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XSTREAM: A Highly Efficient High Speed Real-time Satellite Data Acquisition and Processing System using Heterogeneous Computing

K. Pramod Kumar¹, P. Mahendra¹, V. Ramakrishna rReddy¹, T. Tirupathi¹, A. Akilan¹, R. Usha Devi¹, R. Anuradha¹, N. Ravi¹, S. S. Solanki¹, K. K. Achary², A. L. Satish², and C. Anshu²

¹Advanced Data Processing Research Institute (ADRIN), Department Of Space, Govt. of India, 203-Akbar Road, Manovikas Nagar Secunderabad 500009, India

²ISRO Satellite Center (ISAC), Indian Space Research Organization, Dept. of Space, Govt. of India, Old Airport Road, Bangalore 17, India

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Abstract. In the last decade, the remote sensing community has observed a significant growth in number of satellites, sensors and their resolutions, thereby increasing the volume of data to be processed each day. Satellite data processing is a complex and time consuming activity. It consists of various tasks, such as decode, decrypt, decompress, radiometric normalization, stagger corrections, ephemeris data processing for geometric corrections etc., and finally writing of the product in the form of an image file. Each task in the processing chain is sequential in nature and has different computing needs. Conventionally the processes are cascaded in a well organized workflow to produce the data products, which are executed on general purpose high-end servers / workstations in an offline mode. Hence, these systems are considered to be ineffective for real-time applications that require quick response and just-in-time decision making such as disaster management, home land security and so on.

This paper discusses a novel approach to process the data online (as the data is being acquired) using a heterogeneous computing platform namely XSTREAM which has COTS hardware of CPUs, GPUs and FPGA. This paper focuses on the process architecture, re-engineering aspects and mapping of tasks to the right computing device within the XSTREAM system, which makes it an ideal cost-effective platform for acquiring, processing satellite payload data in real-time and displaying the products in original resolution for quick response. The system has been tested for IRS CARTOSAT and RESOURCESAT series of satellites which have maximum data downlink speed of 210 Mbps.

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