RUAG Space Microprocessors in present and future equipment

Torbjörn Hult

Products

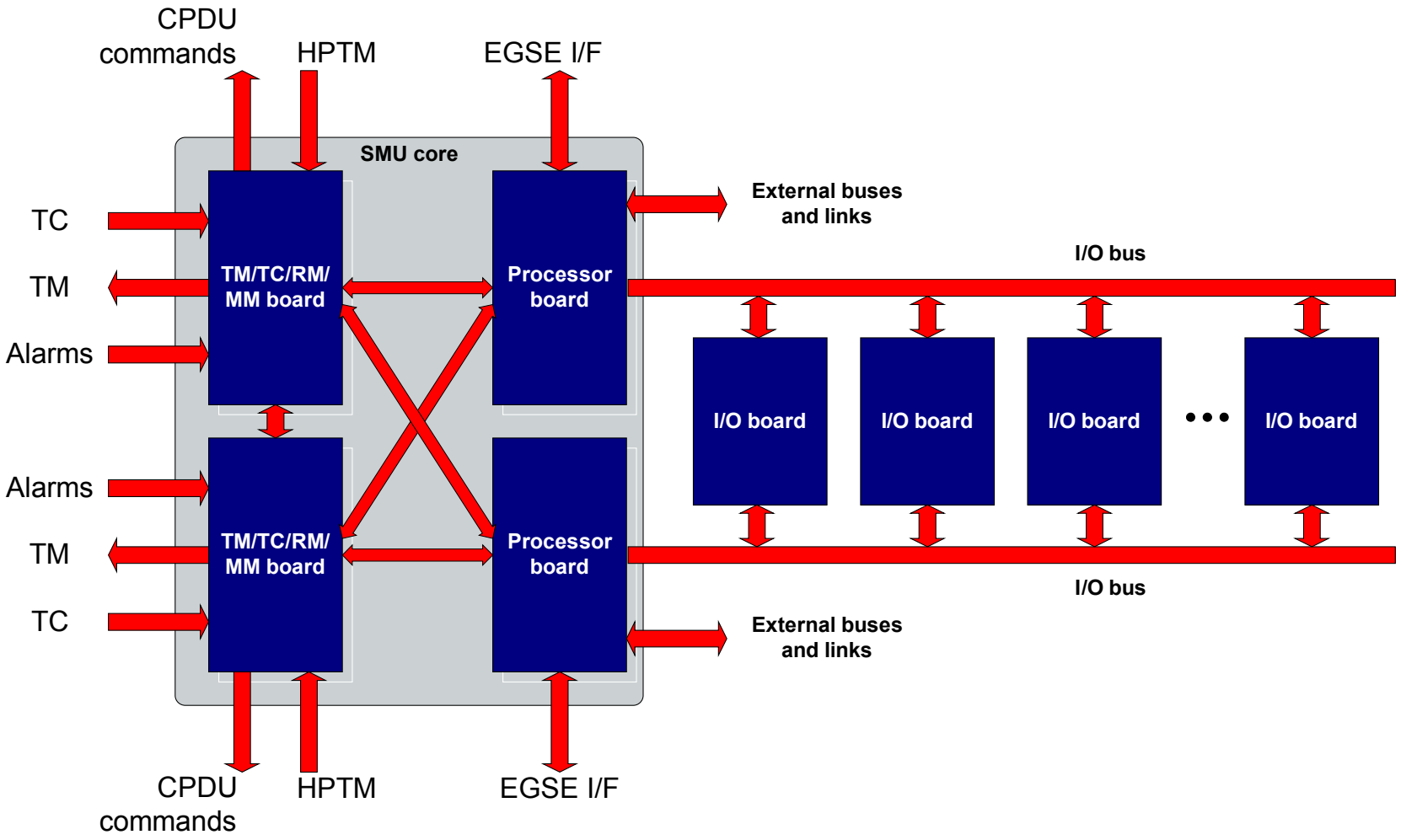
Spacecraft Management Units

Guidance and Control Computers

Payload processing and control

Radio occultation instruments

SMU Technical Concept



Current generation processor boards

RUAG

- Based on TSC695 including:
  - COCOS ASIC
  - Ext. interfaces: 2x1553, 2xSpaceWire/UART, 2xPacketWire, Sync, EGSE
  - Int. interfaces: 1553, OBDH, 4xSpaceWire, 2xPacketWire Sync, Alarms

- Based on COLE ASIC including:
  - 1,8V DC/DC converter
  - Ext. interfaces: 2x1553, 2xSpaceWire, 2xUART, 2xCAN, Sync, EGSE
  - Int. interfaces: 1553, OBDH, 5xSpaceWire, 2xPacketWire Sync, Alarms

COCOS, CPU Companion and I/O ASIC

- CPU Interface
- Memory Interface
- Interrupt Controller
- Watchdog
- Alarms
- Memory Copy Controller
- On Board Time (OBT)

- 3 MIL-STD-1553B
- 1 to 3 UARTs
  (pins shared with SpaceWire)
- PCI bus
- 3 Packet Wire Receiver (PWR)
- 3 Packet Wire Transmitter (PWT)
- 3 to 6 SpaceWire
  (pins shared with UARTs)

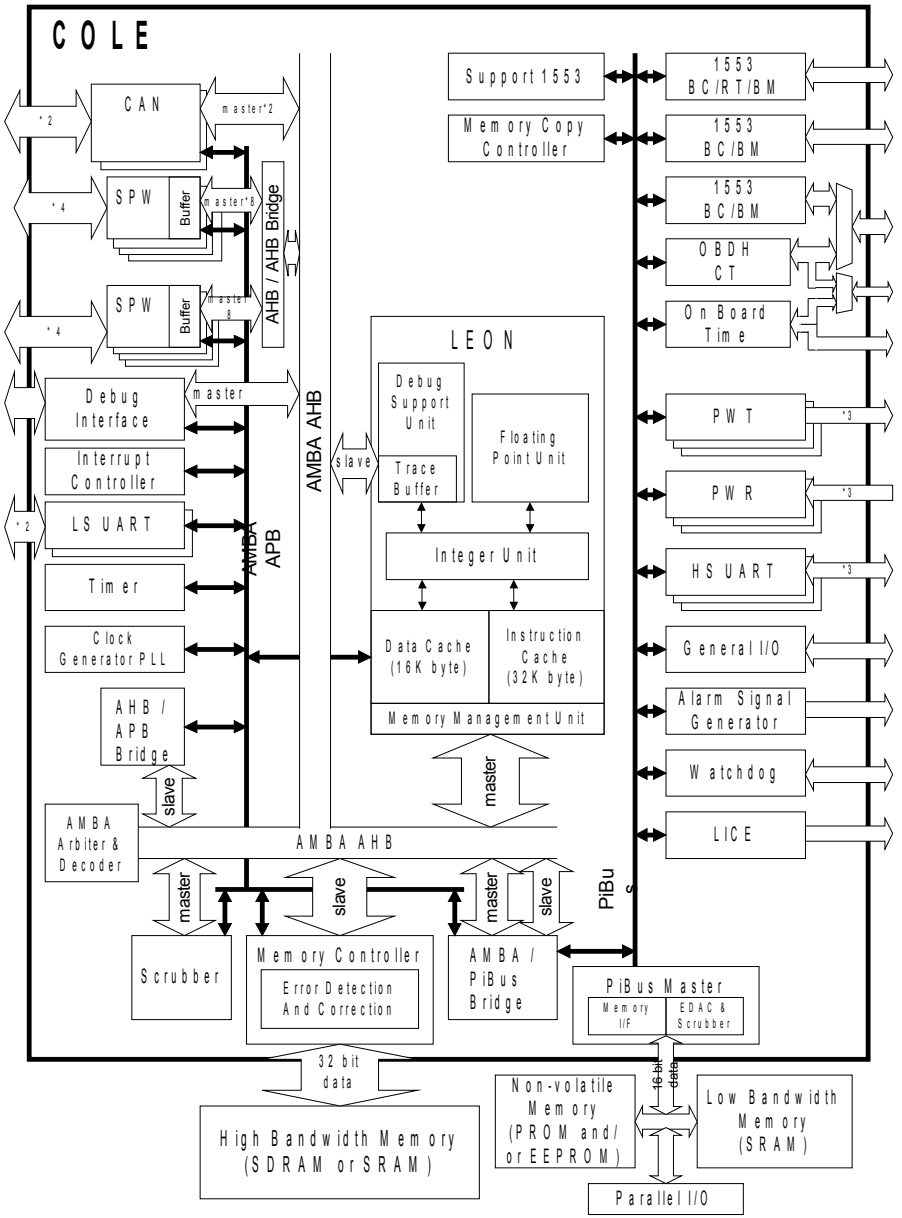
COLE chip

Integration of:

- ”LEON” SPARC v. 8 processor
- COCOS I/O controller

Major improvements:

- Processing Performance
- I/O Speed and Functionality (MMU, enhanced DSU, SpaceWire RMAP)
- CAN bus I/O
- Cost



Next generation computers

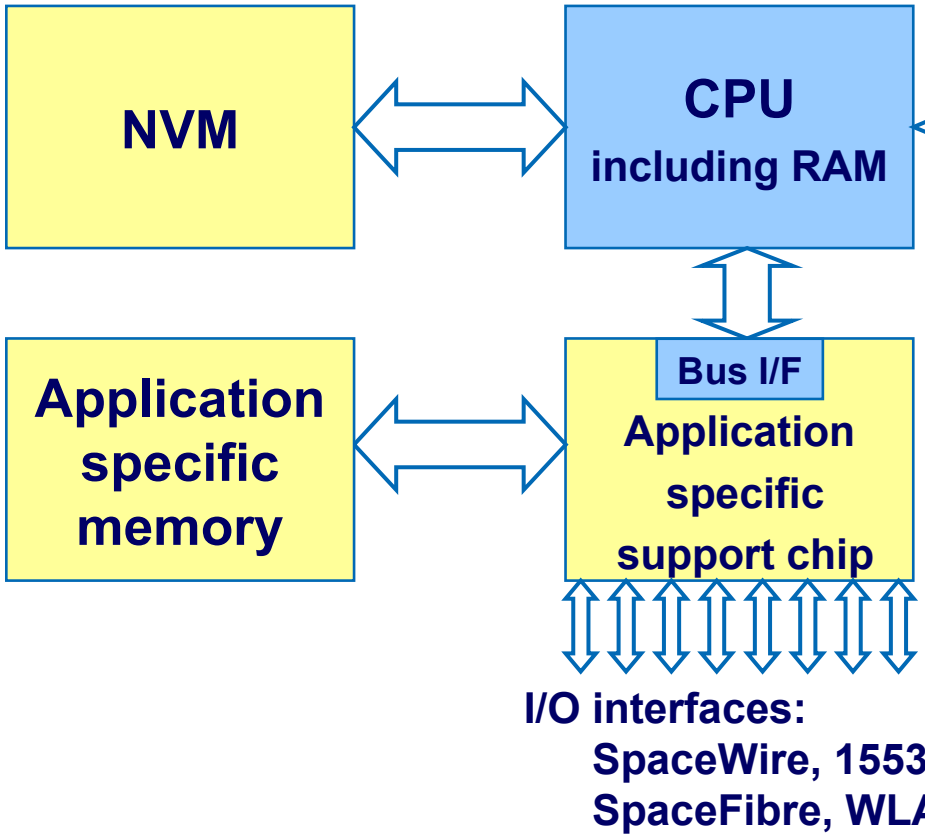
RUAG

- >10 years design lifetime
- Higher performance, i.e. multi-core CPU needed
- Flexible architecture to handle future requirement changes
- New standards impose upgrade of IP blocks and software
- New interfaces such as sensor buses and wireless
- Built-in GPS receiver
- Star Tracker processing in the main computer
- Time and Space Partitioning support

Next generation computer architecture

RUAG

- Processor technology evolves faster than system architecture
- Separate application processor from system application chip

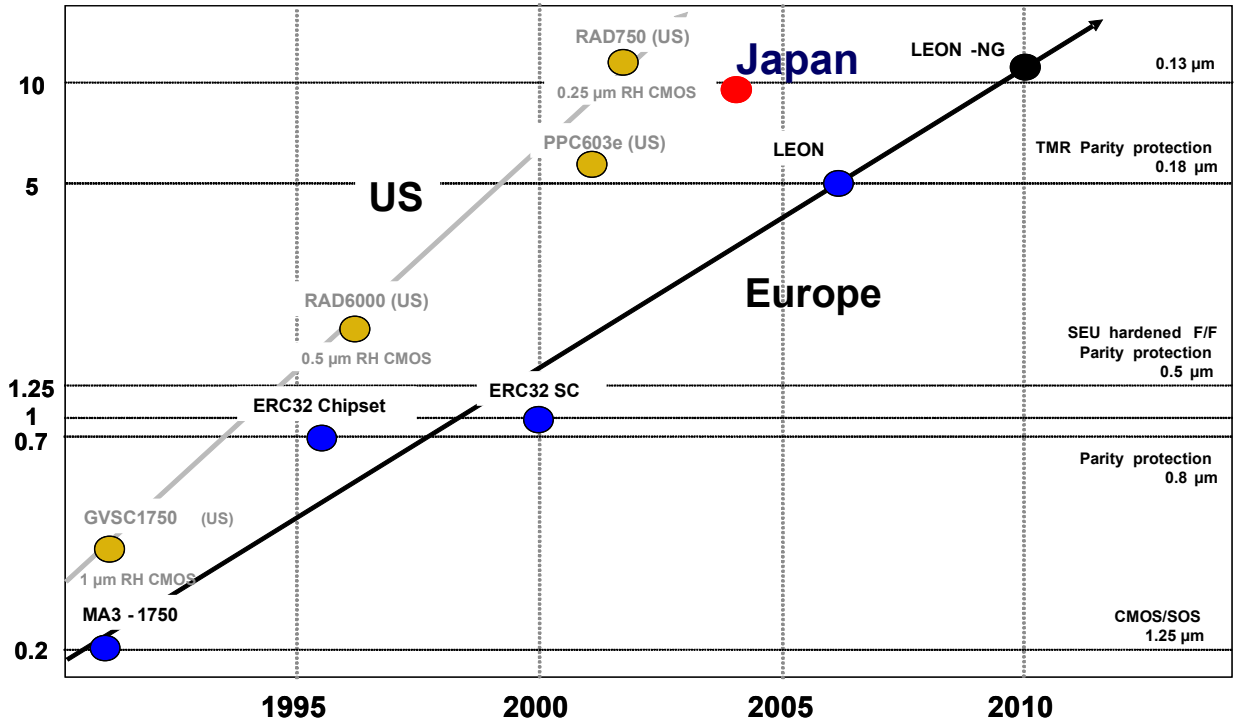


- **Fast bus slave I/F available as IP**
- **No need for advanced memory I/F on the CPU**
- **Backwards compatibility for I/O interfaces to reduce software development effort**

CPU architecture considerations (from 2006 microprocessor RT)

New Europe
goal?

- Performance by extrapolation:
- Are European foundries competitive?
- Does the SPARC architecture give sufficient performance?



- Eurospace Oct 05
- Anything else we can do better in Europe?
- Do we have the resources to participate in the performance race?
- What will be the consequences if we do not participate?