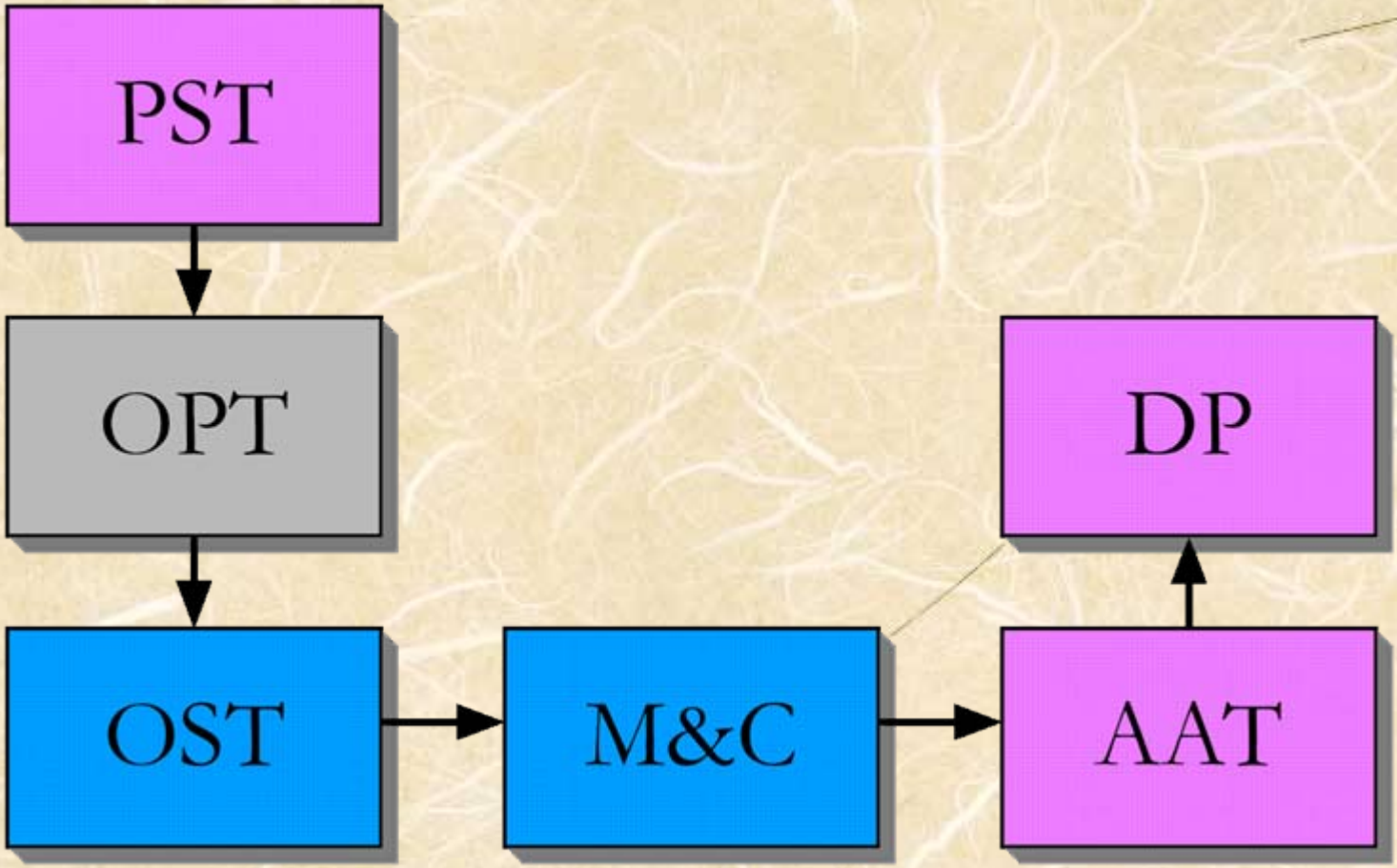
EVLA Software

Bryan Butler

Requirements and Goals of EVLA Software

- Maximize scientific throughput of the instrument
- At a minimum be able to do what we can do with the VLA
- Easy to use, by both experts and novices
- Commonality among NRAO instruments

EVLA Software (Crude) Block Diagram



Proposal Submission Tool

- Supports the preparation, submission, and handling of proposals
- Have a prototype developed for VLA & GBT - has been used for the past 4 proposal deadlines (5th this June)
- Continued development to be managed by E2E Operations Division, to develop a tool common among ALMA, EVLA, GBT, and VLBA

Observation Preparation Tool

- Supports the preparation and submission of observing scripts (think of *jobserve* for the VLA)
- Have a prototype developed for EVLA - includes components for source setup and source catalog management, scan setup, Scheduling Block definition (sequence of scans); lacks detailed hardware setup component
- Continued development to be managed by ALMA, to develop a tool common among ALMA, EVLA, GBT, and VLBA
- EVLA OPT will continue to be developed for support of prototype WIDAR; beta release fall 2007, full release spring 2008

Observation Scheduling Tool

- Supports the scheduling of observing scripts - what gets observed next on the EVLA, either submitted manually or chosen dynamically (think of Barry Clark for the VLA)
- Have a prototype developed for VLA - is being used to schedule ~20% of time on the VLA dynamically
- True EVLA prototype based on this, but integrated into EVLA software system and with full GUI; beta release summer 2007, full release spring 2008
- Continued development to be managed by EVLA, to develop a tool common among ALMA, EVLA, GBT, and VLBA

Archive Access Tool

- Supports access to science data in the archive, the ability to search, to access proprietary data, support VO, etc.
- Have a prototype developed for VLA - is being used extensively (~3X data taken real time is downloaded through this tool)
- Continued development to be managed by E2E Operations Division, to develop a tool common among ALMA, EVLA, GBT, and VLBA

Post-Processing

- Supports reduction of data, including calibration, imaging, display, pipelines, etc. (think of AIPS for VLA)
- CASA developed for this - a suite of applications derived from the former AIPS++ package (only the underlying libraries are common); applications include a Python interface, Matplotlib plotting library, task environment similar to AIPS and Miriad, and GUIs
- Continued development managed by E2E Operations Division, to develop a tool common among ALMA, EVLA, GBT, and VLBA

Post-Processing

- CASA infrastructure in relatively good shape, including import, export, information, editing, flagging, display, plotting, calibration, imaging, modeling, utility, and analysis
- Beta release September 2007
- However, for EVLA, there are two remaining problem areas:
  - Algorithm development, including imaging, RFI, pipelines, and handling large datasets
  - Operational issues (how and where are data actually reduced and what support is given to users?)

Data Rates and Volumes

- To support EVLA bandwidths and resolutions (given beam size), we have the following data rates and volumes (for 6h observation) for the 4 EVLA configurations, for full-beam imaging in continuum:

Config	Nvis (Gvis)	Rate (MB/s)	Volume (GB)
D	0.1	.04	1
C	1	.4	10
B	10	5	100
A	100	50	1000

- This volume of data is a significant computing challenge for any post-processing system!

Algorithm Development

Need algorithms to support:

- Wide bandwidth, wide field, full polarization imaging
- High dynamic range and fidelity imaging in the presence of significant confusion and instrumental errors
- RFI suppression and excision

Because of size of datasets and magnitude of computing problem, we need parallel processing and parallel I/O algorithm development

Algorithm Development

Addressing this with NRAO Algorithms Working Group (NAWG):

- Led by Sanjay Bhatnagar, Steve Myers
- CASA developers & students (Golap, Moellenbrock, Rao-Venkata)
- NRAO-wide staff participation (Fomalont, Greisen, Cotton, Sjouwerman)
- Connection to other efforts (LWA, LOFAR, eMERLIN, RadioNET)

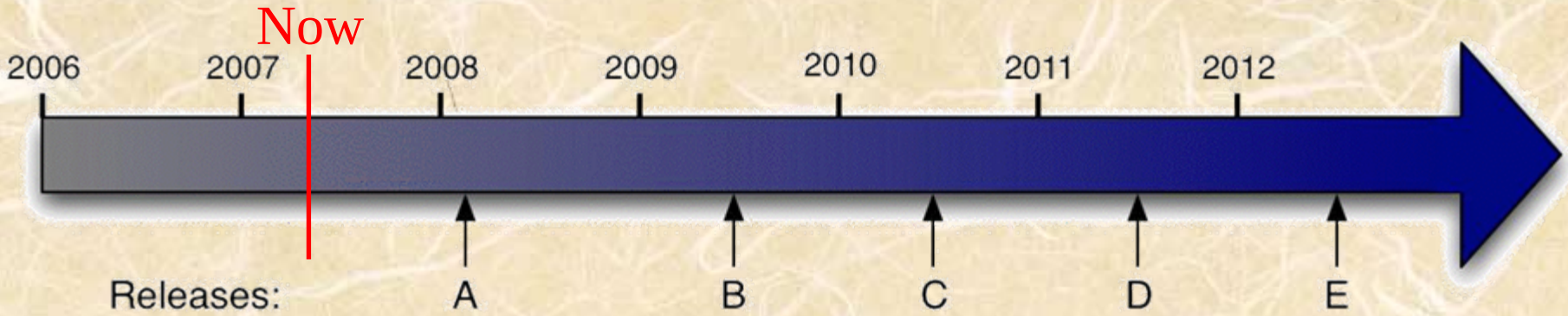
BUT…

- Most folks participating in the NAWG are only at fractional effort, and concentrating mostly on the CASA Beta release currently
- Because of this, progress in algorithm development has been notably slow in the past year or so, and little to no parallel processing or parallel I/O development has occurred
- Need more effort, both to take over what NAWG contributors have been doing for core CASA (to free them up for algorithm development), and for additional algorithm development effort; this additional effort can be:
  - More NRAO internal effort (new hires or redirected effort)
  - "External" (university or other observatory)
  - Mix

Operational Issues

- Given dataset sizes, it is likely that at least a moderate-sized computing cluster will be needed for anything beyond the simplest EVLA experiments; this has been budgeted from the beginning for EVLA
- Some investigators will have access to such clusters, so we should provide software (CASA) for them to reduce data at their home institution
- However, some will not, meaning NRAO should provide an environment for data reduction for visitors
- Support for the data reduction is with both software and with staff support (at data analyst and scientist level)
- This is part of our EVLA science operations plan, to be covered by Claire Chandler

Timescale and Major Releases



Release	Date	Event	Comments
A	Q2 2008	Arrival Prototype Correlator	4 antennas; ~2 GHz
B	Q2 2009	Begin WIDAR Installation	12 antennas; ~2 GHz
C	Q2 2010	WIDAR Installation Complete	System integration testing
D	Q2 2011	Shared-risk Observing	Standard modes supported
E	Q2 2012	Full Operation	End of EVLA construction