Satellite data decompression software framework for high data rate missions

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ABSTRACT

Technological advancements in the fields of sensor, optical and electro-mechanical lead to increase the spatial, spectral, radiometric and temporal resolution of space borne missions. It eventually results into generation of tremondous amount of data onboard satellite. Various compression techniques have been evolved to handle this large amount of data for efficient usage of channel bandwidth and storage space. CCSDS(Consultative Committee for Space Data Systems) has recommended discrete wavelet transform based image data compression standard 122.0-B-1. ISRO's Cartosat-3 satellite provides panchromatic imagery with a spatial resolution of 0.28 m using 24 onboard detectors and Multispectral imagery in four spectral bands with a spatial resolution of 1.12 m using 96 detectors, with a nominal swath of ~17 Km. High Data Rate (HDR) of 2.88 Gbps in Ka band transmission and image data compression technique of CCSDS 122.0-B-1 is employed in Catrosat-3 mission. To handle the large volume of data (10 minutes of satellite pass generates ~200 GB data) and computationally intensive processing of decompression algorithm, a frame work is designed and implemented as part of ground segment establishment to improve the turnaround time for decompression. It is implemented using multi processing techniques with data sharing. Synchronisation between processes is achieved through POSIX Inter Process Communication(IPC). In this framework, multiple processes are spawned for performing detector wise decompression of both panchromatic and multispectral data , followed by detector-wise merging of data.Various tasks related to fetching of input data, file writing is performed in parallel. Framework supports configurable number of compressed data segments to be passed to decompression engine to avoid frequent spawning of processes. Turnaround time for decompression is improved by a factor of 2x by reading of compressed data , performing decompresion, merging of data and writing of data to disk in parallel for each detector.

Keywords: parallel, framework, image data compression, decompression , turnaround time