Distributed Analysis with ASAP

Akram Khan\textsuperscript{1}, Craig Munro\textsuperscript{1}, Julia Andreeva\textsuperscript{2}, J Herrala\textsuperscript{2}, O Kodolova\textsuperscript{2}

\textsuperscript{1} Brunel University, \textsuperscript{2} CERN

CHEP 07
Overview

- Background
- ASAP Client
- ASAP Server
- Agents
- Conclusions
Background

- ARDA project created to prototype distributed analysis applications for the LHC experiments.
- ARDA/CMS investigated new gLite Middleware, created job submission framework - ASAP (ARDA Support for CMS Analysis Processing)
- Server side component created to manage resubmission.
- Using experience from initial version ASAP redesigned from ground up
  - Security, performance and modularity included from start.
ASAP can:
- Create and manage jobs on the Grid.
- Manage submission and monitoring of jobs on behalf of user.
- Manage resubmission of failed jobs.
- Improve turnaround time of users task.
Task Creation

- User creates tasks which are composed of jobs with the same configuration
- A configuration file is used to specify parameters:

  ```
  primary_dataset = mc-onsel-120_PU_Zee
tier = DIGI
processed_dataset = CMSSW_1_2_0-NoPU-DIGI-1169220692
events_required = -1
events_per_job = 5000
pset_file = TracksMonitoring.cfg
input_files = auth.xml, sistripfedcabling.db, SiStripFedCablingCatalog.xml
output_files = dqm_tracks.root
output_se = srm.cern.ch
output_se_path = /castor/cern.ch/user/m/munro/output
  ```

- User code belonging to CMSSW application is packaged
- Wrapper which controls execution on Worker Node created
  - unpacks code, creates environment, fetches input, runs application, checks for errors, stores output
Input Data

- **Published Data**
  - User specifies dataset they wish to analyse
  - ASAP queries DBS for dataset metadata and DLS for dataset location
  - Jobs are split according to user requirements and location of data

- **Simulate Data**
  - User specifies number of events they wish to generate and a random seed

- **Private Data**
  - User can specify input files and parameters for each job using a text file
    ```
    srm://srm.cern.ch:8443/castor/cern.ch/user/u/user/cpv/ttbb1_gen_comphep.root 0 10 1234 ...
    srm://srm.cern.ch:8443/castor/cern.ch/user/u/user/cpv/ttbb1_gen_comphep.root 10 10 5678 ...
    file:///afs/cern.ch/user/u/scratch0/my_root.root 0 100 8769
    ```
  - Input data can be local or remote (ASAP will transport data to Worker Node)
Task Management

- Tasks can be created for LCG, gLite and gLite WMProxy
- Command line client used for generating tasks:
  - `asap --create task.conf --submit`
  - taskid provided for future control of task
- Status can be checked:
  - `asap --taskid 12345 --update --list`

<table>
<thead>
<tr>
<th>Job</th>
<th>ASAP Status</th>
<th>GRID Status</th>
<th>GRID Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DONE * Done (Success)</td>
<td>Job terminated successfully</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>DONE * Done (Success)</td>
<td>Job terminated successfully</td>
<td></td>
</tr>
</tbody>
</table>

* - job is registered with the server

- and output retrieved:
  - `asap --taskid 12345 --fetch`
ASAP Server

Motivation:
- Jobs on the grid fail.
- Managing large numbers of jobs is time consuming.
- Analysing the output of those jobs for errors is even more time consuming.

The ASAP Server automates all of these steps.

Once a task has been created it can be registered or unregistered from the server at any point

```
asap --taskid 12345 {--register, --unregister}
```

- The server submits jobs and monitors them for changes in status.
- Completed jobs are fetched and the logs analysed for failures.
- Failed jobs are resubmitted (up to a certain limit).
- Jobs are not resubmitted to sites they have previously failed at (subject to users requirements).

Akram Khan\textsuperscript{1}, Craig Munro\textsuperscript{1}, Julia Andreev\textsuperscript{2}, J Herrala\textsuperscript{2}, O Kodolova\textsuperscript{2} (\textsuperscript{1}Brunel University, \textsuperscript{2}CERN)
Security

- All communication between the client and server occurs through Apache or delegation service and is secure.
- DN and VOMS attributes used to limit access to the server.
- Server has to act on users behalf - requires users proxy.
- User registers with the server:
  - Registration consists of delegating a copy of the users proxy to the server and storing a long-lived copy of the
  - Server registers proxy in the gLite Proxy Renewal Service
- Input/output files transferred using HTTPS PUT/GET using mod_gridsite
  - Grid Access Control List only allows owner of task to read/write directory.
Monitoring

Distributed Analysis with ASAP

TASK 19535

![Graph showing ASAP Task 19535]

Click on the column headings to sort.

<table>
<thead>
<tr>
<th>ID</th>
<th>ASAP Status</th>
<th>GRID Status</th>
<th>GRID Reason</th>
<th>Exit Code</th>
<th>Events</th>
<th>Registered</th>
<th>Modified</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>FETCHED</td>
<td>Done (Success)</td>
<td>There were some warnings: some output sandbox file(s) needed truncating</td>
<td>0</td>
<td>1342/1342</td>
<td>2007-05-17 10:25:59</td>
<td>2007-05-17 11:52:59</td>
</tr>
<tr>
<td>2</td>
<td>FETCHED</td>
<td>Done (Success)</td>
<td>There were some warnings: some output sandbox file(s) needed truncating</td>
<td>0</td>
<td>1339/1339</td>
<td>2007-05-17 10:25:59</td>
<td>2007-05-17 11:41:25</td>
</tr>
<tr>
<td>4</td>
<td>FETCHED</td>
<td>Done (Success)</td>
<td>There were some warnings: some output sandbox file(s) needed truncating</td>
<td>0</td>
<td>1341/1341</td>
<td>2007-05-17 10:26:00</td>
<td>2007-05-17 11:44:27</td>
</tr>
<tr>
<td>5</td>
<td>FETCHED</td>
<td>Done (Success)</td>
<td>There were some warnings: some output sandbox file(s) needed truncating</td>
<td>0</td>
<td>1341/1341</td>
<td>2007-05-17 10:26:00</td>
<td>2007-05-17 11:44:27</td>
</tr>
<tr>
<td>6</td>
<td>FETCHED</td>
<td>Done (Success)</td>
<td>There were some warnings: some output sandbox file(s) needed truncating</td>
<td>0</td>
<td>1339/1339</td>
<td>2007-05-17 10:26:00</td>
<td>2007-05-17 11:41:31</td>
</tr>
<tr>
<td>7</td>
<td>FETCHED</td>
<td>Done (Success)</td>
<td>There were some warnings: some output sandbox file(s) needed truncating</td>
<td>0</td>
<td>1340/1340</td>
<td>2007-05-17 10:26:01</td>
<td>2007-05-17 11:45:39</td>
</tr>
<tr>
<td>1</td>
<td>FETCHED</td>
<td>Done (Success)</td>
<td>There were some warnings: some output sandbox file(s) needed truncating</td>
<td>0</td>
<td>1341/1341</td>
<td>2007-05-17 10:26:01</td>
<td>2007-05-17 11:51:22</td>
</tr>
<tr>
<td>8</td>
<td>FETCHED</td>
<td>Done (Success)</td>
<td>There were some warnings: some output sandbox file(s) needed truncating</td>
<td>0</td>
<td>1341/1341</td>
<td>2007-05-17 10:26:01</td>
<td>2007-05-17 11:51:35</td>
</tr>
</tbody>
</table>

https://karda13.ch/status.php
<table>
<thead>
<tr>
<th>Task ID</th>
<th>Status</th>
<th>Grid Status</th>
<th>Grid ID</th>
<th>Grid Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>19535/JOB 3</td>
<td>PENDING</td>
<td>Done (Success)</td>
<td><a href="https://rb.07.cern.ch:9000/ARCAaQbmSYSS1UvHALU5Q">https://rb.07.cern.ch:9000/ARCAaQbmSYSS1UvHALU5Q</a></td>
<td>There were some warnings: some output cand/exe files needed truncating</td>
</tr>
</tbody>
</table>

**DATASET:** /mconald-12O_QCD_pt_980_470/FEVT/CMSSW_1.2.0/FEVT-1166726320

**APPLICATION:** CMSSW_1.2.0

---

**APPLICATION:**

**DATASET:**

**REGISTERED:** 2007-05-17 10:29:59

**MODIFIED:** 2007-05-17 11:52:59

**ASAP STATUS:** PENDING

**GRID STATUS:** Done (Success)

**GRID ID:** https://rb.07.cern.ch:9000/ARCAaQbmSYSS1UvHALU5Q

**GRID REASON:** There were some warnings: some output cand/exe files needed truncating

**SITES:**

**CE:**

**GRID:**

**EXIT_CODE:**

**RETRY_COUNT:**

**STDOUT:**

**STDERRO:**

**STDERRO:**

**HISTORY:**

Thu May 17 10:25:59 2007 REGISTERED
Thu May 17 10:26:27 2007 MATCHED
Selected Virtual Organization name (from EDG_WL_UI_CONFIG_VO env variable): cms
Connecting to host rb.22.cern.ch, port 7772

******************************************************************************************

**COMPUTING ELEMENT ID's LIST**
The following CEs(s) matching your job requirements have been found:

* CEID

cmggrid02.hap.wisc.edu:2119/jobmanager-cendor-cms

******************************************************************************************

Thu May 17 10:27:17 2007 SUBMITTED Scheduled Job successfully submitted to Globus
Thu May 17 10:27:23 2007 SUBMITTED Scheduled Job successfully submitted to Globus
Thu May 17 10:27:24 2007 SUBMITTED Scheduled Job successfully submitted to Globus
Thu May 17 10:27:30 2007 SUBMITTED Scheduled Job successfully submitted to Globus
Thu May 17 10:42:31 2007 SUBMITTED Scheduled Job successfully submitted to Globus
Agents

- Each job in a task differs only by the arguments it receives (input files, skipEvents, maxEvents, site)
- An agent can request these parameters directly from the server so that multiple jobs can be executed per submission.
- Transparent to user
• Using Agents decreases turnaround time of users task by communicating directly with the server and redundant execution of jobs.

![Graphs showing time from job registration to completion for (a) Original Method and (b) Agent Method](image)

**Figure:** Time from job registration to completion for (a) Original Model and (b) Agent Model
Conclusion

- System used by a number of CMS physicists
- Server reduces effort required from user and increases success rate.
- Agents reduces turnaround time for the task.