Onasys

The ONline Analysis SYStem (onasys) software provides tools for automating the real-time analysis of gravitational wave data.

- Executes data analysis pipelines created by LSC scientists in real-time to process data from the three LIGO gravitational wave interferometers as it is taken.
- Responsible for the execution and monitoring of data analysis pipelines which generate astrophysical results. Results are returned to the user or can be published for replication around the LSC data grid.

Online monitoring of analysis is available via a web interface which queries job information metadata databases.

Glue

The Grid LSC User Environment (Glue) provides a high level infrastructure for developing LSC grid applications and metadata services.

- Glue provides an infrastructure to simplify the construction of workflows by treating data analysis as modules that can be chained together.
- Glue’s use of metadata (e.g. data quality information) allows complicated workflows to be easily constructed.
- Glue also contains LSC specific metadata clients and servers, such as data discovery tools.
- The figure shows the online analysis infrastructure which uses components of Glue.

LDR

Replicates LIGO and GEO data around the LSC grid.

- Maintains and distributes metadata about interferometer data.
- Replicates data from LIGO observatories and into LSC compute sites.
- Provides services to users and applications for mapping metadata to physical data locations.

Built on top of GridFTP, MySQL, Globus RLS and pyGlobus.

Pegasus

Allows analysis to run on grids which do not have LIGO data.

- Takes abstract workflows created by data analysis pipeline generators.
- Queues metadata catalogs to discover locations of data needed by each node in pipeline.
- Adds additional data transfer and publication nodes needed to run pipeline on the grid.
- Resulting concrete workflows can be executed on a wide variety of grids using Condor and Globus.

LAL

LSC Algorithm Library (LAL) contains data analysis routines.

- Algorithms are written in ANSI C99 for wide portability.
- Routines are contributed to LAL by LSC members.
- LAL algorithms include: Data conditioning, gravitational wave simulation, correlation of data with binary inspiral signals, excess power filters, etc.

LSC Data Grid / Open Science Grid

Provides underlying hardware and operating system software for executing LSC data analysis code.

- Computing clusters at Caltech, MIT, LIGO Livingston Observatory, LIGO Hanford Observatory, UWM, Penn State, AEI, Cardiff, University of Birmingham comprise the LSC Data Grid.
- Online analysis is performed at the observatory sites (LHO and LLO). Offline analysis and follow-up of online results runs at other sites.

LSC Users

Users search for gravitational waves in LIGO data by running data analysis pipelines on the grid.

- Simple text files contain the scientific parameters of the desired search.
- Pipelines are run on the grid to produce scientific results

Pipeline Generation

Complicated workflows can be constructed to perform all steps necessary to search data from the four LSC detectors: the 3 LIGO interferometers and the GEO600 interferometer.

- Pipeline generation is built on top of Glue and the LALApps analysis code.
- Different analysis strategies can be pursued by constructing various workflows.
- Different pipelines are typically constructed for online analysis, offline follow-up of online triggers, and offline analysis used in large scale Monte Carlo simulation and parameter tuning.
- Pipelines are created as Condor DAGs or VDS abstract workflows (DAX).

LALApps

User applications which perform specific data analysis tasks as part of a pipeline.

- LALApps is a suite of stand-alone scientific data analysis applications built on top of LAL.
- This suite contains programs for analyzing interferometer data such as manipulation of data products. It also contains code to abstract the scientific applications to allow pipeline construction in conjunction with Glue.

- A simulated inspiral analyzed with the LALApps excess power search.

LIGO Data Grid

Configure a data analysis pipeline using a user interface which queries job information metadata databases.