ScOSA

A Space Weather Tolerant High Performance Onboard Computer for Satellites

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Space Weather Threatens OBCs

- Interplanetary Coronal Mass Ejections (ICMEs)
  - Three per day during solar maximum
  - Cause Single Event Effects (SEEs) and total dose effects
  - Result in data corruption through bit flips
  - Degrade onboard computers (OBCs)
How Satellites Deal with Solar Radiation Today

- Radiation-hardened processors
  - Expensive
  - Long development cycles
  - Very low computing performance
- Backups and Triple Modular Redundancy
- Heavy radiation shielding
The Perspective Opened by ScOSA

• Use both radiation-hardened and COTS processors
• COTS components for non-critical tasks with high computing demands
• Reconfigurable and fault-tolerant network
• Migrate tasks upon component failure
Example Applications Addressed by ScOSA

On Orbit Servicing – DLR Robotics Institute

Ship Detection – DLR Space Operations
ScOSA Components

- Different types of microcontrollers
  - Reliable Computing Nodes (RCN)
  - High Performance Nodes (HPN)
  - InterFace Nodes (IFN)
- Nodes interconnected by network
- RCNs for stability
- HPNs for computing speed
- IFNs connect to other subsystems
Dynamic Reconfiguration

- Migrate tasks from failed node
- Tasks may be shifted to different Hardware
- Resume operation after reconfiguration
FDIR Services

- **Fault tolerance**
  - Distributed FDIR subsystem
- **Detection**
  - Heartbeat, Voters, Plausibility
- **Isolation**
  - Reconfigure to remove nodes
- **Recovery**
  - Reintegrate nodes after reboot
Outlook on Potential Future Applications

The way forward after UNISPACE+50 and on Space2030 - Rolf Hempel • ScOSA: A Space Weather Tolerant High-Performance Onboard Computer for Satellites - 13th/14th November 2018