High Reliability Processing Node (HRPN-LEON4)

Features:

Open Modular Avionics Architecture

Computer systems for space flight applications require ever increasing amounts of computing power to enable (on-the-fly) preprocessing of large data sets from sophisticated experiments and payloads, or even to perform realtime computation of safety-critical control commands. Without this, spacecrafts would be unable to perform complex docking maneuvers or landing approaches autonomously. Besides meeting high performance requirements, the on-board computer systems must also provide interfaces that allow their embedment in a spacecraft's often redundant communications infrastructure or support redundant ports for instruments with very high data transfer rates in the gigabit range.

With this in mind, the Open Modular Avionics Architecture (OMAC4S) initiative is developing an architectural framework for future on-board computer systems to enable the modular integration of systems with different performance and functional characteristics into the IT infrastructure of a spacecraft. To this end, the project partners are developing a demonstration system consisting of two fault-tolerant on-board computers. One computer is based on the Intel Atom® processor with a triple modularity redundancy (TMR) architecture, the second is a dual modular redundancy (DMR) system with the high-end P4080 embedded multicore processor from Freescale and the third option is a LEON4-based system in single-lane configuration. They use the PikeOS real-time operating system, which also supports the partitioning of the P4080 processor's resources. Also implemented on the basis of 1 Gbps Time-Triggered (TT) Ethernet technology is a redundant interconnect network that enables further computers and subsystems to be hooked up quickly and easily. In addition, the project is developing an I/O component that allows remote sensors to be connected to the computer system

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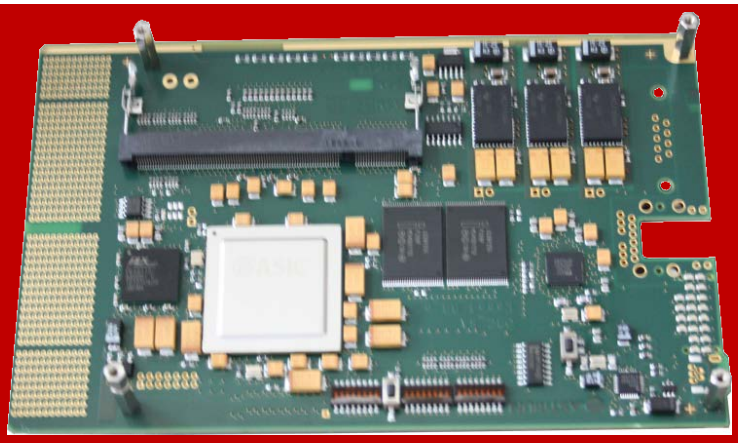
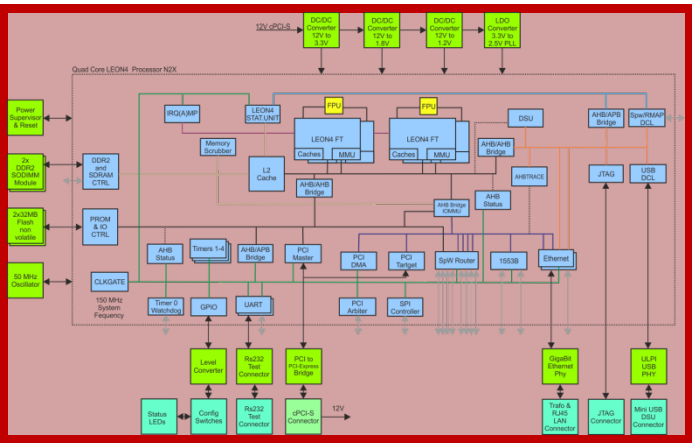
Funding:
The project is supported by the German Aerospace Center's Space Administration with funding from the Federal Ministry for Economic Affairs and Energy.





SPARC-V8 LEON Processor

The OMAC4S compliant high-reliability processor node is built around the LEON4-N2X fault tolerant quadcore processor, running at a system frequency of 150MHz.
The microprocessor interfaces fast DDR-2 random-access-memory and FLASH banks for program memory.
The form-factor of the computer board is a 3U-card according to the PICMG compactPCI standard. The connection to the OMAC4S infrastructure is made via the PCI-serial interface on the backplane connector.
Debugging can be performed via standard interfaces accessible on the front panel.

Technology

- CompactPCI® Serial (PICMG® CPCI-S.0) peripheral slot
- LEON4-N2X quadcore processor
- Clock speed: up to 150 MHz
- Performance: approximately 800 MIPS
- RAM: 1GB DDR-2
- FLASH: 64MB
- Interfaces:
    - PCI serial
    - 1000Mbps Ethernet
    - Spacewire Router (optional)
    - MIL1553b (optional)
    - JTAG and DSU via USB debug interfaces
- Flexible interface configuration through separate Xilinx Virtex-5-based I/O board
- SYSGO PikeOS real-time operating system

Architecture

The HRPN node is integrated into the OMAC4S infrastructure via the interface board also used by the Intel Atom based TRM system. This card provides the translation between the TTEthernet avionics bus and the PCIserial interface of the processor node.
The OMAC4S infrastructure provides access to dual redundant TTEthernet switches via the system bacplane.

About Us

At Airbus Defence and Space in Bremen we can look back on more than two decades of designing and manufacturing of computers for space applications. Our experience ranges from stand-alone boards up to complex data handling systems in single-lane and redundant configurations. The fault tolerant computers on ATV are part of our portfolio as well as payload electronics. Our capabilities also include manufacturing and qualification of electronics and wiring harnesses according to ECSS and IPC standards.
To complete our systems, we can also provide software engineering , coding and testing as well as standardised service layers for Columbus and ExperessRack data interfaces. Ground Support Equipment, standardised enclosures and verification testing complete the list of our services.

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