S-GAE
SunGrid Graphical Accounting Engine

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October 2011
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1. Who we are

• RDlab: Research and Development Laboratory.

• Belongs to LSI department at UPC University.

• Created on fall 2010.

• Currently composed by 5 people.
1. Who we are II: Our numbers

- Over 130 computer servers
  - > 70 nodes Rdlab HPC cluster
  - > 60 project servers
- TIC support for 8 research groups at LSI
  - ALBCOM
  - KEMLG
  - GRPLN
  - GIE
  - LOGPROG
  - LARCA
  - MOVING
  - SOCO
- CEE projects & Enterprise Agreements
1. Who we are III: Our homepage
2. The RDlab Cluster: Our size

- More than 70 nodes.
- More than 560 execution cores.
- More than 1 Terabyte of RAM.
- More than 10 Terabytes of disk space.
- More than 120 users.
- More than 339,000 executed jobs since January 1st!
2. The RDlab Cluster II: Facilities

- Located at UPC’s Data Processing Centre (CPD).
- More than 250m$^2$ surface area.
- Back-up generator with complete autonomy.
2. The RDlab Cluster III: Software

- Oracle GridEngine
- Ubuntu LTS Server Linux x64
- Lustre
- 2 Fujitsu DX80 arrays
3. Accounting

- User activity

  Large number of users
  + A load of jobs per user
  **LOTS** of raw accounting data

- We needed to monitor all this information
- Oracle GridEngine saves this data in a plain text file
- We needed an interface to get easy access to it
3. Accounting II

- Objectives:
  - Monitor and control accounting information
  - Avoiding *Command Line Interface*
  - Form-based customization filters
  - Show aggregated values (avg., %,...)
  - Customized view for cluster users, queue managers and cluster administrators.
4. Existing software

- ARCo:
  - Excessively large database size.
  - SQL based interface for queries.

  - Large list of requirements
  - Poor documentation
  - Not specifically designed for SGE

  - Only a qstat interface.
4. Existing software II

- None of them suited our expectations
- We decided to develop our own product

SunGrid Graphical Accounting Engine

Trivia:
- Oracle Engine is not SunGrid anymore.
- Why “s-gae” and not simply “sgae”...?
5. The S-GAE Application

- Transform tons of raw data into eye-candy charts

<table>
<thead>
<tr>
<th>Name</th>
<th>Size</th>
<th>Owner</th>
<th>Malloc</th>
<th>LTME</th>
<th>TIME</th>
<th>CPFS</th>
<th>MFP</th>
<th>ID</th>
<th>TN</th>
</tr>
</thead>
<tbody>
<tr>
<td>task1</td>
<td>1KB</td>
<td>user1</td>
<td>1KB</td>
<td>1KB</td>
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<tr>
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<td>user2</td>
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<td>2KB</td>
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<tr>
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<td>user3</td>
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<td>3KB</td>
<td>3KB</td>
<td>3KB</td>
<td>3KB</td>
<td>3KB</td>
<td>3KB</td>
</tr>
</tbody>
</table>

![Pie chart showing success and failure rates]
6. S-GAE quick view I: How it works

- Parses Oracle GridEngine accounting data.
  - Periodically (in batch mode): cron
  - On demand: administrator interface
- Compacts and processes data.
- Store it into a MySQL database
  - Group data according to queue name
  - Group by year / month of submission
6. S-GAE quick view II: How it works

- PHP gets data from the database
  - Ready for graphs generation (no further processing).
- Customize results through filters and show graphs
6. S-GAE quick view III: Database

- Most of work is done by the Database Engine
- Data processing is done by Procedures
  - Creates a view with the data needed
  - Calculates averages, top ten orders, etc.
  - Leave result in a single-row table
- PHP calls stored procedures and gets the result
- This reduces data transmission and PHP workload
6. S-GAE quick view IV: Database

- Main index: 1 table
  - Name of queues, enabled, last check date

```
main_index

- id INT
- queue_name VARCHAR(64)
- queue_index_table_name VARCHAR(64)
- last_checked_date INT
- enabled_queue BOOLEAN
- queue_year_summarize_table VARCHAR(...

Indexes

- PRIMARY
- queue_name UNIQUE
```
6. S-GAE quick view V: Database

- Queue index: 1 table per queue
  - Name of data tables by year and month

```sql
queue_index_QQQ

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>id</td>
<td>INT</td>
</tr>
<tr>
<td>year</td>
<td>INT</td>
</tr>
<tr>
<td>month</td>
<td>INT</td>
</tr>
<tr>
<td>queue_data_table_name</td>
<td>VARCHAR(64)</td>
</tr>
<tr>
<td>num_rows</td>
<td>BIGINT(20)</td>
</tr>
</tbody>
</table>

Indexes

- PRIMARY
- year_month_UNIQUE
```
6. S-GAE quick view VI: Database

- Data table:
  - 1+ per queue
  - Parsed data
6. S-GAE quick view VII: Database

- Year summarize charts: 1 per queue

```sql
CREATE TABLE queue_year_summarize_charts (
  id INT,
  year INT,
  last_update_time INT,
  jobs_execution_time_longest INT,
  jobs_execution_time_average INT,
  jobs_execution_time_shortest INT,
  jobs_execution_time_1d INT,
  jobs_execution_time_7d INT,
  jobs_execution_time_31d INT,
  jobs_execution_time_xxd INT,
  jobs_success INT,
  jobs_failure INT,
  jobs_memory_maximum BIGINT,
  jobs_memory_average BIGINT,
  jobs_memory_minimum BIGINT,
  jobs_memory_xxgb INT,
  jobs_memory_8gb INT,
  jobs_memory_4gb INT,
  jobs_memory_1gb INT,
  hostname_usage_top1 INT,
  hostname_usage_top10 INT,
  hostname_usage_top1_host VARCHAR(64),
  hostname_usage_top10_host VARCHAR(64),
  jobs_sent_user_top1 INT,
  jobs_sent_user_top10 INT,
  jobs_sent_user_top1_owner VARCHAR(64),
  jobs_sent_user_top10_owner VARCHAR(64),
  jobs_memory_usage_top1 BIGINT,
  jobs_memory_usage_top10 BIGINT,
  jobs_memory_usage_top1_owner VARCHAR(64),
  jobs_memory_usage_top10_owner VARCHAR(64),
  jobs_execution_time_top1 BIGINT,
  jobs_execution_time_top10 BIGINT,
  jobs_execution_time_top1_owner VARCHAR(64),
  jobs_execution_time_top10_owner VARCHAR(64)
);
```
6. S-GAE quick view VIII: Roles

• Common user
• Queue administrator
• Cluster and Application administrator
6. S-GAE quick view IX: Interface
7. How S-GAE is released

- GNU General Public License v3
- Visit our homepage http://rdlab.lsi.upc.edu/s-gae
Live demo

CONNECT
S-GAE

- Web browser interface with eye-candy charts
- Form-based data filtering and aggregated values
- User, queue and full cluster statistics
- Licensed under GPL v3

http://rdlab.lsi.upc.edu/s-gae