VO & NRAO

Brian Glendenning

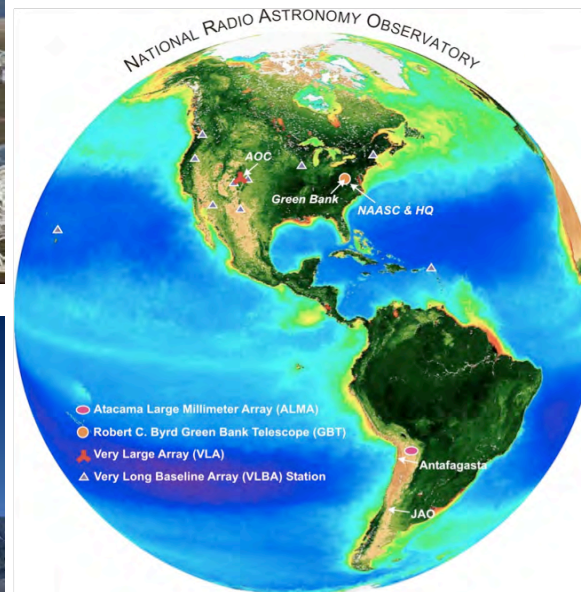# NRAO: 4 telescopes, 3-D data

Jansky VLA   **GBT**

VLBA   **ALMA**

GBT and VLBA under threat ("divestiture" – NSF Portfolio Review)

Very 3-D

- E.g., VLA now compared to pre-expansion

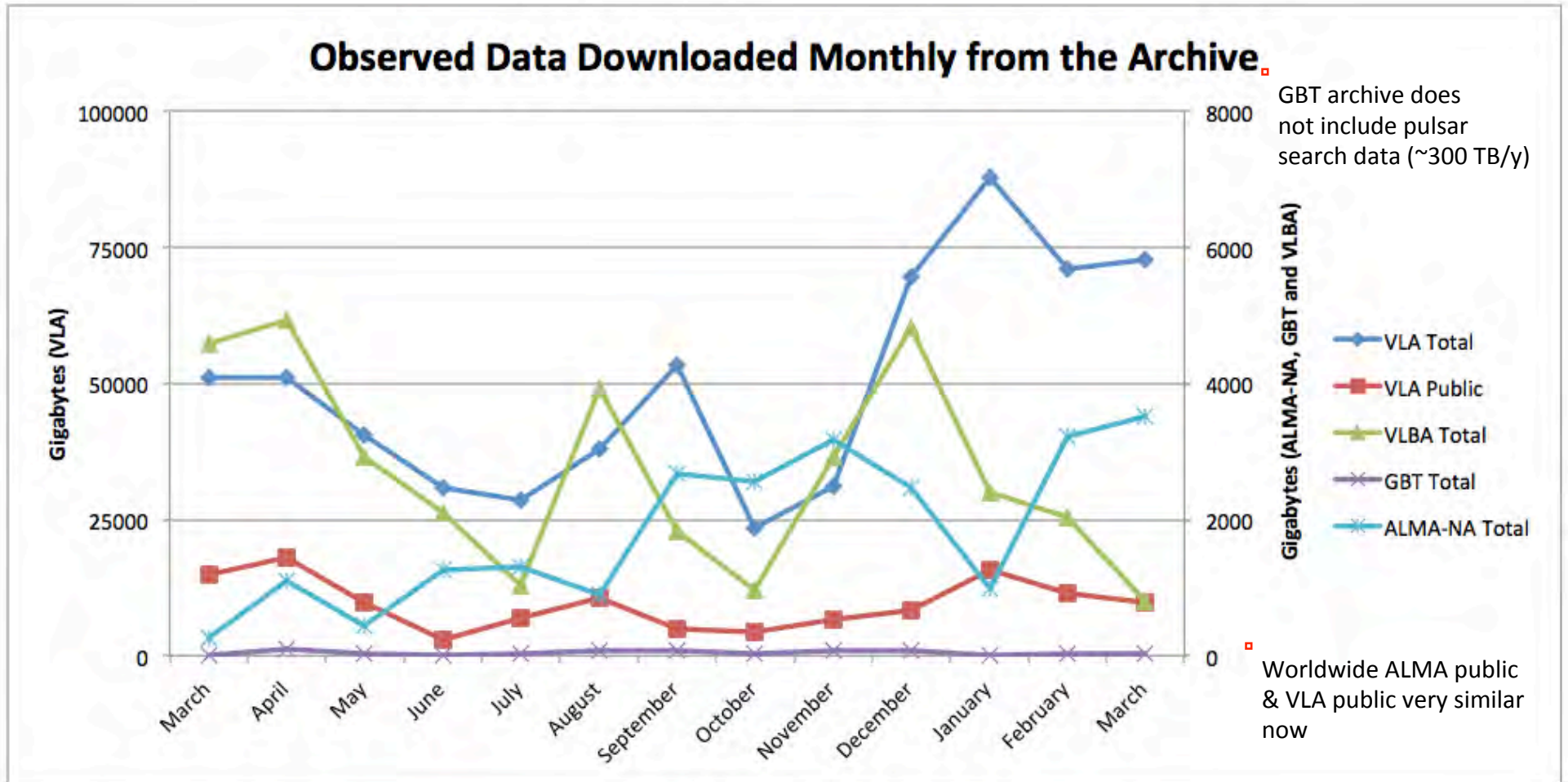| Parameter	VLA	Jansky VLA	Factor
Frequency Coverage (1 – 50 GHz)	22%	100%	5
Continuum Sensitivity (1-σ, 1 hr.)	30 μJy	3 μJy	10
Maximum BW in each polarization	0.1 GHz	8 GHz	80
# of full-polarization spectral windows	2	64	32
# of frequency channels at max. BW	16	16,384	1024
Maximum number of freq. channels	512	4,194,304	8192
Finest frequency resolution	381 Hz	0.12 Hz	3180

Image Data

- Common axes: RA, Dec, frequency/velocity, polarization
  - Rare: time
  - Starting to commonly have multiple "spectral windows" with varying #chan, resolution
    - Typically represented as multiple image cubes (often have different intents for the various spectral windows)

- Typical: 1000^3 (Gpix), Possible: > $10,000^3$ (Tpix), (x1-4 polarizations)
  - GB –> TB image sizes, Mb –> Gb network pipes
  - Server-side cutouts/subregions are important!

Status
Data Distribution

VLA scale >10x other telescopes! Dominated by proprietary downloads

Observed Data Downloaded Monthly from the Archive

GBT archive does not include pulsar search data (~300 TB/y)

Legend:
- VLA Total
- VLA Public
- VLBA Total
- GBT Total
- ALMA-NA Total

Worldwide ALMA public & VLA public very similar now

VO Initiatives @ NRAO

- NRAO has hosted VO activity for a long time (Tody)
- But: has not integrated it into software tools in a serious way until now
- CASA viewer
  - CASA has a large user base (2000 downloads per year)
  - Integrating 3D VO image access into viewer
  - Also Python VO binding
  - Expect release in v4.3 (~November)
- NRAO Archive
  - Being reworked for a number of reasons
  - Building on top of VO and ALMA Archive software
  - More for software reuse practicalities than philosophical reasons
  - Prototype release 1 October

Issues

- Our <u>limited</u> experience is that each service has it's own peculiarities.
  - We're handling this by specializing for each supported service.
- *We are very concerned about VO protocol/API instabilities*
  - At some point you have to stop trying to achieve model perfection and build the user base
  - NRAO/ALMA brings hundreds/thousands of users (observers/survey users)
  - We will not rewrite our software multiple times unless changes extraordinarily well motivated

CASA Viewer Data Manager
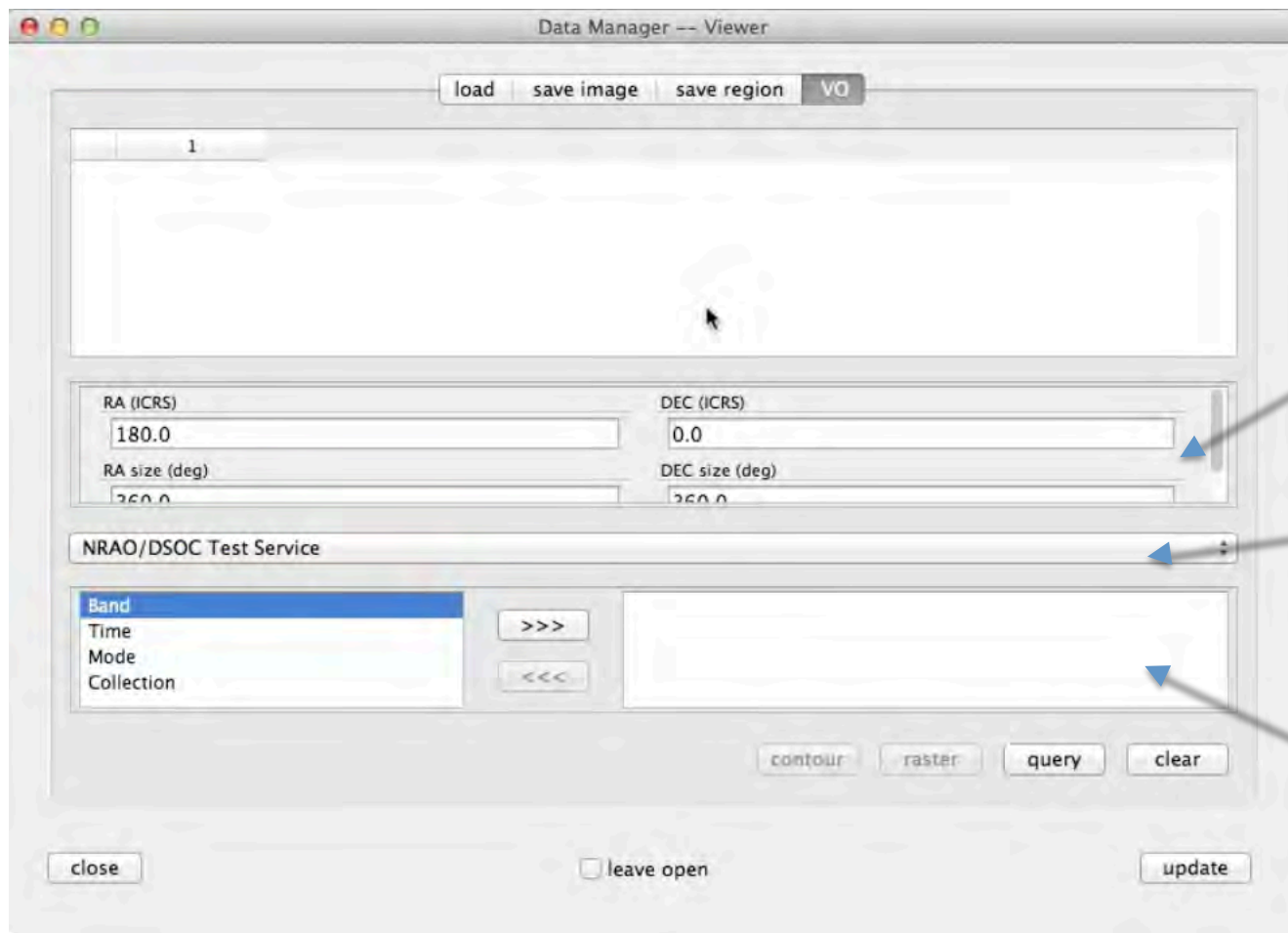
Spatial Selection

Service Selection

Meta Data Selection

Results from test service

Loading an Image

Viewer Window

CASA Viewer Forward Plan

- Currently addressing infrastructure to make this easily distributable and more widely testable
- Next Features
  - Adding "cutout" mode (server side sub-selection)
  - Cube Access Mode
    - Select a subregion of an image for download
    - Unified with capability already in viewer
  - User Interface improvements
    - Unit support in query fields, clean up response fields etc
    - Query based on region selected in current image

Aiming to have initial version available for CASA 4.3 (~Nov)

VO-enabled Archive

- Access to the archive system via VO protocols
- Reduces the overall system development effort while ensuring VO standards compliance
- Interoperability with other astronomical archives and with external applications is enhanced
- Standardize large parts of the archive infrastructure across NRAO and ALMA
- Other external astronomical archives adopted a VO enabled archive architecture

VO-enabled Web Query Subsystem

- A user will enter search parameters in a Web page to execute a search.
- The results of the search will be presented to the user by VOView.
- This part of the functionality will be provided by a Search page.
- The user may select results from the Search page and request to download them.
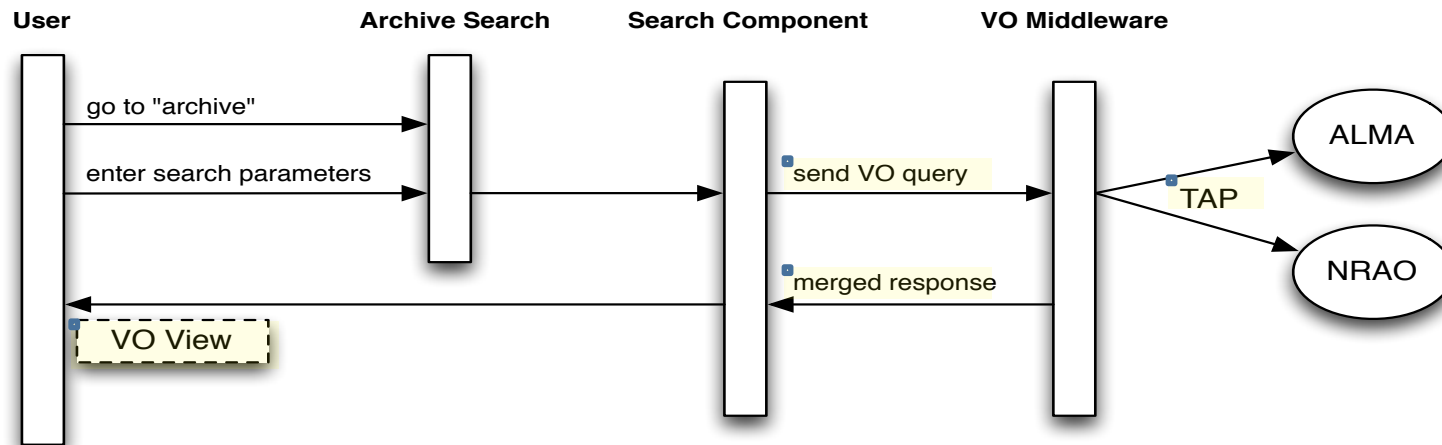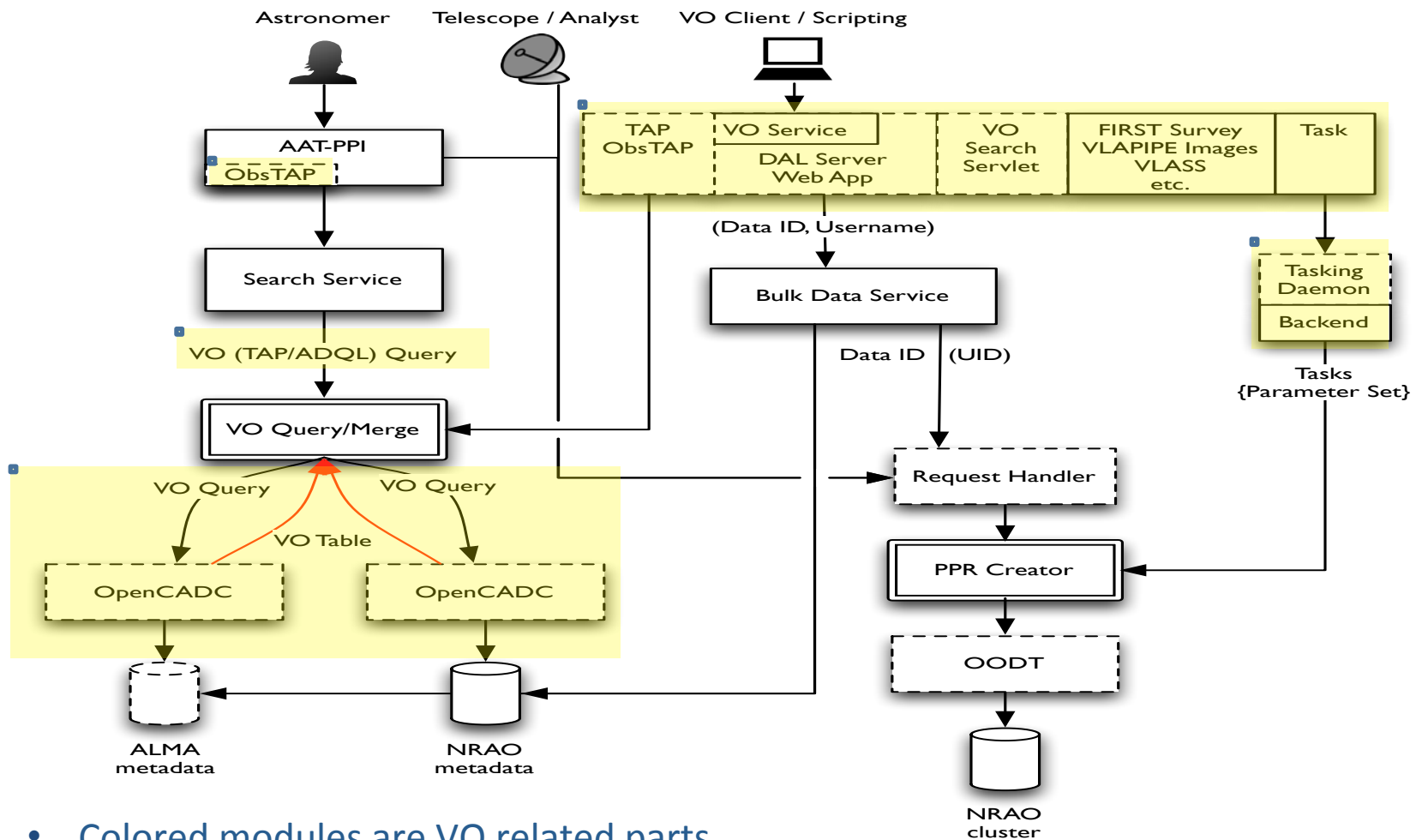
- Colored modules are VO related parts

VOView search page

- Search Service to retrieve metadata that satisfies the user's query.

- The search page will integrate the VOView table visualization component to display the results from the Search Service.

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