Distributed Computing Framework

DLR

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Overview

On iSAT the software framework offers an easy to use interface for communication and controlling. This allows to control the different subsystems and payloads from all over the iSAT. The optimal communication route between different iBLOCKs is calculated depending on the current configuration of the modular satellite. A recalculation of the communication route takes place if reconfiguration of the iSAT or a hardware failures occur. The current hardware configuration is also detected and abstracted to offer a generic and easy to use interface for communication with specific sensors and actors for diverse applications. Because of the different subsystems the utilization of the computational power offered by the OBC varies. To balance the workload on the iSAT and increase the performance of computational heavy tasks, distributed computing capabilities are implemented in the software framework. These techniques are also used to manage energy consumption and thermal load. It also allows to increase the reliability of calculations by using different OBCs as redundant computational units.

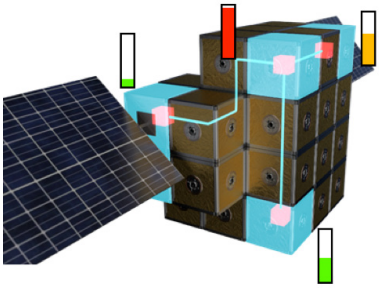

Fig.1: Workload of different OBCs

Communication and hardware-abstraction

Since the topology of the iSAT is variable no fixed communication routing can be used. Therefore, the framework detects the entire connection mesh, which is present in the current configuration of the satellite and computes the optimal route for communication between all iBLOCKs. After the optimal route has been computed the hardware-configuration of each iBLOCK is propagated to all other iBLOCKs. Based on these information the software framework offers an abstracted view of the satellite for direct hardware-software interaction.

Data-handling

To offer the distributed computing capabilities all iBLOCKs need to have access to all data present on the iSAT. Due to reconfiguration of an iSAT or errors in communication between different iBLOCKs a central data-handling on one iBLOCK is not feasible. Therefore data-handling will be done decentralized, additionally implementing a redundancy concept. Thus the database containing all information is available on every iBLOCK.

Distributed Computing

Computational heavy tasks may demand more computing power then available by one OBC. To increase the calculation of those tasks they need to be distributed between different OBCs. To decide which OBC should execute the process an autonomous voting mechanism between all iBLOCKs is used. This mechanism considers different factors, like the actual workload or the thermal characteristics. Since reliability of computations is of major importance the need of redundant computational units is given by the framework.

Scheduling

In some cases the distribution of a process is not required to increase calculation time. But to achieve thermal balancing the shifting of a process to another OBC might be necessary. To decide which computational unit will execute the process a similar voting mechanism is used as described above. Depending on the results of this voting the process is automatically executed to the selected OBC.

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DLR at a glance

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