NRAO Cooperative Software Consolidation Plan

N. Radziwill, M. McKinnon, B. Glendenning, B. Butler, A. Russell
May 14, 2007

Summary

A solution for a) providing a common experience to telescope users across NRAO, b) minimizing long term software operations and maintenance costs, and c) effectively leveraging knowledge between ALMA, EVLA, GBT and any future projects for long-term strategic benefit to NRAO, is presented.

Background

The ALMA North American (NA) partner is responsible for developing software for control systems, the correlator, scheduling (OS), data processing, and pipelines. The software development responsibilities of the ALMA European (EU) partner are proposal submission (PS), observation preparation (OP), and archive tools. ALMA and EVLA already completely share the user-facing software developed by ALMA NA, specifically data processing (CASA) and pipelines. EVLA has been working constructively with ALMA EU to adapt archive software to NRAO's operational environment, develop shared catalogs (for calibrators and spectral lines), and provide feedback to ALMA EU for continued development.

In the past, people have been accountable to achieve the goals of only one NRAO telescope. With this approach, NRAO strategic goals can be overshadowed as individuals make decisions. However, NRAO will be most effective if all groups cooperatively solve problems and seek input and assistance outside of NRAO wherever possible. This requires adapting our structure to enable each group to use its strengths to benefit NRAO as a whole.

The Solution

1. Clearly distinguish responsibilities to construction projects/site operations versus NRAO (multiple projects/sites).

2. Restructure selected projects so that leaders are accountable to NRAO to meet the requirements and schedules of different projects.

3. This consolidation plan has been developed with EVLA and ALMA as the focus. The GBT is a fully operational telescope, and it is widely acknowledged that the delivered GBT software products fully meet requirements. Nevertheless, continued GBT software development and future instruments are obviously an integral part of the NRAO plan. Radziwill will work with Prestage, O'Neil and Shelton beginning immediately to involve GBT in a mutually satisfactory way.

A detailed description of the steps to achieve the solution is presented in the Appendix.

Cost Savings in the Operations and Maintenance Stage

The long term cost savings realized by having common software tools depend upon who maintains the software during the operational phases of the instruments.

- If ALMA EU maintains the PS and OP software and NRAO maintains the OS software when the instruments are operational, the cost savings are estimated to be 1-2 FTE per year when compared to current operational estimates.

- If NRAO maintains the PS, OP, and OS software when the instruments are operational, NRAO must expect to provide an additional 1 FTE per year to support the maintenance of the software for both ALMA and EVLA (in the case that NRAO assumes more of the software maintenance than is done by ALMA EU).

Cost and Schedule Impact on Construction Projects

The work outlined here is an increase in scope to both the ALMA and EVLA projects. To accommodate the new requirement that the two telescopes demonstrate a common user experience, additional costs and scheduling implications are expected:

- The arrangement must not cause ALMA EU to incur additional costs or schedule slips. The details of the arrangement must be negotiated with ALMA EU and are described in the Appendix.

- The estimated cost of this arrangement for the NRAO is 7 FTE-years or about $700K. If the EVLA project must bear the additional cost, it amounts to about 25% of the project's remaining contingency. The estimated schedule delay is two years in the delivery of the OP-equivalent software. This may pose a risk to first science observations with the EVLA. We estimate little schedule delay for the delivery of the PS- and OS-equivalent software.

- Work on EVLA OP must continue to support on the sky tests of the EVLA prototype correlator in April 2008. The EVLA development team will shift its focus to work on functionality instead of usability issues until this time, with the goal of linking activities with the observatory-wide observation preparation activities thereafter.

Risks to NRAO

Since this proposal is an increase in scope, involving significant changes to the management structure and work assigned to employees at all NRAO telescopes (in construction or operations), there are necessarily associated risks. We identify a few of the important risks as:

- NRAO reliance on ALMA EU for long term maintenance and enhancement of software tools may jeopardize timely observing support for the EVLA and GBT.

- The additional managerial oversight required by the solution may stress the existing management structure for NRAO Operations.

- By reassigning development responsibilities between sites and projects, the associated loss of individual creative investment in existing software tools may adversely impact employee morale. Employees will require positive reinforcement during the time of transition to assure them that their value to NRAO comes from their total skills and capabilities, not just their work on a specific piece of software.

Appendix: Responsibility Matrix & Action Plan for Consolidation

Responsibility Matrix (see attached chart)

Telescope computing groups (EVLA, GBT, NAASC DM) are fully responsible for M&C/correlator systems, observation execution, scheduling heuristics and prototype development, handling of and specialized access to monitoring data, and getting science data into the archive. On an observatory-wide basis, NRAO is responsible for proposal submission and handling, observation preparation, scheduling software, data processing and pipeline development. One representative from any of the NRAO sites or projects will be designated as responsible in each observatory-wide area to successfully support the requirements and timescales of all NRAO telescopes.

Achieving one proposal management system for NRAO

1. Radziwill is responsible for achieving the common user experience between all NRAO telescopes in this area, and is accountable to McKinnon for meeting EVLA requirements, Prestage for GBT requirements, Glendenning for ALMA project requirements, and Carilli/JAO for ALMA operations requirements.

2. To achieve this, NRAO is and will continue to negotiate with Bridger to cooperatively develop the proposal management system with ALMA EU.

Achieving one observation preparation system for NRAO

1. Moving forward, we acknowledge the difference between observation execution (getting an observation in the form of a scheduling block to run on a telescope and produce meaningful raw and calibrated data) and observation preparation (value-added tools to make it easy for a broader community to access the software).

2. Glendenning immediately becomes responsible for launching observatory-wide software development for observation preparation not to include observation execution, which is the responsibility of the telescopes. Glendenning will work with ALMA EU groups to leverage their deliverables.

3. Butler continues progress on EVLA OP to support what is needed for prototype correlator testing, focusing on functionality but not human factors/usability.

4. Butler and Glendenning develop a common interferometer project data model, which specifies among other things, the content and structure of scheduling blocks, by May 2008. Glendenning is responsible to McKinnon for making sure that ALMA software is effectively adapted to meet the EVLA requirements according to the EVLA schedule. NRAO will determine how, when, and under what circumstances to involve GBT in the observation preparation system.

Achieving one scheduling system for NRAO

1. Butler immediately becomes responsible for software development for scheduling, focusing on integrating the ALMA and EVLA resources working in this area and providing direction. Butler is accountable to both EVLA and ALMA for meeting requirements and adhering to delivery schedules.

2. All projects will proactively share information about challenges and findings.

3. Progress will be evaluated by Jewell to determine how, when and under what circumstances to involve GBT. (The process is identical to what was done with GBTIDL, including intention to move forward with a cross-observatory effort later in time). We acknowledge that the scheduling requirements for the GBT, a hands-on single dish operating in an extremely wide range of environmental conditions, are quite different from an interferometer, and may require different algorithms albeit using shared infrastructure wherever possible.

4. Similar to observation preparation, a common project data model for the scheduling system needs to be developed by Butler and Glendenning.

Achieving one archiving system for NRAO

1. Radziwill is responsible for observatory-wide deployment of archive infrastructure developed by ALMA EU and development of search capabilities and Virtual Observatory integration of science data. Raw data stores, monitor data archives, and disaster recovery backups remain the responsibility of the telescopes.

2. NRAO archive developers will continue to informally collaborate with the ALMA EU group responsible for developing the archive. This arrangement has been highly beneficial to both NRAO and ALMA EU for the past two years and the benefits are expected to continue; note that GB is already effectively integrated into this arrangement.

3. New staff members hired as archive technicians/data curation specialists will join the unified group to immediately benefit from cumulative lessons learned.

Additional elements of Observatory software, such as pipeline development, user services, and web portals are mentioned in the responsibility matrix, but we do not discuss them here because they have been addressed by End to End Operations.

What's Different?

NRAO software development managers agree to take responsibility for key areas for all of NRAO, strategically "let go" of certain areas, and trust our coworkers to deliver according to requirements and required timescales as necessary. We all help each other out, and eliminate need for internal negotiations. We are all responsible; we each take care of a certain area.

The ALMA organization is unchanged: all construction deliverables are part of a subsystem which reports to the management of the Computing Integrated Product Team (CIPT), who in turn report to the JAO and Executive management. From the ALMA perspective, the results of this paper are that CIPT subsystems have increased participation from NRAO.

Agreement between NRAO and ALMA EU

Both NRAO and ALMA EU (principally) will agree to use the same basic software product in the areas of proposal submission, observation preparation, scheduling, data processing, and archive storage and access. It is understood that both EVLA and ALMA may want specific layers on top of the basic software, but they should be written to not require incompatible changes in the underlying software. The details of the collaborations between NRAO and ALMA will be defined in a short agreement to be approved by the major stakeholders (NRAO management, the JAO, and ALMA EU management). While the agreement is still to be negotiated, it is expected that it will have to contain at least the following elements for it to succeed:

- Timely agreement on data models, with controlled evolution thereafter.
- Agreement on the initial code base to develop from
- The arrangement must not cause ALMA EU to incur additional costs or schedule slips. Since necessarily additional work in Europe will be needed to generalize the software for non-ALMA use, this will probably be handled by NRAO agreeing to assume responsibility for items currently within ALMA EU scope. This also implies that by the end of construction any lost schedule should be recovered.
- Collaboration style: we believe that joint teams are most likely to succeed for the "common" portions.
- Dispute settling mechanism.