Continuous Data Recording on Fast Real-Time Systems

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The PCU-Project[1] launched for the enhancement of the vertical stabilisation system at JET has required the designed of a new real-time control system with the challenging specifications of 2Gops and a cycle time of 50us. The RTAI based architecture running on an x86 multi-core processor technology has been demonstrated to be the best platform for meeting the high requirements.
Moreover, on this architecture thanks to the smart allocation of the interrupts it was possible to demonstrate simultaneous data streaming at 50MB/s on ethernet while handling a real-time 100kHz interrupt source with a maximum jitter of just 3us.
The RTAI-based PCU-controller, because of the limitations of the 32bit Linux kernel mode address space, offers a maximum practical data storage of 800MB per pulse. While this can accepted for normal operation it posed some limits in the debugging and commissioning of the system.
In order to increase the capability of the data acquisition of the system we have designed a mechanism that allows continuous full bandwidth (~32MB/s) data streaming from the real-time task (kernel mode) to either user mode data collector or a potentially an external data acquisition server. The rchitecture involves a peer to peer mechanisms where the sender running in RTAI kernel mode sends large chunks of data using UDP packets, implemented using the 'fcomm' RTAI extension[2], to a receiver that will store the data.
The paper will present the results of the initial RTAI operating system tests, the design of the streaming architecture and the first experimental results of its use.
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[1] F. Sartori et al., Proceedings 6th IAEA-TM, Inuyama, Japan, 2007
[2] A. Neto et al., Proceedings 25th SOFT conference, Rostock, Germany, 2008
* See the Appendix of F. Romanelli et al., Proceedings 22nd IAEA Fusion Energy Conference, Geneva, Switzerland, 2008.

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