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40-Gbps Data-Acquisition System for NectarCAM, a camera for the Medium Size Telescopes of the Cherenkov Telescope Array

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The Cherenkov Telescope Array (CTA) will be the next generation ground-based gamma-ray observatory. It will be made up of approximately 100 telescopes of three different sizes, from 4 to 23 meters in diameter. The previously presented prototype of a high speed data acquisition (DAQ) system for CTA (CHEP 2012) has become concrete within the NectarCAM project, one of the most challenging camera projects with very demanding needs for bandwidth of data handling.
We designed a Linux-PC system able to concentrate and process without packet loss the 40 Gb/s average data rate coming from the 265 Front End Boards (FEB) through Gigabit Ethernet links, and to reduce data to fit the two ten-Gigabit Ethernet downstream links by external trigger decisions as well as custom tailored compression algorithms. Within the given constraints, we implemented de-randomisation of the event fragments received as relatively small UDP packets emitted by the FEB, using off-the-shelf equipment as required by the project and for an operation period of at least 30 years.
We tested out-of-the-box interfaces and used original techniques to cope with these requirements, and set up a test bench with hundreds of synchronous Gigabit links in order to validate and tune the acquisition chain including downstream data logging based on zeroMQ and Google ProtocolBuffers.

Tertiary Keyword (Optional)

High performance computing

Primary Keyword (Mandatory)

DAQ

Secondary Keyword (Optional)

Network systems and solutions

Primary authors: Dr HOFFMANN, Dirk (Aix Marseille Université, CNRS/IN2P3, CPPM UMR 7346, 13288, Marseille, France); HOULES, Julien (Aix Marseille Université, CNRS/IN2P3, CPPM UMR 7346, 13288, Marseille, France)

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