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Challenges & Solutions for Building High Data Rate Archival Software for an Astronomy Experiment

Ground-based gamma-ray telescopes are built to detect Cerenkov radiation generated by the interaction of the earth's atmosphere and gamma rays coming from different astronomical sources. Major Atmospheric Cerenkov Experiment (MACE) is a 21m diameter ground-based high energy gamma-ray telescope set up by BARC at Hanle (32.7◦ N, 78.9◦ E, 4270 m asl) in the Ladakh region of North India. The telescope consists of various subsystems like camera and data acquisition system, mirror alignment, telescope control unit, sky monitoring, weather monitoring, calibration system, operator console, data archival, and analysis systems. These subsystems generate data at different rates and the archiving system has to handle this varied data rate, providing sufficient read-write speed for real-time analysis. The camera and data acquisition system generates maximum data at an estimated rate of 1kHz with an average throughput of ~20 MB/sec, which may increase with the increase of hit pixels. Storage of such large data and subsequent analysis has led to the requirement for developing a robust and fault-tolerant data archiving software. In this paper, we present a detailed software architecture, design, implementation, and testing of the Data Archival System (DArS) Software for MACE Telescope. We describe the challenges faced in our previous implementation and how this design has helped us solve the issues. Generic software architecture has been designed which can be adopted for systems with similar functional requirements. The design principles followed provide scalability and maintainability of the software.

Collaboration / Activity

B.A.R.C , MACE Project

First author

Email

Primary author: SARKAR, Debangana (Bhabha Atomic Research Centre)

Presenter: SARKAR, Debangana (Bhabha Atomic Research Centre)

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