Obit: Software Environment

Why develop a new package?
- AIPS not properly maintained the last 10+ years
- AIPS architecture difficult to extend
- No suitable environment for algorithm development
- Fortran 77 losing compiler support
Obit: What?

What is Obit?

- Software environment for algorithm development.
- Modest requirements on host computer
- Re engineer AIPS algorithms and data structures
- Support multiple external data representations (currently AIPS and FITS)
- Data model and structures compatible with AIPS
- AIPS and Obit Software inter-operable

Modern software environment:

- Object oriented in c
- Extensive use of third party packages
- Python user interface
- Communication via xmlrpc
**Obit: Components**

- Class libraries in c with glib extensions
  - Simple class hierarchy system
  - Python binding to high level functionality
- Standalone compiled “Tasks”
  - Similar to AIPS tasks
  - Can be run from command line or python shell
- ObitTalk python shell
  - Similar in function to AIPS POPS
  - Derived from ParselTongue (RadioNET)
  - Can run tasks, and
  - Manipulate data using Python interface
  - Executes locally or remotely over network
**Obit Tasks**

- Similar to AIPS tasks:
  - Can run synchronously or asynchronously
  - Can run locally or remotely
  - Given parameters, operate on datasets and images
- Compiled executables in c
- Can talk to ObitView, interactive image display
- Comparable to or faster than AIPS equivalents
- Inter-operable with AIPS tasks for AIPS data
- Online documentation
ObitTalk Task Window

IMEAN Messages

IMEAN1: Task IMEAN (release of 31DEC02) begins
IMEAN1: Image= NGC315 .F555W . 1 1 xywind= 1 1 800 800
IMEAN1: Mean and rms found by fitting peak in histogram:
IMEAN1: Mean=-6.4481E-01 Rms= 1.4449E+00 **** from histogram
IMEAN1: Mean and rms found by including all data:
IMEAN1: Mean= 3.6113E-01 Rms= 1.2806E+01 over 640000 pixels
IMEAN1: Minimum= -2.7389E+02 at 5 21
IMEAN1: Skypos: DEC 30 20 47.3327 RA 00 57 47.62883
IMEAN1: Maximum= 7.6721E+03 at 10 95
IMEAN1: Skypos: DEC 30 20 47.9776 RA 00 57 47.88477
IMEAN1: returns adverbs to AIPS
IMEAN1: Appears to have ended successfully
IMEAN1: smeagle 31DEC02 TST: Cpu= 0.0 Real= 0

Task Finished
**ObitTalk**

- Python preloaded with functions
- Can run interactively or on a script
- Can execute tasks locally/remotely, synchronously/asynchronously, Obit/AIPS
- Can execute scripts locally/remotely, synchronously/asynchronously
- Can use ObitView interactive image display
- Data access via python binding
  - Read/write headers, tables, data
  - High level bindings to Obit class libraries allow flexible “toolkit”
**ObitView**

- Interactive image display
- Communicates via xmlrpc allowing use over networks
- Display AIPS or FITS images
- Standalone image browser
ObitView screen shot
Obit algorithm development and testing

- Most AIPS imaging technology implemented, much of the calibration.
- Use of object-oriented methodology simplifies algorithm development and testing.
- Interoperability with AIPS means existing functionality can be used.
- New algorithms can be tested in a production environment.
- Several new algorithms developed.
- autoWindow useful for imaging surveys.
**Obit Distribution**

- Distributed via anonymous cvs
- Uses GNU GPL license
- configure/make installation
- Minimal support
Documentation

- ObitTalk User documentation: online and
- ObitTalk architecture document:
- Obit architecture document:
- Obit software documentation (from doxygen)
Why Use Obit for Sky Surveys?

- autoWindow algorithm gives superior imaging
  - based on idea from difmap
  - dynamically determine CLEAN windows
- Only available in Obit for wide-field imaging
- Very import to constrain CLEAN when no. pixels exceeds degrees of freedom in data.
- Reduces “CLEAN” bias – power from real sources redistributed over image.
Constraining CLEAN

Example:
SiO masers,
large field of view
VLBA snapshot imaging
Comparison of autoWindow and unconstrained CLEAN

AutoWindow channel image

Full CLEAN window
Ratio of Full to auto window

Typical values 0.4-0.8

Significant reduction of flux density with unconstrained CLEAN
VLSS (74 MHz) Survey image

AutoWindow

Systematically higher flux density (less CLEAN bias)
Bias Reduction in Survey processing

Test for CLEAN bias by adding artificial sources into VLA survey data. Image and deconvolve to see what flux density recovered.
Bias Reduction in Survey processing

Average bias in image RMS with and without autoWindow for range of artificial source flux densities, 220 test fields
Summary

- Obit is a reasonable environment for algorithm development
- Obit is sufficiently robust and efficient for selected production processing.