

ARC ACCOUNTING COMPONENT – JURA

Technical document

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1 Purpose

The *Job Usage Reporter of ARC* (JURA) is a component implementing accounting functionality in the ARC middleware. Its objective is to gather metered resource usage data for each job and submit it to accounting services along with the job submitter's identity and miscellaneous job-related metadata.

The accounting service stores the received usage data in a database, and provides an interface for querying it. Queries can be made by the consumers of the accounting data, such as a billing component. The service itself is a third party application, separate from the middleware distribution. JURA is currently capable of using the logging service of the SweGrid Accounting System (SGAS)[?], but maintaining the possibility to enable utilising other services has been kept in mind during design.

Before the usage data collected from the resource manager is submitted, it is transformed into records of job-level granularity. To every job corresponds exactly one Grid user, therefore reports over a time period (e.g. an invoice) can be generated per-user, or alternatively on a larger scale such as job project or VO level.

2 Architecture

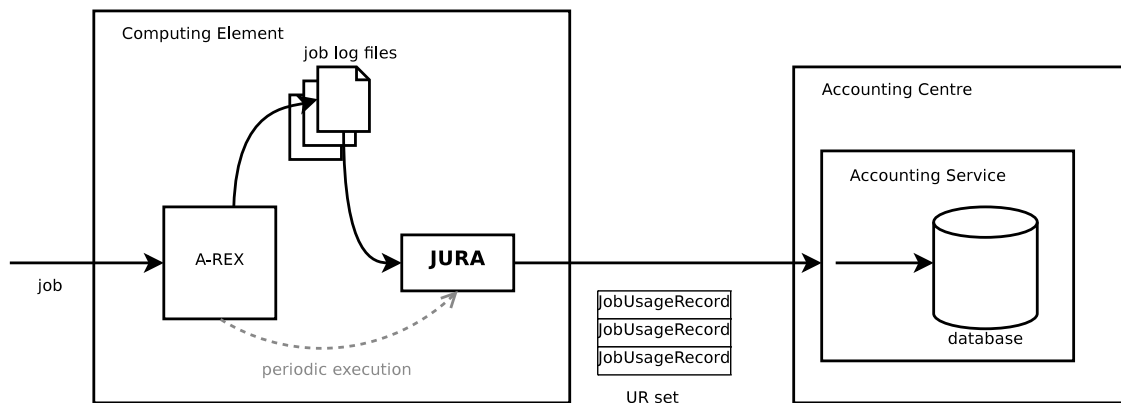


Figure 1: The usage reporting mechanism.

JURA offers a complete replacement in functionality for the old *logger* utility[?], a job metadata logging tool with a purpose very closely related to that of this new tool. However, backwards compatibility is maintained, so the old logger can still be deployed.

The ARC execution manager, A-REX[?] initiates JURA in a similar way to invoking logger. JURA reads job log files provided by A-REX. These files have the same format as those meant for logger, with additional lines which are necessary for accounting scenarios.

It also acts as a client for one or more accounting services, specifically SGAS Logging and Usage Tracking Services (LUTS's), inserting the generated records in batches. (See Figure 1.)

3 Operation

3.1 Invocation

JURA is a stand-alone executable application, executed hourly by A-REX. It has no separate configuration file; it gets all necessary configuration options from A-REX, in part through command-line arguments, but mostly via lines in the job log files (see Appendix 5 for details). The source of the latter are lines in the grid-manager configuration file.

The command line format is a subset of that of logger:

```
jura [-E <expiration_time>] <control_dir>
```

where *expiration_time* is the validity length of job log files in days, after which time they are considered invalid; *control_dir* is the A-REX control directory for a mapped local UNIX user.

3.2 Parsing job log files

The job log files generated by A-REX reside under the directory *jcontrol_dir/logs*. They have file name format *jngjobid.random*, where *ngjobid* is the identifier created for the job by A-REX, *random* is a randomly generated sequence of alphanumeric characters to avoid collision of different files pertaining to the same job. For each job and for each reporting destination (i.e. accounting service to be contacted), at least two log files are written for each job: one at the time of job submission, and another one after the job finishes, and possibly others at each start and stop event. Reporting destination URLs are acquired from “*jobreport=*” lines in the A-REX configuration file, and a limited number of additional destinations can be supplied by the submitter in the job description.

A job log file consists of “*name=value*” lines. These make up some of the configuration options for JURA, such as the URL of an accounting destination in the “*loggerurl=*” line. The file also contains detailed resource usage data and related metadata to be reported about the job. (See Appendix 5 for more details.) The accuracy of the metered data may depend on the type of batch system used.

Based on the usage data in the processed job log file, JURA assembles records in the format proposed by the Open Grid Forum (OGF), called the *Usage Record* (UR)[?]. This is an XML representation holding consumption information for all commonly used resources and metrics. It can be extended by custom elements for non-standard resources and/or other types of job metadata. For a list of UR properties used by JURA, see Appendix A.

Some elements of UR are mandatory, these must all be present in the job log file to be able to generate a UR. For example, the job log file generated upon job submission contains no *status* entry, so this file is ignored, and no UR is generated from it.

3.3 Accessing LUTS

After the necessary URs to be inserted are filled and valid, they are submitted to the accounting service specified by the URL in the “*loggerurl=*” line of the job log file, through the insertion interface of the service. The service in particular, SGAS LUTS has a simple custom web service interface loosely based on WS-ResourceProperties[?].

To increase communication efficiency, LUTS accepts a batch of several URs within a single request. The batch is an XML element called *UsageRecords*, containing elements representing URs. The maximal number of URs in a batch is limited, it can be set in the “*jobreport_options=*” line of the A-REX configuration file (see Sec. 5).

4 Security

The JURA executable runs as the same user as A-REX does, typically as *root*. The owner of a job log file is the local user mapped for the submitter entity of the corresponding job. These files contain confidential data, access to which must be restricted, therefore read access is limited to the owner and the super user. If JURA is executed by A-REX, it can read data from these files, and delete expired files.

The authentication towards the SGAS LUTS is done via the standard X.509 certificate mechanism over SSL protocol: a chain of valid (i.e. not expired and/or revoked) certificates with a trusted root certification authority is accepted as authentic identification of the client. This means that the client can access the service using a proxy certificate as well. In the scenario involving A-REX and JURA, all usage records are submitted using credentials given in the *jobreport_credentials* line of the A-REX configuration file (see A-REX Description and Administration Manual[?]), and no proxies are used. Normally the credentials for the A-REX service should be used.

The access control policy for LUTS can be configured in two ways. One is a plain text configuration file where users, identified by their DNs, can be granted or denied publish and/or query rights for all URs. The

other option is a service port type called *Service Authorization Management* (SAM). One can set access control rules through the SAM port of the service in a format based on XACML.

5 Configuration

JURA can be set up through the configuration file of A-REX. Three commands are used by JURA: *jobreport*, *jobreport_credentials* and *jobreport_options*. See the A-REX Description and Administrator's Manual[?], Section "Configuration" for details.

The *jobreport_options* command allows passing a generic option string to JURA verbatim. This option can be used for example for service-related settings. Currently only SGAS LUTS service is supported, for which the UR batch size can be set with the following command format:

```
jobreport_options="urbatch:size"
```

where *size* is a positive integer, the number of URs sent within one request. If not given, the default is 50.

6 Implementation

JURA is written merely in C++, built with standard GNU tools, and tested in a GNU/Linux environment. It depends on the HED libraries, and thus also on all mandatory dependencies thereof. The *openssl* library is also required, since sensitive accounting data needs to be sent in a secure manner.

7 Installation and deployment

Upon `make install`, the executable called "*jura*" is placed into the *libexec* directory of the configured ARC install location. There is a symbolic link to the executable in the same directory, called "*logger*", through which A-REX executes JURA. This is to keep compatibility with the old logger client. No other executables or wrapper scripts are installed.

8 Limitations and issues

Although stable, JURA still has minor imperfections, some of them stemming from flaws in A-REX or the *arcsb* client:

- The time frequency of running JURA is not configurable. It is a hardcoded value in A-REX: 3600 seconds, i.e. one hour.
- The number of user-supplied reporting destinations is limited for the sake of robustness. This upper limit is hardcoded: max. 3 destinations are parsed from JSDL, and max. 1 from RSL.
- The *arcsb* job submission client removes all but one reporting destination URL from the job description, further limiting the number of user-supplied destinations.
- The expiration time of job log files can be given in each "*jobreport=*" line in the configuration file. However, only one single value is used for all reporting destinations; the last one given overrides the previous ones.
- Missing UR properties: charge, processors, network etc. see App. A
- The GNU time memory measurement bug

A Usage Record properties

The following table shows which properties in OGF UR are filled, what data source was used for them, which properties are missing, and what extensions have been added to UR.

UR Property	Description	Source (job log entry)
RecordId	Globally unique identifier for UR	nodename, ngjobid
GlobalJobId	Globally unique identifier of job	globalid
LocalJobId	CE-specific identifier of job	localid

B Additional job log file entries

Table ?? describes entries of the job log file not present in Table ??.