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Meerkat prototyping proceeds

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South African and Australian scientists are collaborating on the software underlying the Square Kilometre Array (SKA) radio telescope for which both countries are competing.

SA and Australia are on the shortlist to host the R10 billion project, touted as the planet's biggest radio telescope yet. Once operational in the decade after 2010, the telescope will give scientists new insight into how the universe was formed.

According to the latest edition of the SKA SA newsletter, a large part of the recent focus has been to develop and integrate the complete software chain for the Meerkat prototype (XDM) dish and engineering experiments.

“As of the end of August 2007, the software runs end-to-end in the laboratory using actual XDM computing hardware,” says Meerkat project officer Jasper Horrell. Meerkat is a successor to the Karoo Array Telescope.

“This includes end-to-end facility monitoring and control, using both Web and scripted components, antenna control software with a simulated XDM dish, the data filler and data processing software, simulated RF and DSP subsystems, and simulated environmental monitoring,” he adds.

Horrell says preliminary work on XDM integration with the real DSP subsystem has already commenced and lab integration with the other subsystems started in September 2007.

“The Convergent Radio Astronomy Demonstrator (Conrad) computing collaboration with the Australians is proceeding well, with the code base maturing in a number of areas, such as the synthesis code for pipelined imaging and the various monitor and control components (also used in the XDM system),” he says.

The Conrad computing architecture will be used by the SKA, as well as the KAT-7 engineering test-bed and Meerkat, an 80-dish telescope that may become an SKA cornerstone or be built independently of the SKA should Australia win the bid.

Work in the US

The newsletter also reports that the joint effort between the Meerkat Digital Backend (DBE) team and the Centre for Astronomy Signal Processing and Electronics Research (Casper), at the University of California (UC), Berkeley, has produced results in “less than six months after the project started in earnest”.

The DBE team is using Casper's iBOB hardware and software design tools and libraries to build a system for processing signals from the Meerkat prototype dish.

The teams are also working together to develop instruments for future radio telescopes. The Casper team works closely with the Radio Astronomy Laboratory, in the Department of Astronomy at UC Berkeley, which is building the Allen Telescope Array (ATA).

“This contact with the ATA project and other telescope projects around the world, including Meerkat, ensures that Casper continues to work on important projects that are of broad interest to digital back-end designers working on current and future radio telescopes,” the newsletter says.

The present generation iBOB board from Casper, and the next-generation Reconfigurable Open Architecture Computing Hardware (Roach) are both designed specifically for digital processing of signals in radio telescopes. Roach, currently under development through a collaboration of Meerkat, Casper and the National Radio Astronomy Observatory in the US, is set to deliver more than half a Teraop of processing power and up to four bi-directional 10Gb communication links. Roach will provide the primary building block for digital signal processing systems in numerous next-generation radio telescopes.

Edging out Australia

At home, the National Assembly recently adopted the Astronomy Geographic Advantage Bill that may give SA an edge over its southern rival. The Bill must still go before the National Council of Provinces before president Thabo Mbeki can sign it into law.

A site for the SKA has already been identified to the northwest of Carnarvon, in the Northern Cape. The site will also host Meerkat, a SKA precursor. The Bill, when it becomes law, will allow science and technology minister Mosibudi Mangena to declare the site a protected area.

The Bill says this will ensure “geographic areas in the republic, which are suitable for astronomy and related scientific endeavours due to, among other things, atmospheric transparency, low levels of light pollution, low population density or minimal radio frequency interference, are protected, preserved and properly maintained”. This will include steps to restrict light pollution and radio frequency emissions.

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