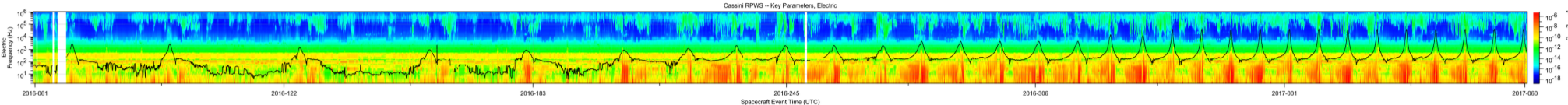


Adaptive Resolution Access for Low Frequency Radio Times Series and Spectrograms

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Abstract

Low frequency radio data collections from ground observatories or space missions are covering long time intervals (several years or decades) split into a large number of files. Searching for events or statistical analysis on such collections raises an immediate issue: downloading a large number of files or a huge data volume for recent datasets. We have selected a set of tools (client and server side, developed by University of Iowa), which allows to transmit data with adaptive temporal resolution, with a smart resampling on server-side. This setup is perfectly fit to modern radioastronomy data repositories serving times series or temporal spectrograms (such as beam-formed datasets). We will show use cases on several data collections (ground and space based) including NenuFAR, a SKA Pathfinder.

Das2

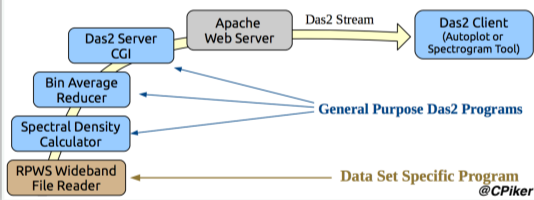
Das2 is an REST API dedicated to serving adaptive resolution time series data stream. It implements server-side data resampling and data caching. The das2 API output is a dedicated format: *das2stream*.

Das2 has been developed by Univ. of Iowa.

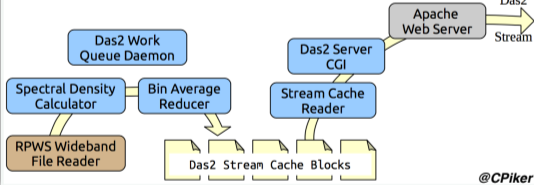
Das2 Design Considerations

- **Scientists care about data and plots, not files.**
Reader programs hide file format and naming convention details from the rest of the system.
- **Thick clients are required for responsive user interfaces.**
Custom Java client library and applications render data locally and convert user input into data requests. The server is not required for many operations.
- **Very large datasets can be handled by modest hardware if processed a record at a time.**
Das2 Stream format transmits a single slice across multiple arrays in each packet. As new array types are encountered in the input files, new array definitions are pushed onto the stream.
- **The number of pixels in a plot provides a lower limit on the amount of data that must be transmitted.**
Das2 clients can send required time resolution with each data request. If no resolution is specified, the server returns the full resolution output of the reader program.

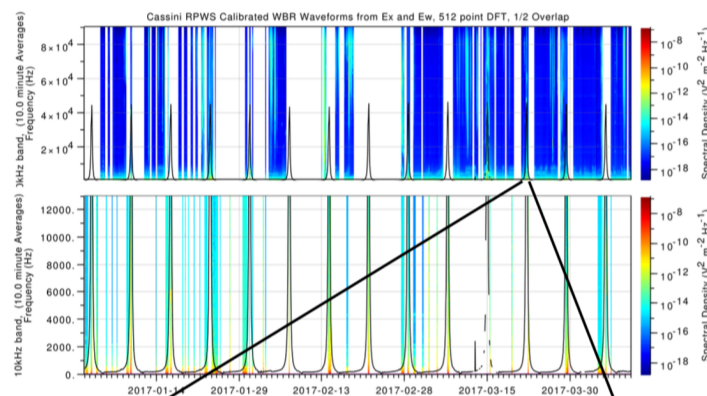
Das2 Server Reduces Transmitted Data Volume



Das2 Server Reduces Load Times

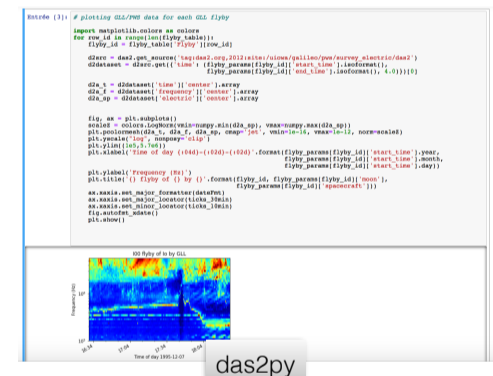
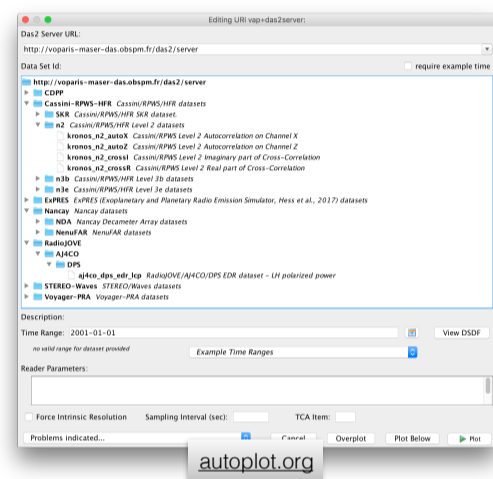


As a Result, Latency Becomes Scale Independent 100 day plots backed by 3.4 GB of data transfer and display in 2.1 seconds...



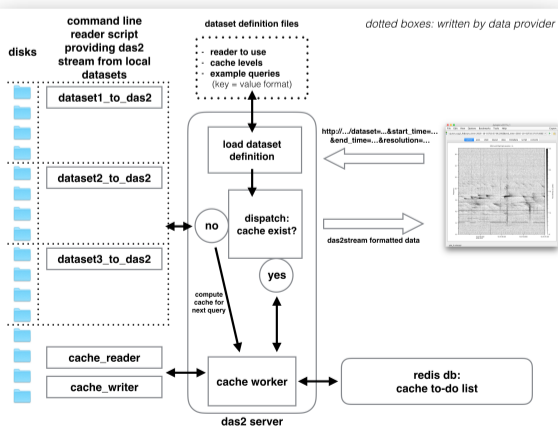
...10 minute high-rate science plot at intrinsic resolution in 3.0 seconds.
Coverage plots are no longer essential since data may be displayed for any time range.

Clients



Architecture

Das2server is a series of CGI scripts behind an Apache server. It includes efficient data reducers and data caching. The server configuration is based on simple dataset definition files (text files).



References

- Piker et al. AGU-2018. doi:10.1002/essoar.10500359.1
- Cecconi et al. AGU-2018. doi:10.1002/essoar.10500145.1
- Faden, et al. 2010. Earth Sci. Inform. 3: 41–49. doi:10.1007/s12145-010-0049-0

