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Cajun Advanced Picosatellite Experiment

CAPE-II

Command and Data Handling Subsystem (CDH)

Subsystem Hardware Specifications

- Power Budget : 250mW
- MCUs : Cirrus Logic EP7312 @ 36.864Mhz
- RAM (per MCU) : 8MB
- ROM (per MCU) : 4MB
- Flash Memory : 64MB

Subsystem Design Objectives

- fault tolerance
- implement an RTOS
- implement non-volatile data storage to “store and forward” data collected from buoys and store any new software or data uploaded while in orbit

Fault Tolerance

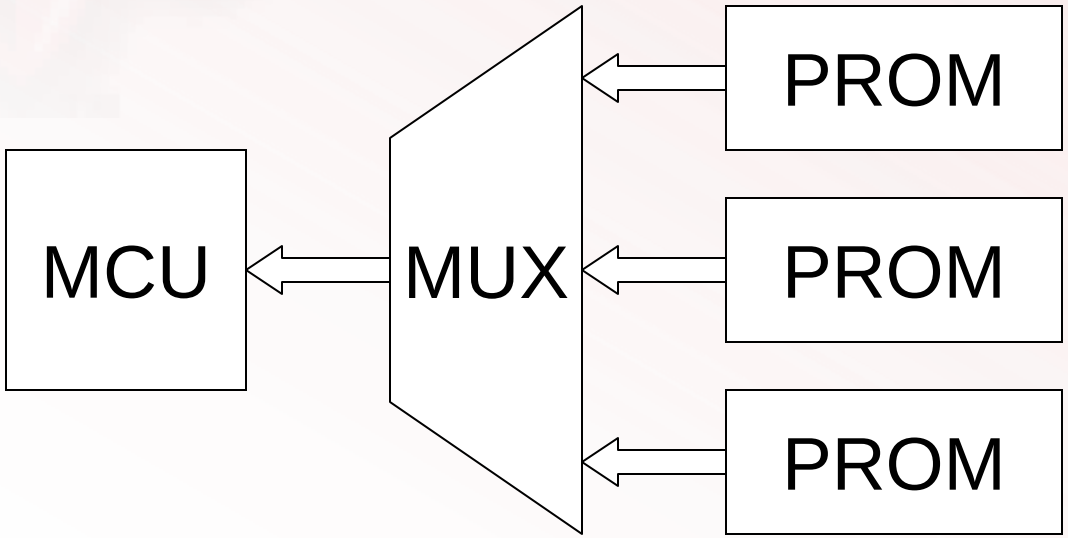
Single/Multi Event Upsets

- caused by charged partials and cosmic radiation
- anomalous state changes in memory
- permanent damage to silicon
- disruption of microcircuit processes

Fault Tolerance

Design Approaches

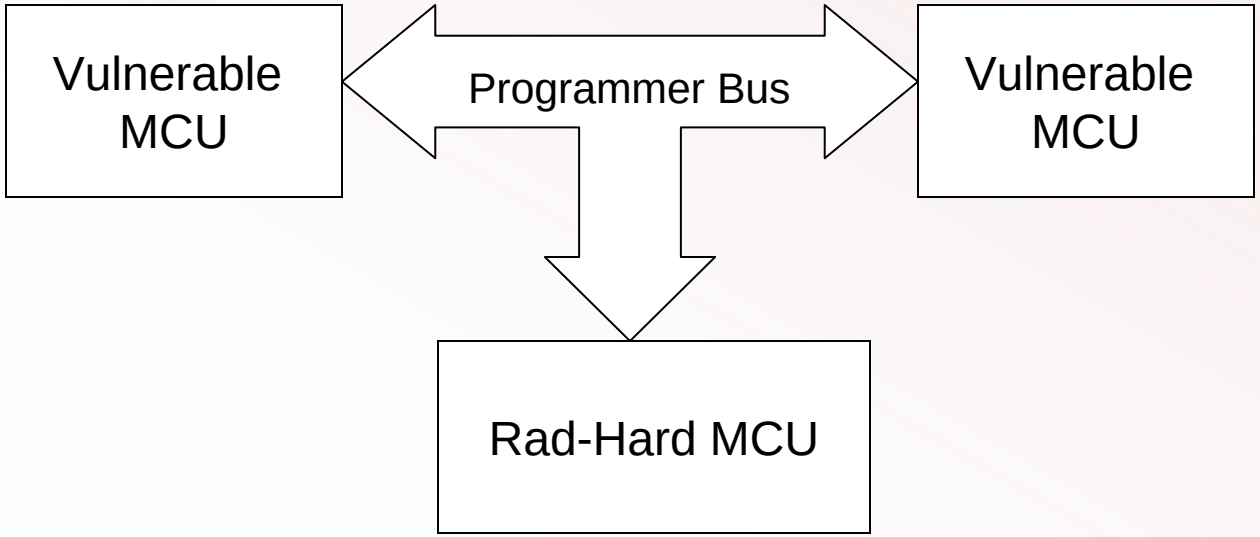
- boot from redundant array of PROM



Fault Tolerance

Design Approaches

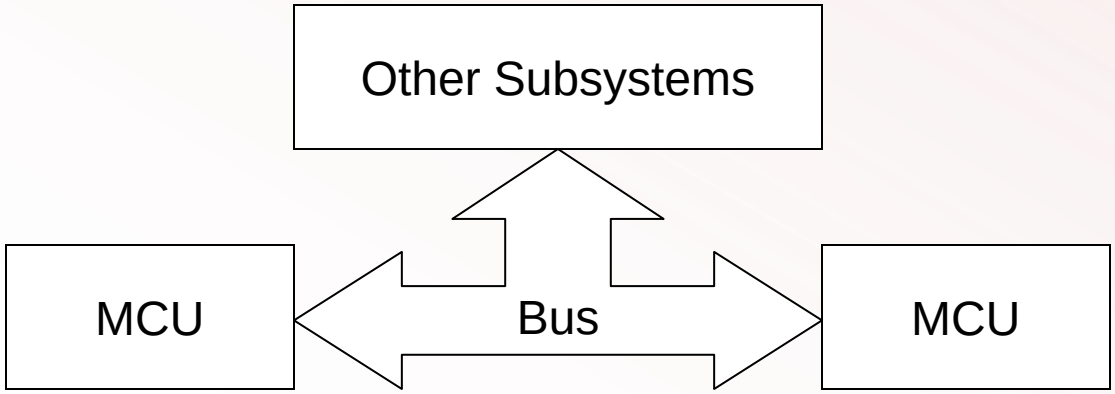
- boot from redundant array of PROM
- check/reprogram MCUs with vulnerable memory



Fault Tolerance

Design Approaches

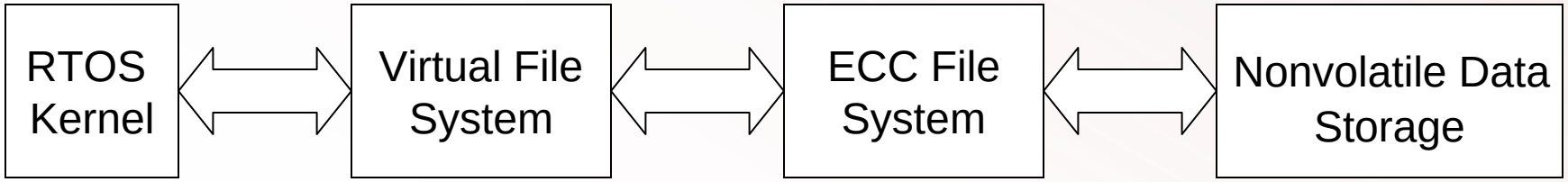
- boot from redundant array of PROM
- check/reprogram MCUs with vulnerable memory
- redundant MCU control



Fault Tolerance

Design Approaches

- boot from redundant array of PROM
- check/reprogram MCUs with vulnerable memory
- redundant MCU control
- error checking and correcting file system for non-volatile data storage



RTOS

Operating Systems

- organized way of offering services such as file management, network interfacing, and process scheduling
- program loader, process control, and memory management makes uploading and running new software easier and safer
- eases development of other subsystem software

RTOS

Linux

- mature and well documented
- supports a wide range of hardware and software
- large development and support community
- many development resources and tools

Non-volatile Data Storage

Data Storage for CDH Subsystem

- stores all software and data not critical to satellite operation
- high capacity to accommodate the temporary storage of sensor data collected from buoys which will be transmitted to a ground station
- capacity also allows for the backlogging of data

Non-volatile Data Storage

Flash Memory

- low power
- standard CFI/JEDEC interface
- serial interfaces also exist (SPI, I^2C, etc…)
- fast read/write times

Any Questions?