Deep Space Avionics

ON BOARD COMPUTER – Preliminary datasheet

Fault-Tolerant, Robust Flight Controller for LEO and Deep Space Applications

Figure 1: OBC preliminary render

The OBC is designed to be the central spacecraft flight controller and is one of three modules dedicated to data handling in the avionics stack, besides the Computational Platform Unit and the Mass Memory Unit. Its main functions are:

- Management of the spacecraft: validation, scheduling, execution of commands, basic FDIR of the spacecraft, collection, concentration, and storage of telemetry
- Interfaces management: route data to and from external buses, internal buses and verify message integrity and validity
- Attitude control of the spacecraft: collection of inputs from external sensors, filtering and state determination
- Dependable non-volatile memory to store command, telemetry and (small volumes of) payload data
- Maintenance of a time reference and ephemeris data, even over resets, for missions where Earth acquisition pointing is critical

MAIN FEATURES

- 2 cold-redundant microcontroller units
- Robust watchdog with failure detection
- Complete real-time software framework

BUDGETS

- Mass: < 0.5 kg
- Volume (w x h x d): 20 x 120 x 135 mm
- Power: < 3 W quiescent

ENVIRONMENT

- Operational temperature range: -30 °C to +60 °C.
- Non-operational temperature range: -40 °C to +70 °C.
- Radiation: qualified up to 30 kRad total ionizing dose and for high energy protons.
- Lifetime: > 5 years.

READINESS

- Technology readiness: TRL 6 with expected TRL 7 by Q1 2024.

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HARDWARE FEATURES

- Unregulated +28VDC power input
- 2 standalone cold-redundant units, with transparent switchover and hardware unit failure detection
- 2 standalone hot-redundant real-time clocks
- No single-point failure

MEMORIES

- 4 Mb MRAM for sensitive program and payload data
- 256 Mb DRAM for program calculations
- Shared 2x1 Gb FLASH for payload data
- Shared 2x4 Mb MRAM for state recovery and diagnostics

EXTERNAL INTERFACES

- 1x CAN
- 8x RS-485 or 4x RS-422
- 3x SPI
- 2x UART with flow control
- 20x GPIO, 12 interrupt-enabled
- 12x 12-bit analog inputs

STACK INTERFACES

- Redundant CAN bus
- 100 Mbps Ethernet bus
- Pulse-command bus

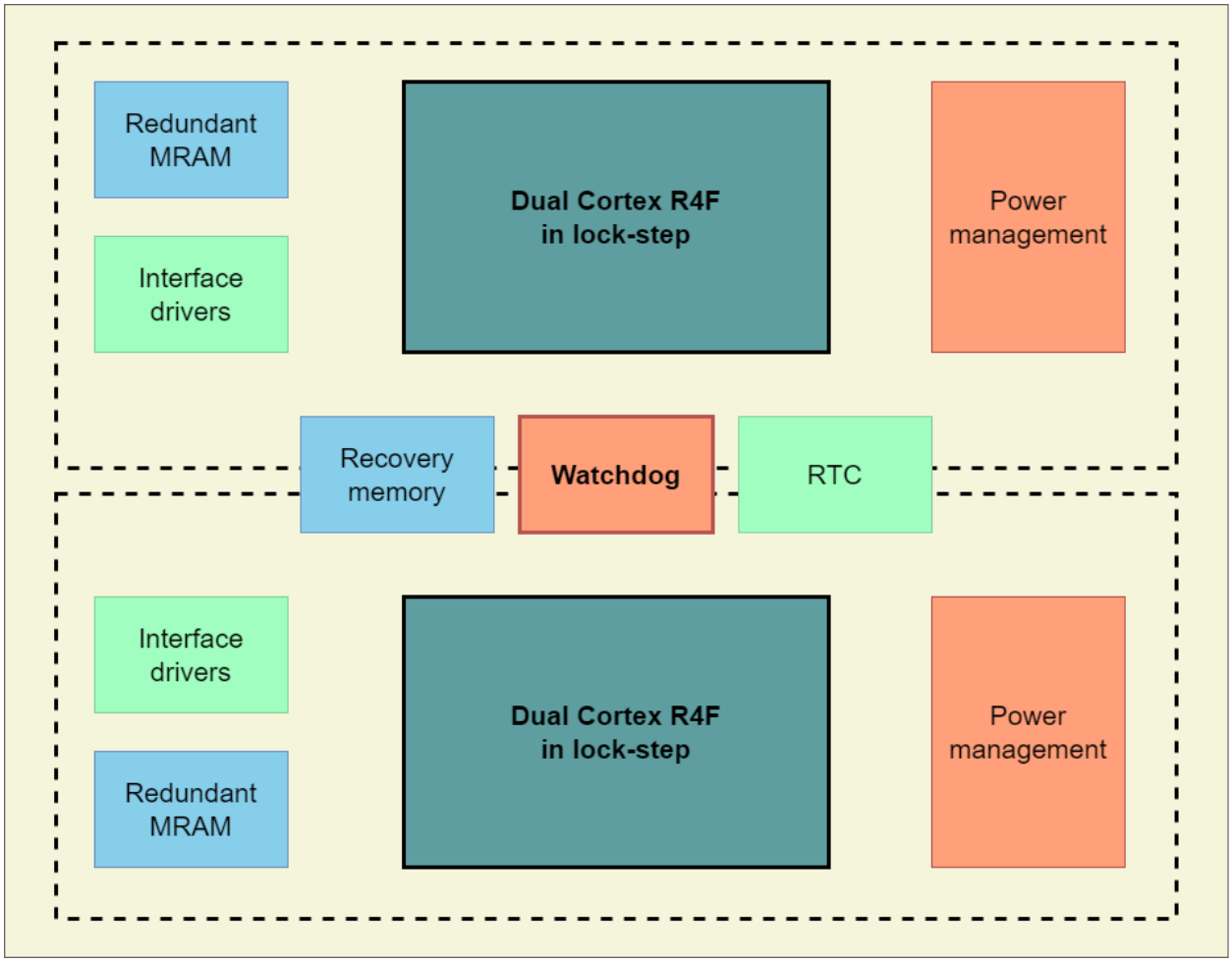

Figure 2: OBC cold-redundancy architecture

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OBC Software Framework

SOFTWARE FEATURES

- Modular and extendable layered software architecture
- Reliable software execution platform and fault protection
- Configurable platform software components
- Auto-generation of application code and of the interfaces to services
- Events, Housekeeping, parameter reporting
- Parameter statistic and monitoring
- Time, position, event based automation
- Support for device integration
- Mission based PUS service tailoring
- On board procedures scripting engine
- Support for XTCE information model for telemetry and commanding
- Generic platform increases compatibility with other Bradford Space subsystems

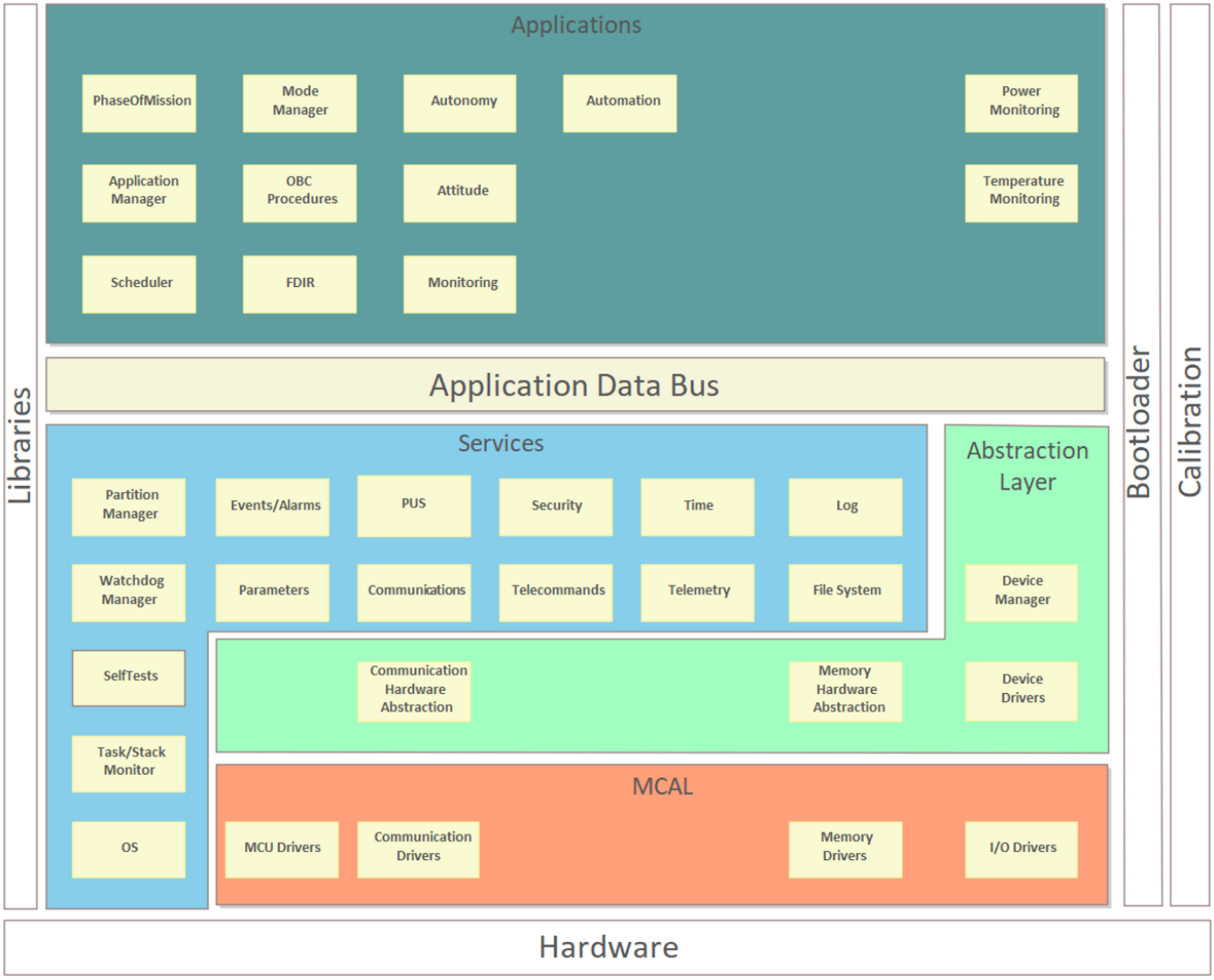

Figure 3: OBC Software Functions

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