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ORIGINAL ARTICLE

# A high speed networked signal processing platform for multi-element radio telescopes

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**Abstract** A new architecture is presented for a Networked Signal Processing System (NSPS) suitable for handling the real-time signal processing of multi-element radio telescopes. In this system, a multi-element radio telescope is viewed as an application of a *multi-sensor, data fusion* problem which can be decomposed into a general set of computing and network components for which a practical and scalable architecture is enabled by current technology. The need for such a system arose in the context of an ongoing program for re-configuring the Ooty Radio Telescope (ORT) as a programmable 264-element array, which will enable several new observing capabilities for large scale surveys on this mature telescope. For this application, it is necessary to manage, route and combine large volumes of data whose real-time collation requires large I/O bandwidths to be sustained. Since these are general requirements of many multi-sensor fusion applications, we first describe the basic architecture of the NSPS in terms of a *Fusion Tree* before elaborating on its application for the ORT. The paper addresses issues relating to high speed distributed data acquisition, Field Programmable Gate Array (FPGA) based peer-to-peer networks supporting significant on-the fly processing while routing, and providing a last mile interface to a typical commodity network like Gigabit Ethernet. The system is fundamentally a pair of two co-operative networks, among which one is part of a commodity high performance computer cluster

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