GLAST Large Area Telescope

Instrument Flight Software
EM2 Design Review
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1553 Communications

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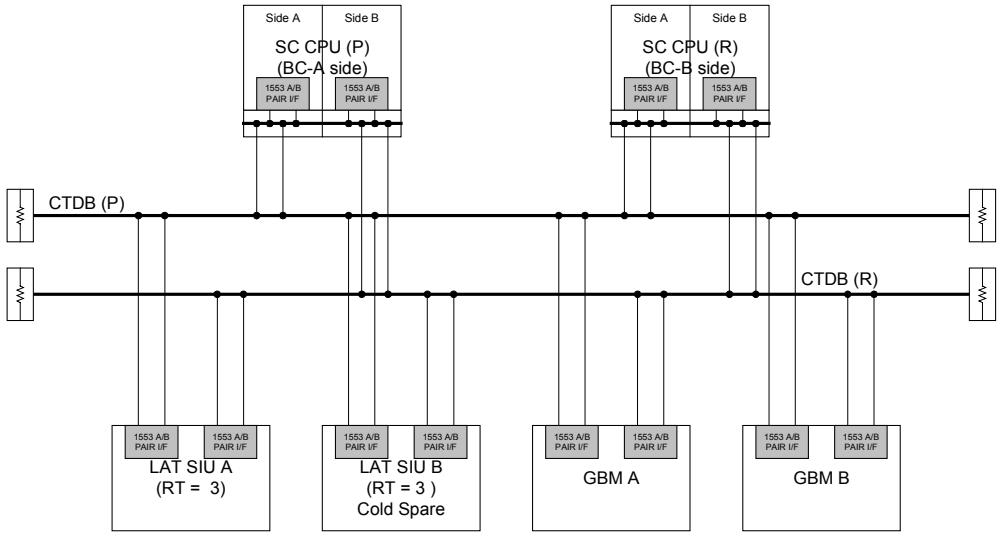
LAT 1553 Interface



- MIL_STD_1553B (1553) bus is primary interface for exchanging information between LAT, SC, and GBM
  - Telecommands from SC and GBM
  - Telecommands to SC and GBM
  - Telemetry to SC (housekeeping, diagnostic, alert)
- SC will act as bus controller (BC) node
- Each SIU can act as remote terminal (RT) node
- Bus protocol and schedule under control of SC
  - GLAST 1553 Bus Protocol Interface Control Document
- All traffic will consist of CCSDS packets (CP_PDU).

1553 RT Driver Requirements (1)

- Requirements derived from GLAST 1553 ICD
  - Support data wraparound
  - Support Notice II mode codes
  - Receive up to 20 CCSDS telecommands / second and deliver to consumer applications
  - Collect and send up to 5 CCSDS telecommands / second from producer applications (application driver only)
  - Collect and send CCSDS telemetry packets from producer applications
    - Insert telemetry packets into telemetry message blocks (4 / second)
    - Allow for one real-time housekeeping telemetry packet for each telemetry block

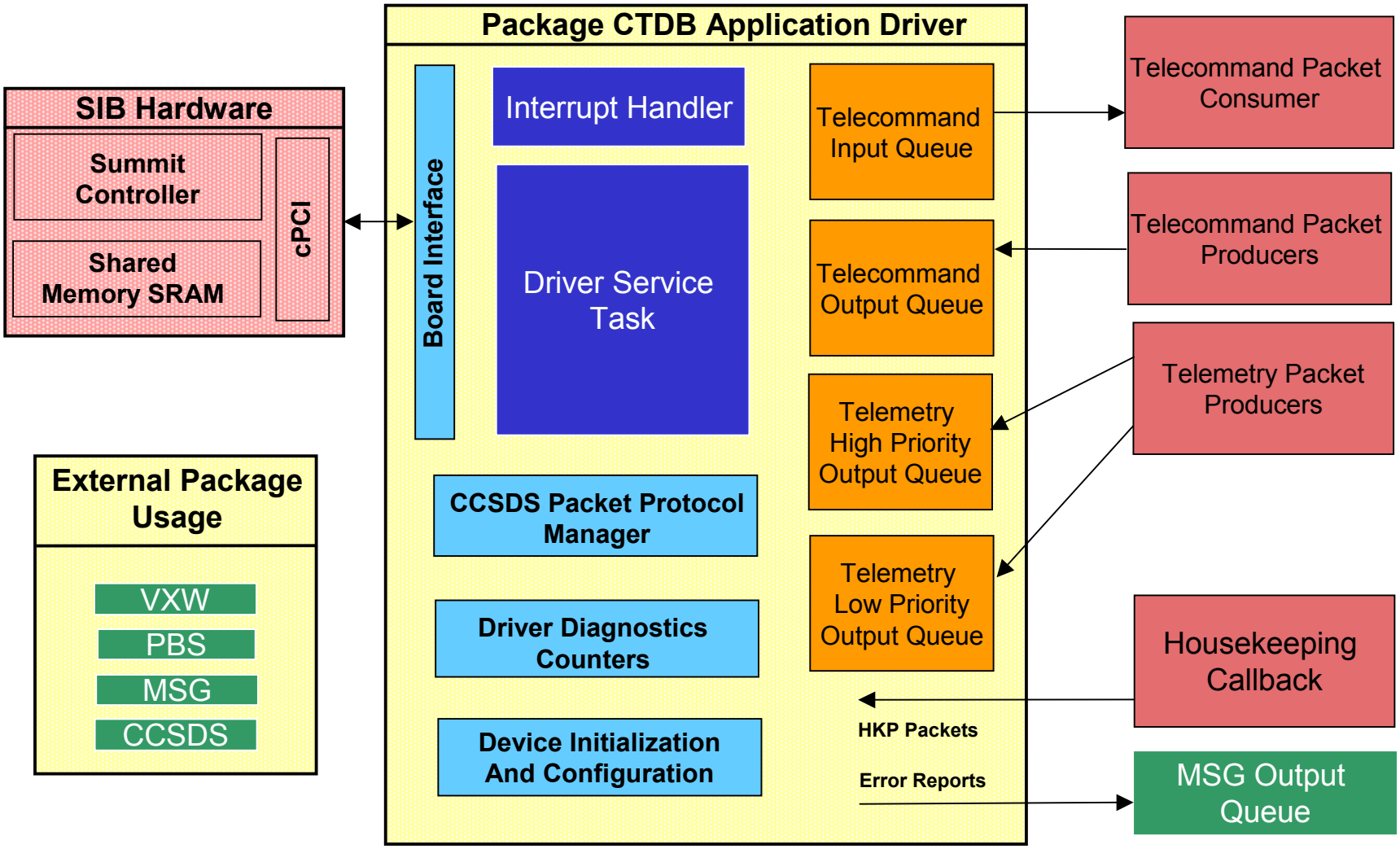
1553 RT Driver Requirements (2)

- Internal requirements from LAT FSW
  - De-couple bus schedule activity from application processing
    - One exception is real-time housekeeping packet, which should be delivered synchronous to the bus schedule
    - Guarantee that the HKP packet is always delivered at head of telemetry blocks
  - Log 1553 bus errors as detected by the Summit controller
  - Keep communications diagnostics counters (application only)
  - Perform timeout on telemetry and telecommand send polling by BC (application only)
  - Provide priority levels for outgoing telemetry packets (application only)
- See CTDB 1553 Drivers document

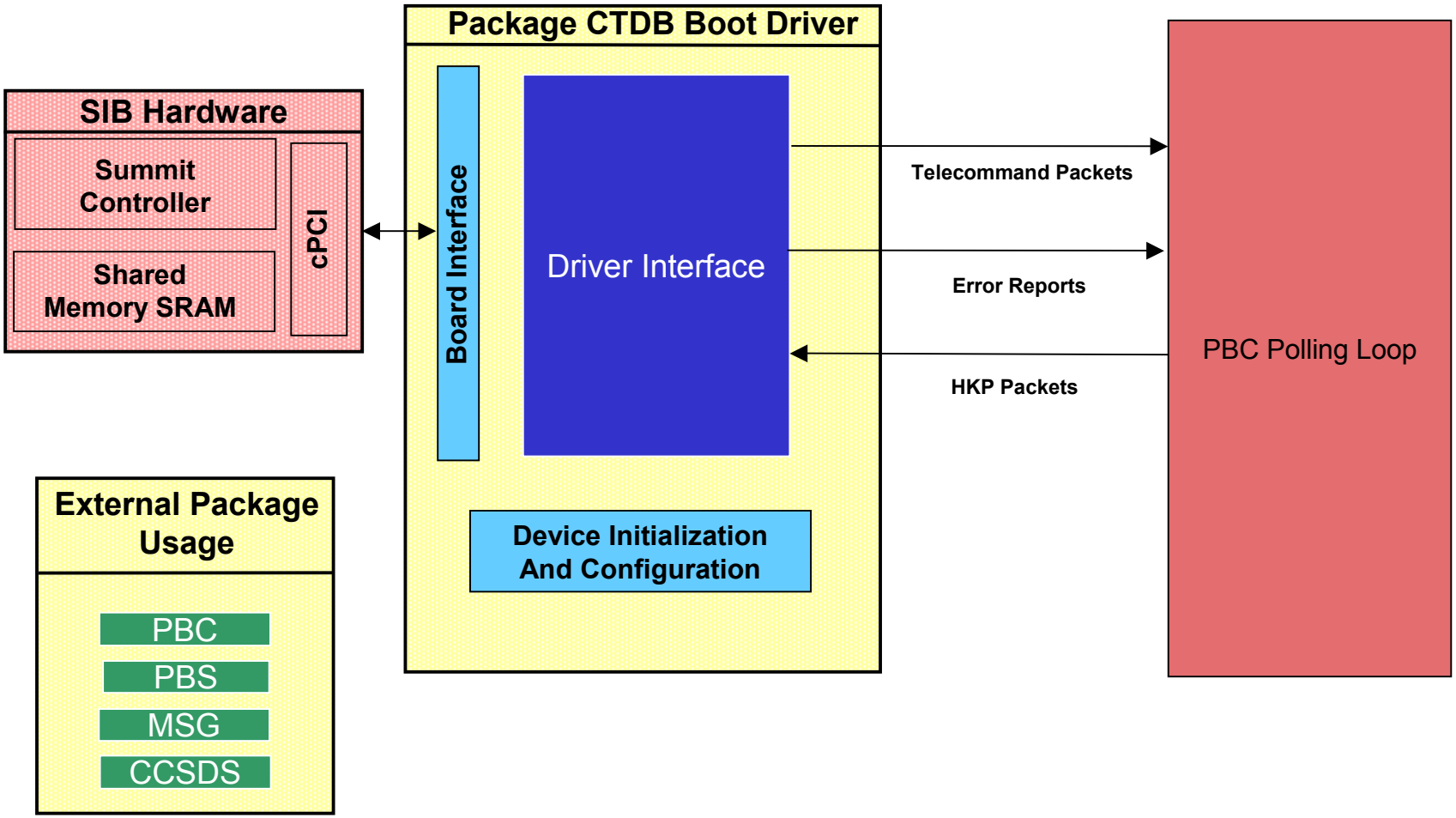
1553 Software Organization

- 1553 drivers and related software contained in package CTDB
  - API for client software is the same among variants
- RT Drivers for SIB board
  - Constituent: sumt_rt_sib – application mode driver
  - Constituent: sumt_rt_poll_sib – boot mode driver
- RT Drivers for COTS Alphi PMC 1553 board
- BC Drivers for testing and development
- IP/Ethernet Simulator for testing and development
- Unit Test for hardware-independent portions of driver available
- Functional tests for drivers using SIIS/SDIS available
- Documentation for design overview and API available
- 1553 RT software runs on SIU crate only

1553 RT Driver (Application) Architecture



1553 RT Driver (Boot) Architecture



1553 Driver Inputs/Outputs

- Inputs
  - Driver configuration, input at initialization
    - 1553 addressing
    - Queue sizes
  - Outgoing telecommand packets to SC or GBM
  - Outgoing telemetry packets to SC
- Outputs
  - Incoming telecommand packets from SC or GBM
  - Error reports for API calls (out of range parameter, etc …)
  - Error reports for 1553 bus illegal activity
  - Diagnostics counters (application driver only)
    - Packet counts
    - Byte counts
    - Error counts

1553 RT Driver Testing (1)

- CTDB package unit test covers 'CCSDS Packet Protocol Manager' portion of driver
  - Simulate raw 1553 input messages and extract CCSDS telecommand packets
  - Simulate CCSDS telemetry output packets and construct raw 1553 output messages
- Two functional tests for RT driver
  - Functional tests have two components
    - LTX script which loads target software and records target logs
    - SIIS/SDIS Perl script which performs closed-loop testing
  - ctdb_link_test – Tests that driver has properly initialized the device and complies with standard
    - Uses special 1553 link level telecommands and telemetry provided by SIIS and SC FSW

1553 RT Driver Testing (2)

  - Verifies data wraparound with multiple patterns
  - Verifies all unused subaddresses are illegal
  - Versions for both application and boot drivers
- ctdb_com_test – Tests that the driver can perform basic CCSDS packet communications
  - Uses LAT commuications diagnostic telecommands and telemetry
  - SIIS Perl script sends a telecommand to LAT RT and waits for the expected telemetry reply packet from LAT RT
  - Versions for both application and boot drivers
  - Issue: Testing of telecommand send functionality
  - Issue: Testing of “dump style” telemetry
- Interactive test applications for development (both RT and BC)

1553 Software Status

- Application and boot RT drivers and API designed, documented, and reviewed
- Boot driver integrated into primary boot code (service for package PBC)
- Repeatable tests developed
  - Not quite full coverage of functionality
  - Need to implement test of dump telemetry
- Recent work involves integrating and testing driver with EM model SIB board
- Application driver still needs to begin integration