Real Time Interferometer Imaging

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We present the architecture for a real-time imaging system for interferometer data. This system is currently in use for the Allen Telescope Array (ATA), but is designed for any interferometer used for centimeter-wave radio astronomy. This system supports automated processing of both continuum and spectral line observations.

Motivation for this system comes from the sheer volume of data produced at the ATA. At current capacity, the ATA correlator can produce several terabytes of data every month. The addition of new correlators and antennas will cause the data collecting rate to increase by well over a factor of 200. Such large volumes of data do not easily allow for traditional offline processing. Online data analysis and automated imaging therefore become necessary for timely scientific results and practical data storage. This issue is particularly relevant to the SKA, as it will generate even higher data rates than the ATA.

The real-time imaging system is divided into three subsystems: flagging, calibration and imaging. Each subsystem is designed to work independently, but may work in conjunction with other subsystems and observing software for optimal results. In each subsystem, automated processing must operate fast enough to keep up with the incoming data rate and allow for error checking of processing results.

The real-time imaging system is designed to derive information about both the frontend and backend systems, as well as develop models for the sky brightness distribution across several frequencies. The system utilizes this information to improve future observations, but is not dependent upon this information. Error checking algorithms allow for dynamic adaptation to changes, both in hardware (e.g. antenna malfunction) or sky brightness (e.g. transient events).