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The ATLAS ReadOut System - improved performance with the switch-based architecture

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About 600 custom-built ReadOut Buffer INput (ROBIN) PCI boards are used in the Data-Collection of the ATLAS experiment at CERN. In the standard setup requests and event data are passed via the PCI interfaces. The performance meets the requirements, but may need to be enhanced for more demanding use cases. Modifications in the software and firmware of the ROBINs have made it possible to improve the performance by using the on-board Gigabit Ethernet interfaces for passing part of the requests and of the data. Details of these modifications as well as measurement results will be presented.

Summary

The custom-built ReadOut Buffer INput (ROBIN) board is used in the ATLAS experiment at CERN to buffer the event data coming from the ReadOut Drivers (ROD) of the sub-detectors via ˜1600 optical links. Per ROBIN three of those links can be connected. The maximum input event fragment rate is 75-100kHz (first level trigger rate). The about 600 ROBINs are plugged into the PCI slots of rack mountable PCs (usually 4 per PC), which run the the software to manage the requests by the Level 2 Trigger (L2) and the Event Builder (EB) as well as delete requests. The connection to the Data Collection (DC) network is established via Gigabit Ethernet (GbE). About 150 of these PCs form the ReadOut System (ROS), which can service ˜20 kHz rate of requests from L2 for data input via 2-3 optical links per ROS PC and ˜3.5 kHz rate of requests from the EB for data input via all 12 links (4 ROBINs with 3 links each). Certain use cases include Full-Scan requests (similar to EB requests) by L2, which would go far beyond the capabilities of the standard ROS system with respect to the available bandwidth and processing power. For such demanding scenarios the message handling mechanism can be offloaded partially to the individual ROBINs in the so-called Switch-Based scenario, utilizing the on-board GbE interface for a direct connection to the DC network. To make this possible the FPGA and software for the on-board processor of the ROBIN were modified, allowing the ROBIN to output responses to requests arriving via the network interface like a ROS PC. First measurement results show that a Full-Scan at 20 kHz would be possible for fragments of ˜1kB (which is the canonical size). Details of the implementation and results as well as further plans for improvement will be presented.

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