

Interactive Remote Datareduction Framework

JIVE contribution to WP 3.4 Mark Kettenis, Software Project Scientist



JIVE



- Promote and advance the use of VLBI for astronomy
 - Central correlation
 - User services
 - Network support
 - Innovation
 - EC liaison/representation
- Founded in 1993
 - Base budget from partners in 9 countries:
 - China, France, Germany, Italy, Spain, Sweden, United Kingdom, South Africa, the Netherlands
 - Hosted by ASTRON in Dwingeloo, NL
 - A European Research Infrastructure Consortium as of December 2014
- Large number of external projects
- Many people with temp positions in R&D/Science

24 people, 8 nationalities





EVN: European VLBI Network



- Consortium of radio telescopes
 - Involving 15 different organizations around the world: Europe, China, Puerto Rico, South Africa, Russia, Korea
 - More than 30 telescopes
 - And 12 more antennas for "Global observations" with NRAO
- Covering range of frequencies
 - Workhorse frequencies 18cm, 6cm,
 - Also available: SX, 5cm, 1.2cm
 - And at specific stations 90cm, 21cm, UHF, 50cm, 2cm, 7mm
- Reaching mas resolutions
 - From 15mas for 1.4 GHz EVN
 - To 1 mas at 5GHz with Asian, African or American baselines
- Sensitivity of 5µJy in 8hr at 1.4 GHz
 - Combination of Big Antennas and 1 Gbps bandwidth (and soon 2 or 4Gbps)
 - Big antennas also vital for spectroscopy (mJy sensitivity)
 - Operational approximately 60 days/year
 - 3 sessions augmented with e-VLBI once a month



VLBI with the SKA

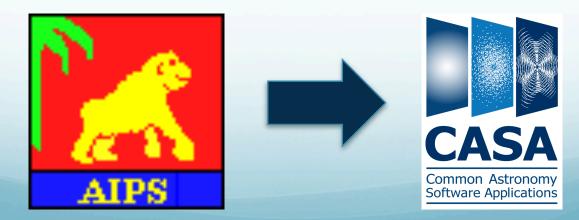
- VLBI is part of the Level 1 requirements
 - Coherent beamformer
- Official VLBI Working Group
- Multiple beams
 - For simultaneous observations of target and calibrators





New software needed

- VLBI (still) uses "classic" AIPS
- Radio Astronomy community uses CASA
- New developments use CASA/casacore.
 - Conversion of polarisation basis
 - Wide field imaging
 - Beam shape correction



Exploratory Data Reduction



- Semi-interactive using (Python) scripts
- Re-run scripts with new parameters and/or small variations
- Redundant re-calculation of intermediate data products
- Errors caused by attempts to avoid re-calculation

Framework for minimal recomputation

- 1. Turn CASA scripts into execution graphs
- 2. Compare execution graphs from CASA scripts
 - Using a Graph Partitioning approach
- 3. Generate sub-graph to be executed
 - Using intermediate data projects from object cache
- HILADO project delivered code to create execution graphs (UCAM) and Haskell code to compare execution graphs (JIVE)
- Use ZFS as backend for the object store



Jupyter

- A new name for IPython notebooks
- Web-based, enabling remote computation
 - Data sets getting too large to ship around
- Used at HPC centers, e.g. TACC

Good match: CASA uses IPython!





Goals

- Integrate CASA with Jupyter
- Integrate the HILADO minimal recomputation framework with Jupyter
- Deliver Python and Haskell modules necessary to achieve this
- Deliver a description on how to set up a complete envrionment