HTCondor-CE: For When the Grid is Dark and Full of Terrors

Iain Steers - CERN IT
Outline

Introduction

History

Configuration

Job Routes

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Introduction

Our journey from CREAM and LSF to HTCondor-CE and HTCondor as our Grid offering at CERN.
Glimpse of the Past

As some of you will know, CERN has based its Grid Compute around LSF as the Batch System. However, we’ve had a rather fraught relationship with Compute Elements (CEs).

Several years ago, when the decision was taken to move to a HTCondor batch system, several CEs were evaluated.
The ARC Compute Element

In our initial Grid Pilot of HTCondor we offered the ARC-CE as the entry point.

However, we ran into a few issues and felt like something was missing.

There was a disconnect between how we had to manage ARC, and how we wanted to manage the farm in general.
Enter HTCondor-CE

We’d heard of HTCondor-CE, however, we were under the impression it was tied to the OSG environment.

This didn’t turn out to be the case. A couple of days with Brian Bockelman and we had a test CE in the pool.
Migrating VOs

CMS and ATLAS already base their submission infrastructure on condor schedds.

However, the none-OSG VOs had never worked with them in this manner before.

We embarked upon a campaign to offer our help and get the other VOs submitting via schedds.
Review

Over the next couple of months we evaluated where we stood and the pros/cons.

After familiarizing ourselves with configuring/managing the CE, we decided that the HTCondor-CE is where we wanted to take the future of the pool.
CE Configuration

HTCondor-CE is literally just a special configuration and instantiation of HTCondor running on a schedd machine.

A couple of configuration options need to be provided:

- UID_DOMAIN.
- Site-specific security overrides.
- Your job route definitions.
Puppet Sites

```ruby
class {'::htcondor_ce'}
```

Plus some hiera.

```text
https://github.com/cernops/puppet-htcondor_ce
```
Job Routes

Job Routes are a declarative approach to defining what a job looks like on your local batch system.

You take an incoming resource request from a VO and turn it into what you want a job to look like.
Job Routes ctd.

You’ll want a base catch-all route and then maybe some VO/project specific routes.

The routes can be as simple or as complex as you like.
Route Example

Here’s an example of our main route, although we have others.

```plaintext
JOB_ROUTER_ENTRIES = \\
[ \\
    MaxIdleJobs = 4000; \\
    TargetUniverse = 5; \\
    name = "Local_Condor"; \\
    set_AcctSubGroup = ifThenElse(regexp("production",x509userproxyfqan),strcat("grid_
    set_CERNAcctGroup = toUpper(x509UserProxyVOName)); \\
    eval_set_AccountingGroup = strcat("group_u_", CERNAcctGroup, ".", AcctSubg
    eval_set_AcctGroup = strcat("group_u_", CERNAcctGroup, ".", AcctSubGroup)
    delete_SUBMIT_Iwd = true; \\
    set_WantIOProxy = true; \\
    set_default\_maxMemory = 2000; \\
    set_DataCentre = "$$(DataCentre:meyrin)"; \\
    set_HEPSPEC = "$$(HEPSPEC:80)"; \\
]
```
CE Management

Simple to manage and easy to see what’s going on.
CE versions of all the condor CLIs, e.g. condor_ce_q

<table>
<thead>
<tr>
<th>CE Name</th>
<th>Start Time</th>
<th>Run Time</th>
<th>Status</th>
<th>Pilot Job Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>lhbpint01</td>
<td>2/26 10:32</td>
<td>0:02:10</td>
<td>R</td>
<td>976.6 DIRAC_PCL24_Pilot</td>
</tr>
<tr>
<td>lhbpint01</td>
<td>2/26 10:52</td>
<td>0:01:22</td>
<td>C</td>
<td>48.8 DIRAC_S2cRdm_pilot</td>
</tr>
<tr>
<td>lhbpint01</td>
<td>2/26 11:32</td>
<td>0:01:14</td>
<td>R</td>
<td>976.6 DIRAC_Fc7VvE_pilot</td>
</tr>
<tr>
<td>lhbpint01</td>
<td>2/26 11:52</td>
<td>0:00:57</td>
<td>R</td>
<td>1464.8 DIRAC_DfF3lu_pilot</td>
</tr>
<tr>
<td>ilc030</td>
<td>2/26 11:59</td>
<td>0:00:18</td>
<td>R</td>
<td>0.2 DIRAC_cjEAIt_pilot</td>
</tr>
<tr>
<td>lhbpint01</td>
<td>2/26 12:12</td>
<td>0:00:38</td>
<td>R</td>
<td>976.6 DIRAC_geUrJz_pilot</td>
</tr>
<tr>
<td>lhbpint01</td>
<td>2/26 12:32</td>
<td>0:00:18</td>
<td>R</td>
<td>732.4 DIRAC_T5oA1k_pilot</td>
</tr>
<tr>
<td>aliasmg76</td>
<td>2/26 12:49</td>
<td>0:00:00</td>
<td>I</td>
<td>0.0 agent.Startup.3660</td>
</tr>
<tr>
<td>lhbpint01</td>
<td>2/26 12:52</td>
<td>0:00:00</td>
<td>I</td>
<td>0.0 DIRAC_C_Mh2N_pilot</td>
</tr>
</tbody>
</table>

4852 jobs; 1517 completed, 0 removed, 781 idle, 2554 running, 0 held, 0 suspended
[root@ce504 ~]#
Logging

All logs files go to `/var/log/condor-ce`.

Important log files: `JobRouterLog`, `SchedLog`, `AuditLog`

AuditLog: Anything that happened on the queue, proxies, authentication etc. Automatically configured to be kept for 90 days.
Excerpt from the Job Router Log:

<table>
<thead>
<tr>
<th>Route Name</th>
<th>Submitted/Max</th>
<th>Idle/Max</th>
<th>Throttle Recent: S</th>
<th>Recent</th>
<th>Started</th>
<th>Succeeded</th>
<th>Failed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local_Condor</td>
<td>6313/12000</td>
<td>40/4000</td>
<td>none</td>
<td>5</td>
<td>57</td>
<td>93</td>
<td>0</td>
</tr>
<tr>
<td>External_Cloud</td>
<td>203/10000</td>
<td>160/2000</td>
<td>none</td>
<td>3</td>
<td>34</td>
<td>17</td>
<td>0</td>
</tr>
</tbody>
</table>

03/02/16 09:43:24 JobRouter: Checking for candidate jobs. routing table is:

03/02/16 09:43:24 JobRouter (src=3043640.0,dest=3951953.0,route=Local_Condor): finalized job
03/02/16 09:43:24 JobRouter (src=3043641.0,dest=3951954.0,route=Local_Condor): finalized job
03/02/16 09:43:25 JobRouter (src=3043614.0,dest=3951929.0,route=Local_Condor): finalized job
03/02/16 09:43:25 JobRouter (src=3043634.0,dest=3951957.0,route=Local_Condor): finalized job
03/02/16 09:43:25 JobRouter (src=3043636.0,dest=3951959.0,route=Local_Condor): finalized job
03/02/16 09:43:25 JobRouter (src=3043591.0,dest=3951897.0,route=Local_Condor): finalized job
03/02/16 09:43:26 JobRouter (src=3043638.0,dest=3951961.0,route=Local_Condor): finalized job
03/02/16 09:43:25 JobRouter (src=3043639.0,dest=3951962.0,route=Local_Condor): finalized job
03/02/16 09:43:26 JobRouter (src=3043558.0,dest=3951880.0,route=Local_Condor): finalized job
03/02/16 09:43:26 JobRouter (src=3027782.0,dest=3940672.0,route=Local_Condor): finalized job
03/02/16 09:43:26 JobRouter (src=3043599.0,dest=3951921.0,route=Local_Condor): finalized job
03/02/16 09:43:27 JobRouter (src=3043576.0,dest=3951942.0,route=External_Cloud): finalized job
Monitoring

We monitor primarily with the python-bindings.

Make sure the CE Schedd and Batch Schedd aren’t out-of-sync with job numbers.

Monitor and alarm on the Job Router run-time.
## Monitoring Example

### HTCondor-CE Overview

<table>
<thead>
<tr>
<th>Running</th>
<th>Idle</th>
<th>Held</th>
<th>Last Data Update</th>
</tr>
</thead>
<tbody>
<tr>
<td>3023</td>
<td>36</td>
<td>185</td>
<td>Thu May 19 2016</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GMT-0500 (CDT)</td>
</tr>
</tbody>
</table>

### Last Hour

#### CE Pilot Counts

- Running: [Graph]
- Idle: [Graph]
- Held: [Graph]

### Last Day

#### CE Pilot Counts

- Running: [Graph]
- Idle: [Graph]
- Held: [Graph]

### Last Week

#### CE Pilot Counts

- Running: [Graph]
- Idle: [Graph]
- Held: [Graph]

### Pilots

<table>
<thead>
<tr>
<th>VO</th>
<th>VOMS</th>
<th>Jobs</th>
<th>Running</th>
<th>Idle</th>
<th>Held</th>
<th>DN</th>
</tr>
</thead>
<tbody>
<tr>
<td>alice</td>
<td>/alice/Role=lcgadmin</td>
<td>3153</td>
<td>2926</td>
<td>26</td>
<td>185</td>
<td>/DC=ch/DC=cern/OU=Organic Units/OU=Users/CN=pavirin/CN=762973/CN=Pavlo Svirin</td>
</tr>
<tr>
<td>lhcb</td>
<td>/lhcb/Role=pilot</td>
<td>800</td>
<td>97</td>
<td>10</td>
<td>0</td>
<td>/DC=ch/DC=cern/OU=Organic Units/OU=Users/CN=romanov/CN=427293/CN=Vladimir Romanovsky</td>
</tr>
</tbody>
</table>

### Info

<table>
<thead>
<tr>
<th>OSG Resource</th>
<th>condorce01</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSG Resource Group</td>
<td>CERN-PROD</td>
</tr>
<tr>
<td>Batch System</td>
<td>HTCondor</td>
</tr>
<tr>
<td>HTCondor-CE version</td>
<td>2.0.2</td>
</tr>
<tr>
<td>HTCondor version</td>
<td>$CondorVersion: 8.4.4 Feb 03 2016 BuildID: 355883</td>
</tr>
</tbody>
</table>

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May 19, 2016
How the VOs Interact

There are two submission methods.

• Submit via a condor_schedd running on a vobox.
• Direct submission to the CE with condor_submit.

The Schedd set-up has some great advantages and power.

More involvement from the VO framework is required for direct submission.
The schedd based submission mentioned on the previous slide relies on a special job universe called the Grid Universe.

The Grid universe allows submission to a number of classical grid systems and public clouds.

See Todd’s Talk of Lies for the full list.
Grid Universe Power

Full job management semantics of usual condor.

Periodic actions, i.e. remove, hold. Job Requirements also can be expressed.
## VO Management

<table>
<thead>
<tr>
<th>VO</th>
<th>Job Manager</th>
<th>Info Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMS</td>
<td>Schedd</td>
<td>Factory Frontend</td>
</tr>
<tr>
<td>ATLAS</td>
<td>Schedd</td>
<td>PaNDA</td>
</tr>
<tr>
<td>ALICE</td>
<td>Schedd (JobRouter)</td>
<td>ALiEN (BDII)</td>
</tr>
<tr>
<td>LHCb</td>
<td>Direct</td>
<td>DIRAC (BDII)</td>
</tr>
<tr>
<td>ILC</td>
<td>Schedd</td>
<td>DIRAC (BDII)</td>
</tr>
<tr>
<td>COMPASS</td>
<td>Schedd</td>
<td>APF</td>
</tr>
</tbody>
</table>
Conclusion

In conclusion, we’ve been incredibly happy with HTCondor-CE.

It scales nicely, is a pleasure to manage and fits perfectly with our wider needs/plans for managing the Tier-0 batch farm.

“Everything is better with some condor in the system.”

— Miron Lannister Livny
Thanks to

We’d like to thank the following people:

- Brain Bockelman for getting us set-up with the HTCondor-CE
- Brian Lin for his development work and help.
- OSG Software Team for their work on the stack.
- The HTCondor Team for producing the meat of what makes this work.
Any Questions?

The night is dark and full of feathers