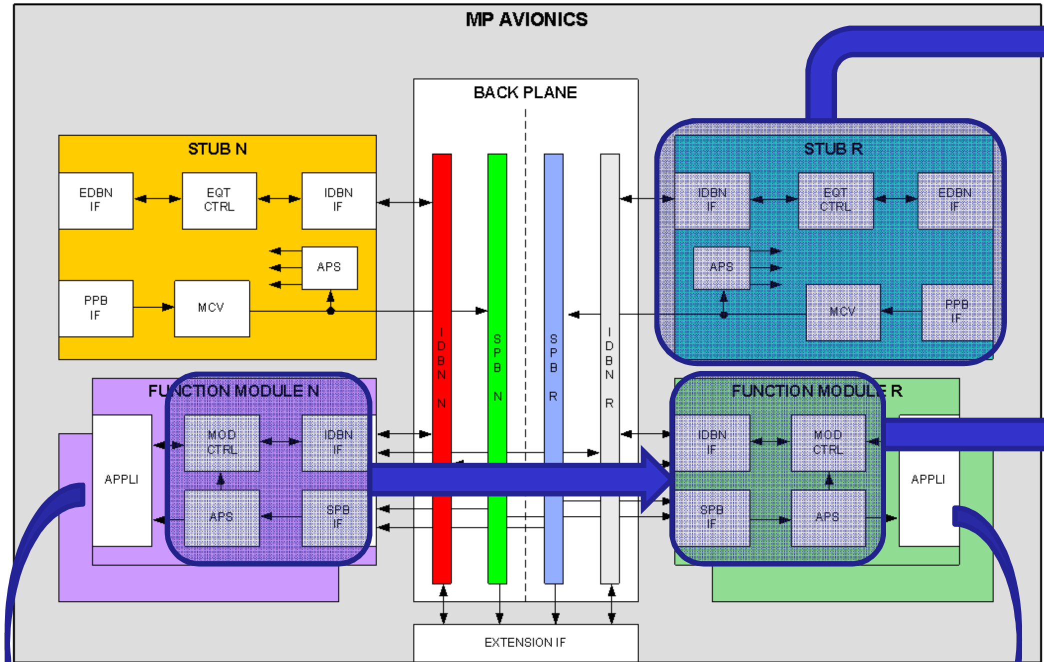
BBK SOLUTIONS



- Standard module: STUB
  - Used on multiple programs
- Standard physical BBK: DPM

- Advantages:
  - No redesign
  - Standard & stable back-plane interface
  - Stable routing of complex function
  - FW upload & validation at DPM level
  - Easier teaming agreements
  - ➔ risk management

SAM:
- 2 half-bridge drivers
- Used for SADE & APME
- Used on SDIU Mk2, all RTU's,,…

HLS:
- 8 hot line switches + itlm
- Used for heaters, pyro, bypass, propulsion, HLC,…
- Used on SDIU Mk2, all RTU's,…

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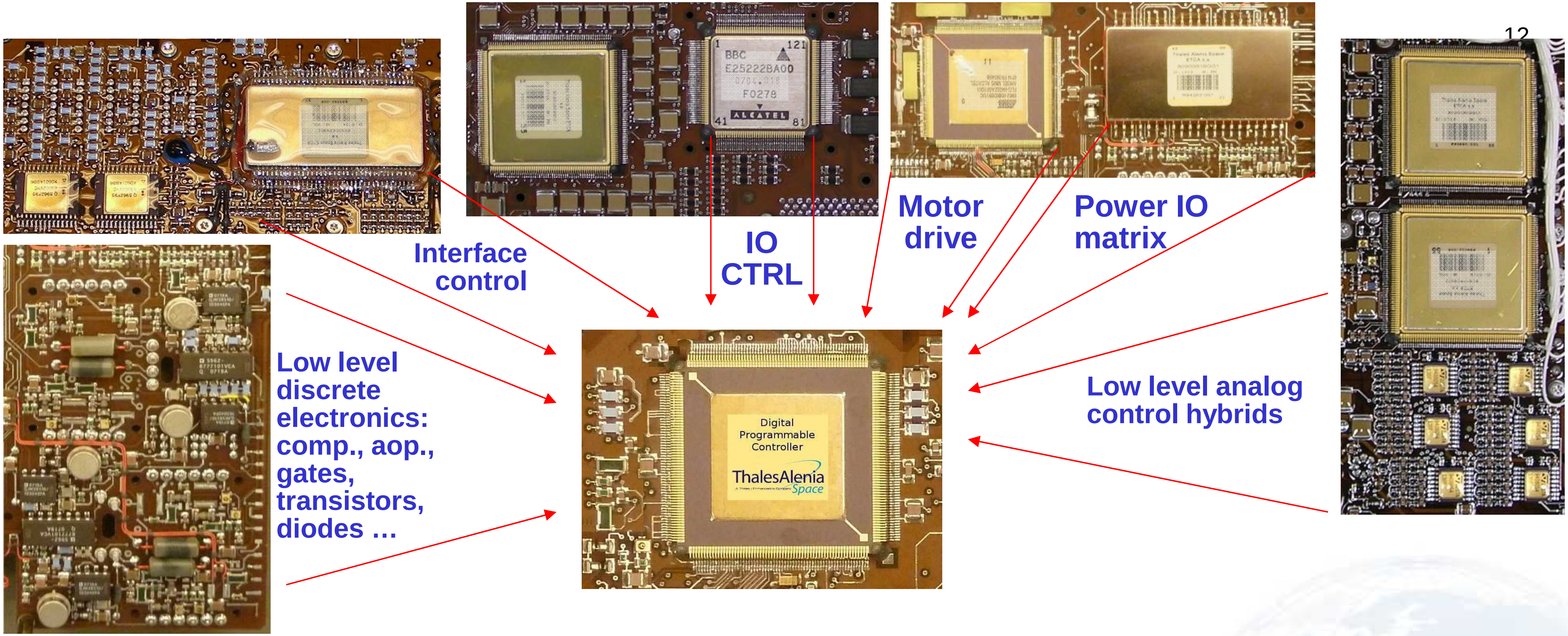
Space

DPC-G1 as key function for rationalisation of today's products



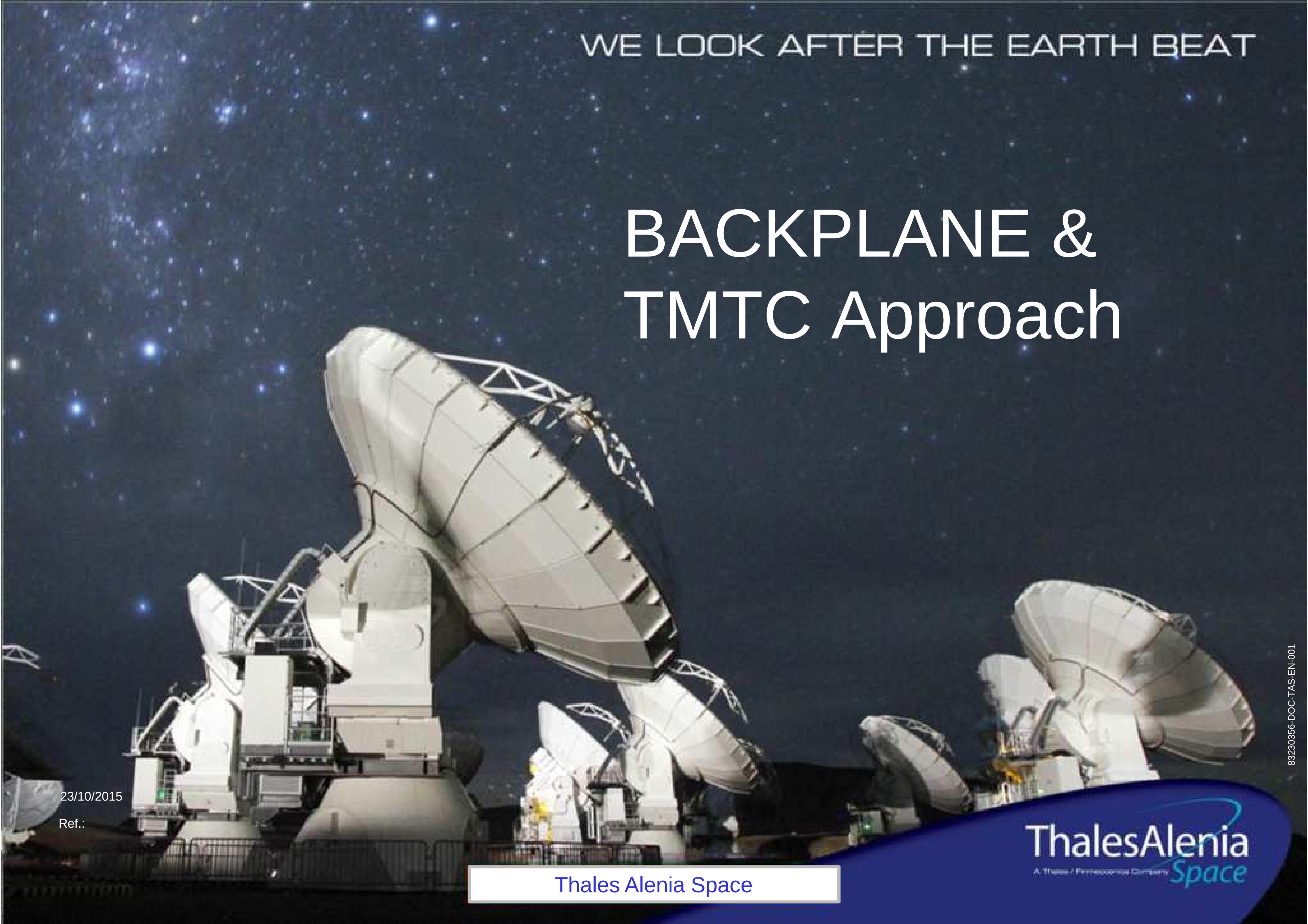
- One single chip replaces several functions !
  - Back-plane interface standard hybrid
  - Function specific ASIC or FPGA
- Firmware particularize the functionality

BBK SOLUTIONS

- AFFORDABILITY ←→ COMPETITIVITY

  - Development of COMPETITIVE Building Blocks.
    - Reuse of validated elements
    - Reduction of risk
    - Sharing of know-how throughout TAS

  - SAVOIR baseline definition
    - Common architecture definition
    - Reuse of Avionics definition for next programs



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BACKPLANE & TMTC Approach

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STANDARDISED BACK-PLANE APPROACH

Avionic products require a different approach of Back-panel depending on the nature of the signals required in those units

- PLIU/RTU Backplane contents:
  - Supply distribution
    - 1 to 3 rails typically
  - Internal C&C distribution
    - low to medium rates <10 Mbps
    - SPI, CAN, ML16/DS16 busses concept.
  - Discrete signals

- ICU Backplane contents
  - Supply distribution
    - 1 to 3 rails typically
  - Internal C&C distribution
    - low to medium rates <10 Mbps
    - SPI, CAN, ML16/DS16 busses concept.
  - Discrete signals
  - High rate data transmission
    - >10Mbps when data processing required (depending on the mission)
    - SpW, SpF, TTEth, cPCI, dedicated ones…

STANDARDISED BACK-PLANE APPROACH

However Standardised Back-planes bring advantages

Why?

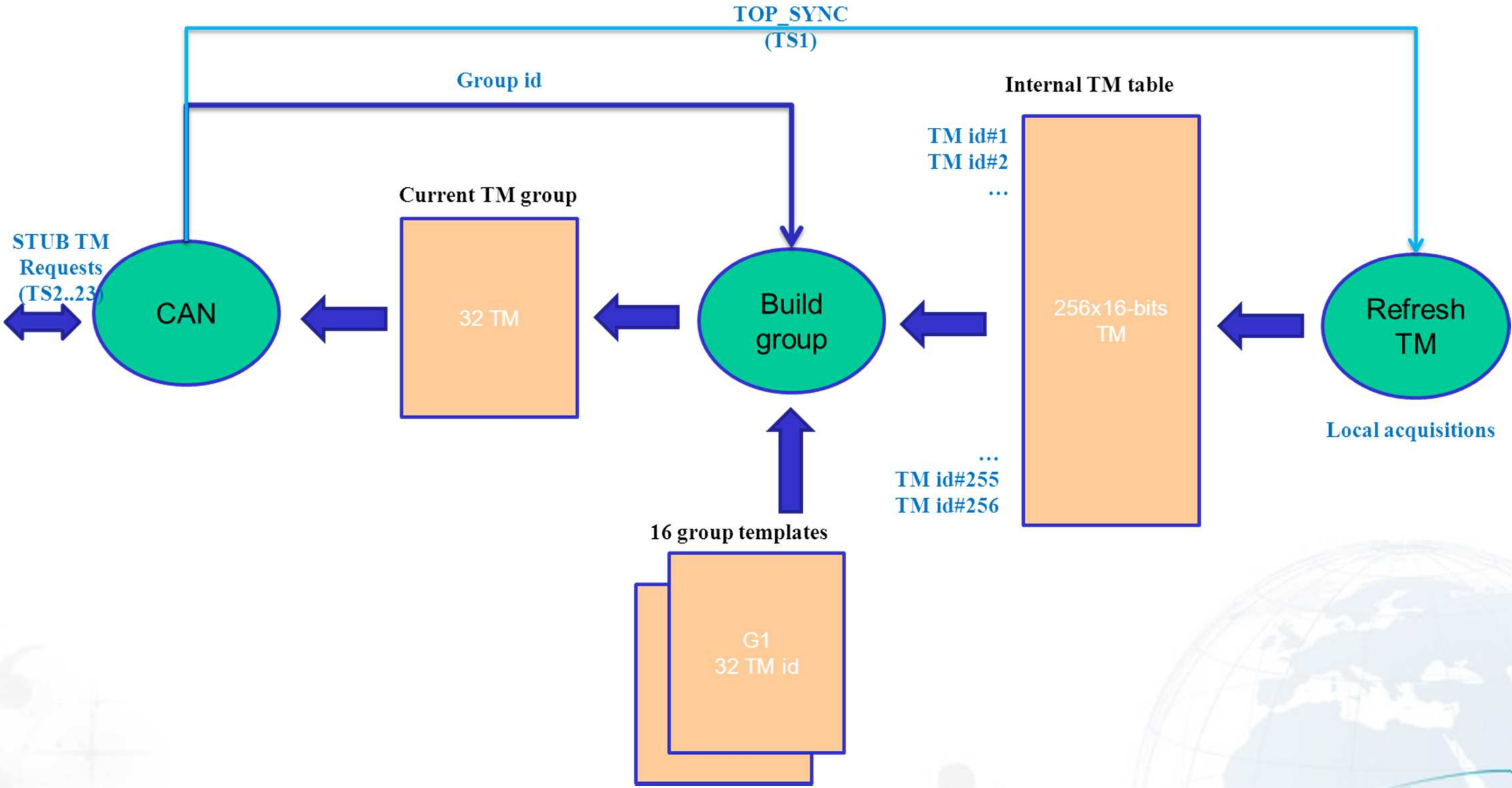
- The signal carrying backplane electrical interfaces within a unit are not dictated by customer requirements and are typically non-standard, consisting of discrete lines, parallel busses, device specific serial busses
- The mechanical interfaces for each PCB module are vendor specific
- Module level AIT is complicated by the large number of interface types, so emulating a module that is still in the development cycle is non-trivial

A potential solution is to create a Backplane Standard for each type, e.g. CAN, SpaceWire, SPI

Module re-use between missions and instruments is then practical

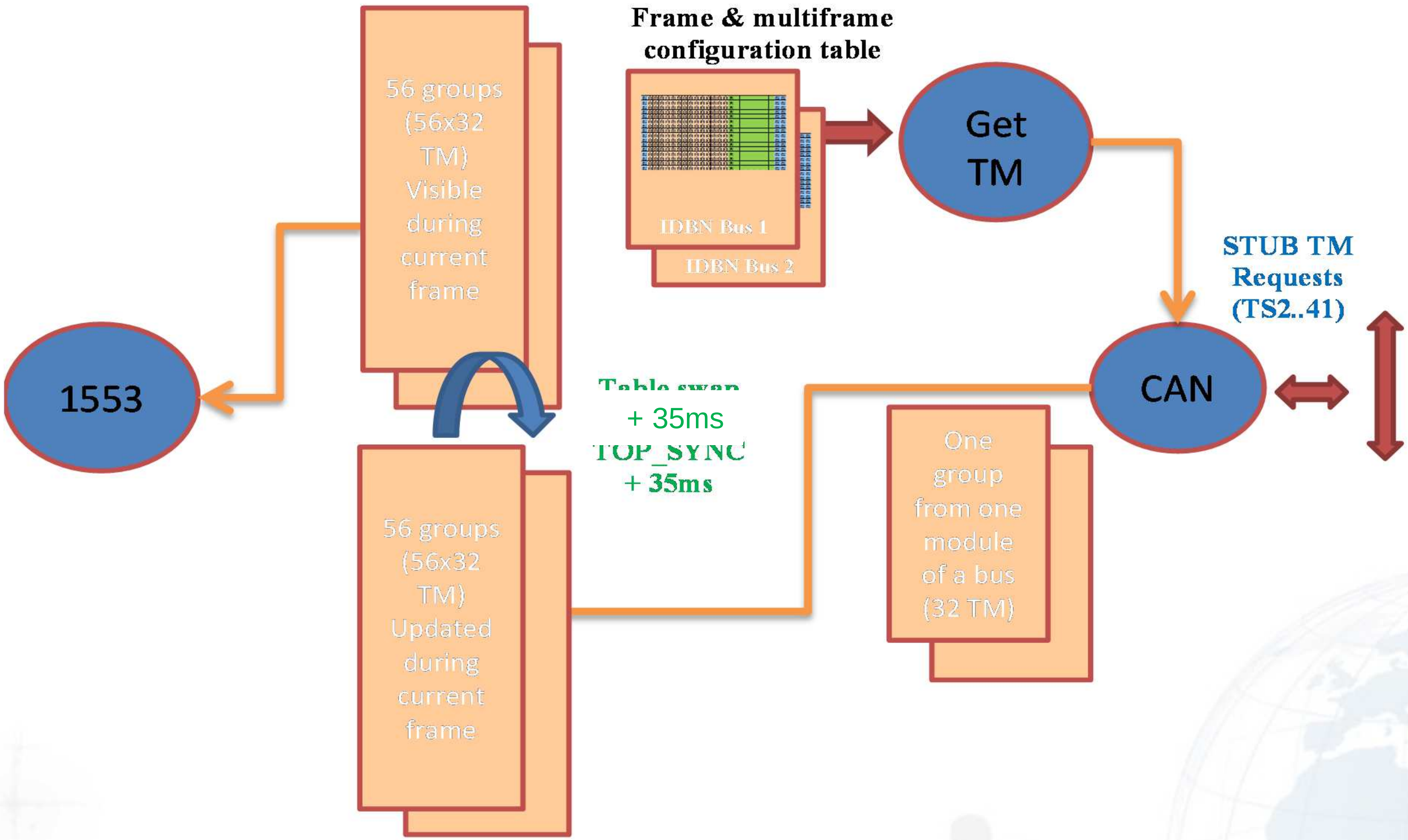
EX1: CAN BACK-PLANE – Management

CANBUS : TM processing at module side

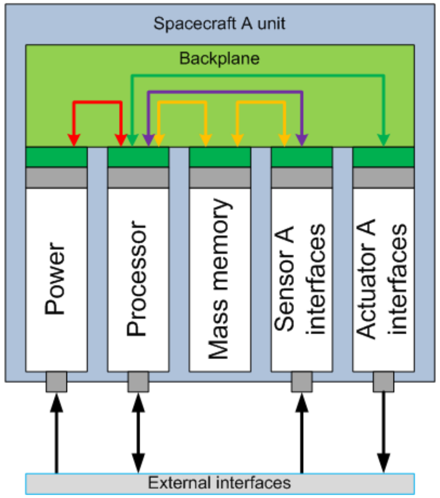


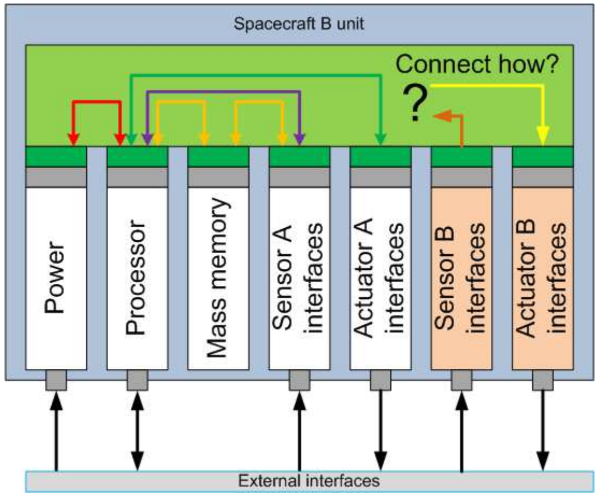
EX1: CAN BACK-PLANE – Management

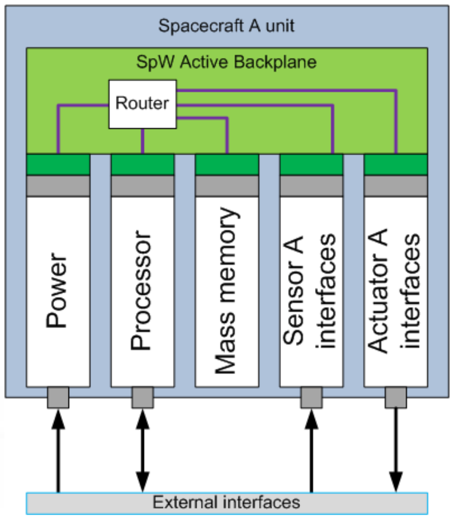
CANBUS : TM processing at STUB side

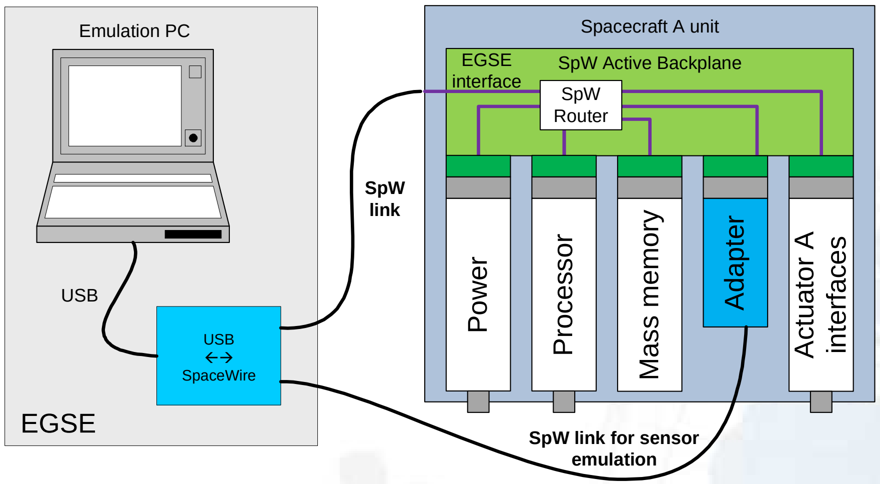


SpW : Adhoc interconnect v. SpW backplane



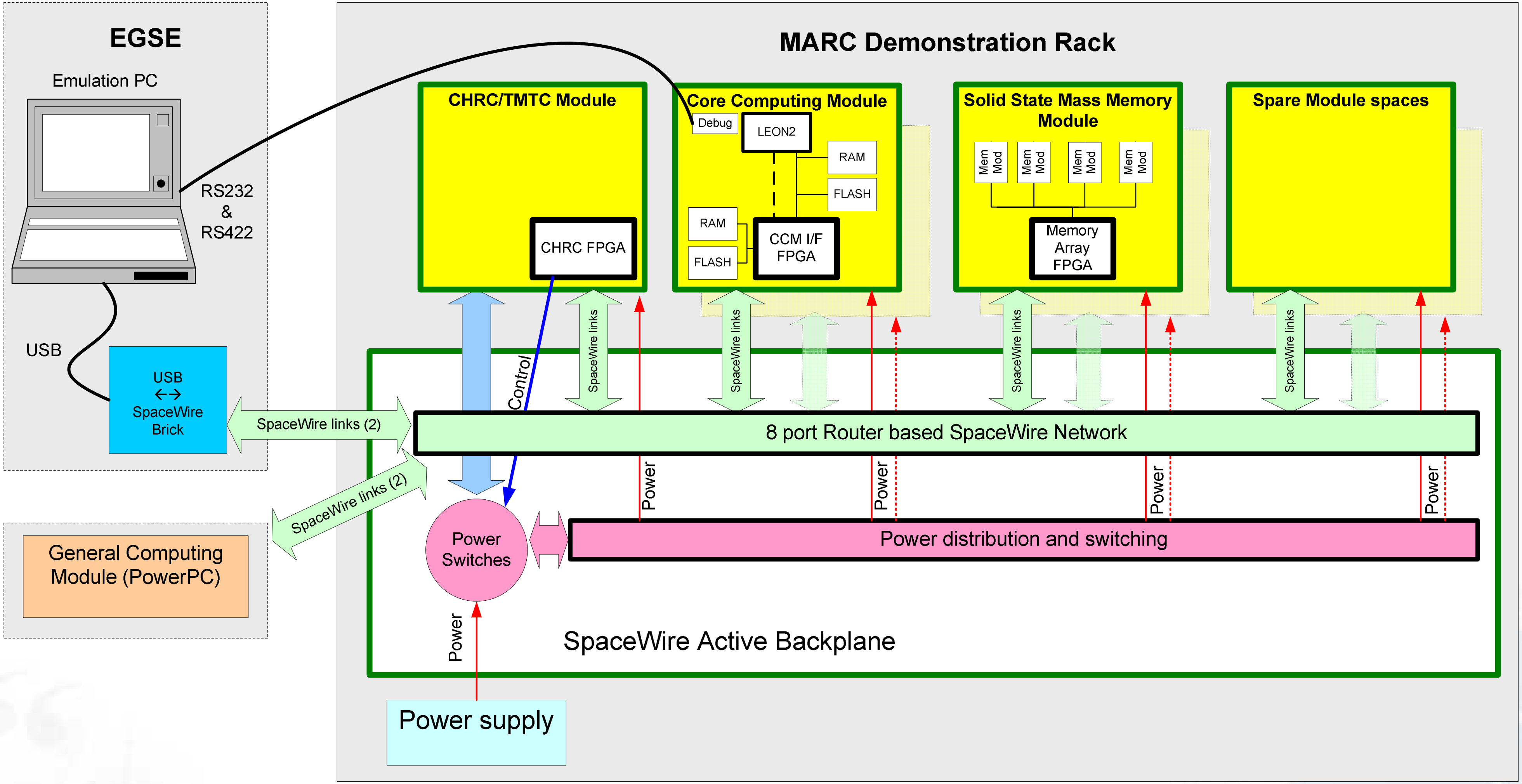






EX2: STANDARDISED BACK-PLANE – SpaceWire

SpW: MARC demonstrator



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CONCLUSIONS

- Certain core functions may be standardised but architecture must allow scalability
- BBK can be physical modules as well as physical elements
- Varied applications can imply a number of backplane standards ➔ CAN, SPI, SpW,….
- Inclusion of third party suppliers comes through standardised backplane interface

Thank you for your attention!