The ALMA Real Time Control System

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The Atacama Large Millimeter Array (ALMA) is a revolutionary millimeter and sub-millimeter array being developed on the Atacama plateau of northern Chile. An international partnership lead by NRAO, ESO, and NAOJ this powerful and flexible telescope will provide unprecedented observations of this relatively unexplored frequency range.

The control subsystem for the Atacama Large Millimeter Array must co-ordinate the monitor and control of at least sixty six antennas (in four different styles), two correlators, and all of the ancillary equipment (samplers, local oscillators, front ends, etc.). This equipment will be spread over tens of kilometers and operated remotely. Operation of the array requires a robust, scalable, and maintainable real time control system.

The real time control system is responsible for monitoring and control of any devices where there are fixed deadlines. Examples in the ALMA context are antenna pointing and fringe tracking. Traditionally the real time portion of a large software system is an intricate and error prone portion of the software. As a result the real time portion is very expensive in terms of effort expended both during construction and during maintenance phases of a project.

The ALMA real time control system uses a Linux based real time operating system to interact with the hardware and the CORBA based ALMA Common Software to communicate in the distributed computing environment. Mixing the requirements of real time computing and the non-deterministic CORBA middleware has produced an interesting design. We discuss the architecture, design, and implementation of the ALMA real time control system. Highlight some lessons learned along the way, and justify our assertion that this should be the last large scale real time control system in radio astronomy.