A Dynamically Reconfigurable Processor Architecture for Future Space Missions' Payload Data Processing

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The advance in sensors technology implies that significant amount of data can be produced within a multi-sensor environment. The transmission of raw-data (pre-processed data) is not an option due to power and communication link restrictions in various missions. This leads to the increased focus toward on-board processing as a solution to this problem. There is a continuous need for increased computational power as well as data throughput due to the huge amount of acquired data and the introduction of new or enhanced processing algorithms and applications. This added to the diversity of the compression techniques used for future missions. We propose here a novel architecture based on dynamically reconfigurable instruction cells that can provide ultra low power, high performance, as well as ANSI-C programmability in a single core. In this architecture compiled instructions are segmented and dynamically mapped into parallel arrays in order to execute different data in parallel. This is achieved by allocating big chunks of the application to be executed concurrently. The concept is new in creating a structural datapath in terms of interconnections and modules rather than moving data in data registers as in other VLIW architectures or other DSPs. The concept has been tested and verified on number of applications with its programming tool flow, and it has proven its advantages from power and flexibility point of view. This architecture can be adapted for intensive processing of future space missions' payload data. The proposed architecture has been developed by the System Level Integration (SLI) Group in the University of Edinburgh, one of World's largest and most prestigious digital research groups. The SLI group research incorporates all aspects of SLI system design and test. More information can be obtained through the group website at (www.see.ed.ac.uk/~SLIg). The proposed platform has been licensed by Spiral Gateway a spin out company from the University of Edinburgh (www.spiralgateway.com). Both University and Spiral Gateway will be involved in the development of the proposed architecture for next generation space missions.